GRAY'S REEF BENTHIC MACROINVERTEBRATE COMMUNITY ASSESSMENT, JULY 2003

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INTRODUCTION

The Gray's Reef National Marine Sanctuary was sampled during May 2003. One aspect of this study 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 Gray's Reef stations are given in Figure 1 and Table 1.

METHODS

Sample Collection and Handling

A Young dredge (area = 0.04 m^2) was used to collect bottom samples at each of T station locations (three replicate samples were taken at each station), while a diver core (area = 0.0071 m^2) was used to collect the D station samples (five replicate samples were taken at each station)(Table 1). Samples were prescreened through 0.5 mm mesh sieves, by NOAA in the field and fixed in 10% formalin. The preserved sample fractions were transported to BVA's 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 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/Quality Control (QA/QC) reports for the Gray's Reef samples are given in the Appendix.

Assemblage Structure

Several numerical indices were chosen for analysis and interpretation of the macroinfaunal data. Selection was based primarily on the ability of the index to provide a meaningful summary of data, as well as the applicability of the index to the characterization of the benthic community. 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 total 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 by 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 faunal equitability to taxa diversity for a given area, Pielou's Index J' (Pielou, 1966) was calculated as J' = H'/ln S, where ln S = 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

Sediment data for the D and T stations are given in Table 1 and Figure 2. Sediment texture at the D stations was uniformly sand throughout the sampling area (> 98% sand; Figure 2). Sediment texture at the T stations was also uniformly sand (> 95% sand; Figure 2). The percent total organic carbon (TOC) fraction of the sediment at the D and T stations was very low with all values ≤ 0.20% (Table 1, Figure 2).

BENTHIC COMMUNITY CHARACTERIZATION

Faunal Composition, Abundance, and Community Structure

Microsoft ™Excel spreadsheets are being provided separately to NOAA which include: raw data on taxa abundance and density, 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 number of taxa, density, taxa diversity and taxa evenness by station.

A total of 402 organisms, representing 103 taxa, were identified from the D stations (Table 3). Malacostracans were the most numerous organisms present representing 33.8% of the total assemblage, followed in abundance by polychaetes (33.6%) and bivalves (19.4%). Malacostracans represented 39.8% of the total number of taxa followed by polychaetes (32.0%) and bivalves (12.6%) (Table 3). The percent abundance of major taxa at the D stations is given in Table 5 and Figure 3. A mixed assemblage of annelids, mollusks and arthropods was found at each D stations (Figure 3).

A total of 1949 organisms, representing 216 taxa, were identified from the T stations (Table 4). Polychaetes were the most numerous organisms present representing 60.1% of the total assemblage, followed in abundance by gastropods (9.5%), other taxa (9.2%) and bivalves (8.7%). Polychaetes represented 42.1% of the total number of taxa followed by malacostracans (22.7%), gastropods (13.9%) and bivalves (11.6%) (Table 4). The percent abundance of the major taxa at the T stations is given in Table 6 and Figure 3. Annelids (polychaetes) were dominant at each of the T stations (Figure 3).

The dominant taxa collected from the D stations were the bivalve genera, *Laevicardium* (LPIL*)*, the polychaete, *Paraonis pygoenigmatica*, the malacostracan, *Erichthonius brasiliensis*, the polychaete, *Spiophanes bombyx*, and the bivalve, *Semele muculoides*, representing 7.0%, 6.0%, 5.7%, 5.0% and 4.7% of the assemblage, respectively (Table 7). There were six taxa found at 100% of the stations, the most abundant being the polychaete, *Spiophanes bombyx* (Table 7). The distribution of taxa

representing > 5% of the total assemblage at each D station is given in Table 9.

The dominant taxa collected from the T stations were the polychaetes, *Sphaerosyllis piriferopsis*, *Spiophanes bombyx*, and *Fabricinuda trilobata*, and the gastropod, *Caecum johnsoni*, representing 8.4%, 5.0%, 4.9% and 4.4% of the assemblage, respectively (Table 8). There were numerous taxa found at 100% of the stations, the most abundant being the polychaete, *Spiophanes bombyx* (Table 8). The distribution of taxa representing > 5% of the total assemblage at each T station is given in Table 10.

Station taxa richness and abundance data are summarized for the D stations in Table 11 and Figures 4 and 5. The mean number of taxa per station ranged from 10.4 (SD = 2.8) at Station D01 to 16.8 (SD = 2.6) at Station D75 (Table 11; Figure 4). Mean density per station ranged from 1803.0 organisms·m^2 (SD = 502.1) at Station D01 to 3746.2 organisms·m^2 (SD = 1047.4) at Station D75 (Table 11; Figure 5).

Station taxa richness and abundance data are summarized for the T stations in Table 12 and Figures 4 and 5. The mean number of taxa per station ranged from 50.3 (SD = 22.4) at Station T03 to 73.3 (SD = 10.4) at Station T10 (Table 12; Figure 4). Mean density per station ranged from 3291.7 organisms·m^2 (SD = 1795.4) at Station T03 to 8083.3 organisms·m^2 (SD = 2198.1) at Station T10 (Table 12; Figure 5).

Taxa diversity and evenness for the Gray's Reef D stations are given in Table 11 and Figure 6. Taxa diversity (H´) was uniformly high and ranged from 3.18 at Station D25 to 3.67 at Station D75 (Table 11; Figure 6). Taxa evenness (J´) ranged from 0.88 at Station D25 to 0.92 at Station D01 (Table 11; Figure 6).

Taxa diversity and evenness for the Gray's Reef T stations are given in Table 12 and Figure 6. Taxa diversity (H´) was high and ranged from 3.70 at Station T17 to 4.26 at Station T03 (Table 12; Figure 6). Taxa evenness (J´) ranged from 0.80 at Station T17 to 0.90 at Station T03 (Table 12; Figure 6).

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 and sediment data for NOAA Gray's Reef D stations, July 2003.

Station	Latitude	Longitude	Depth (m)	Temp. (C)	Sal. (PSU)	Conductivity (μmhos)	% T.O.C.	% Gravel	% Sand	% Silt + Clay	USACE Description	Median Particle Size (phi)	Sorting Coefficient	% Moisture
D01	31° 23.9898	80° 53.3383	18.0	20.77	34.68	4.83	0.11	0.38	99.48	0.14	Sand	1.644	0.733	18.24
D10	31° 23.9899	80° 53.3384	18.0	20.77	34.68	4.83	0.20	0.16	99.62	0.22	Sand	1.632	0.778	17.65
D25	31° 23.9900	80° 53.3385	18.0	20.77	34.68	4.83	0.10	1.03	98.63	0.33	Sand	1.588	0.729	19.08
D75	31° 23.9901	80° 53.3386	18.0	20.77	34.68	4.83	0.03	0.75	98.99	0.26	Sand	1.777	0.803	18.39

* Too much Gravel for remaining textural descriptions.

Table 2. Summary of station location and sediment data for NOAA Gray's Reef T stations, July 2003.

Station	Latitude	Longitude	Depth (m)	Temp. (C)	Sal. (PSU)	Conductivity (μmhos)	% T.O.C.	% Gravel	% Sand	% Silt + Clay	USACE Description	Median Particle Size (phi)	Sorting Coefficient	% Moisture
T03	31° 25.518	80° 52.008	20.5	19.37	33.36	4.53	0.11	2.48	97.28	0.24	Sand	1.110	1.027	17.30
T10	31° 24.336	80° 49.386	21.0	19.86	34.20	4.68	0.05	1.36	98.34	0.30	Sand	0.830	0.823	17.31
T17	31° 21.474	80° 53.862	17.5	19.39	34.12	4.63	0.18	4.24	95.56	0.20	Sand	0.111	0.820	19.13

* Too much Gravel for remaining textural descriptions.

Table 3. Summary of overall abundance of major benthic macroinfaunal taxonomic groups for the Gray's Reef D stations, July 2003.

Taxa	Total No. Taxa	% Total	Total No. Individuals	% Total
Annelida				
Oligochaeta	1	1.0	6	1.5
Polychaeta	33	32.0	135	33.6
Mollusca				
Bivalvia	13	12.6	78	19.4
Gastropoda	6	5.8	11	2.7
Arthropoda				
Malacostraca	41	39.8	136	33.8
Echinodermata				
Asteroidea	1	1.0	1	0.2
Echinoidea	1	1.0	6	1.5
Ophiuroidea	1	1.0	1	0.2
Other Taxa	6	5.8	28	7.0
Total	**103**		**402**	

Table 4. Summary of overall abundance of major benthic macroinfaunal taxonomic groups for the Gray's Reef T stations, July 2003.

Taxa	Total No. Taxa	% of Total	Total No. Individuals	% of Total
Annelida				
Oligochaeta	2	0.9	41.0	2.1
Polychaeta	91	42.1	1,172.0	60.1
Mollusca				
Bivalvia	25	11.6	169.0	8.7
Gastropoda	30	13.9	185.0	9.5
Polyplacophora	1	0.5	17.0	0.9
Scaphopoda	1	0.5	2.0	0.1
Arthropoda				
Malacostraca	49	22.7	162.0	8.3
Echinodermata				
Asteroidea	1	0.5	5.0	0.3
Echinoidea	1	0.5	1.0	0.1
Ophiuroidea	2	0.9	16.0	0.8
Other Taxa	13	6.0	179.0	9.2
Total	**216**		**1,949**	

Table 5. Summary of abundance of major benthic macroinfaunal taxonomic groups by station for the Gray's Reef D stations, July 2003.

Station	Taxa	Total No. Taxa	% Total	Total No. Individuals	% Total
D01	Annelida	10	27.0	15	23.4
	Mollusca	9	24.3	16	25.0
	Arthropoda	15	40.5	25	39.1
	Echinodermata	1	2.7	5	7.8
	Other Taxa	2	5.4	3	4.7
	Total	**37**		**64**	
D10	Annelida	16	36.4	56	45.2
	Mollusca	8	18.2	22	17.7
	Arthropoda	14	31.8	29	23.4
	Echinodermata	1	2.3	1	0.8
	Other Taxa	5	11.4	16	12.9
	Total	**44**		**124**	
D25	Annelida	14	37.8	30	37.0
	Mollusca	7	18.9	9	11.1
	Arthropoda	14	37.8	38	46.9
	Echinodermata	0	0.0	0	0.0
	Other Taxa	2	5.4	4	4.9
	Total	**37**		**81**	
D75	Annelida	21	35.6	40	30.1
	Mollusca	10	16.9	42	31.6
	Arthropoda	23	39.0	44	33.1
	Echinodermata	2	3.4	2	1.5
	Other Taxa	3	5.1	5	3.8
	Total	**59**		**133**	

Table 6. Summary of abundance of major benthic macroinfaunal taxonomic groups by station for the Gray's Reef T stations, 2003.

Station	Taxa	Total No. Taxa	% Total	Total No. Individuals	% Total
T03	Annelida	54	47.0	199	50.4
	Mollusca	29	25.2	102	25.8
	Arthropoda	21	18.3	45	11.4
	Echinodermata	2	1.7	8	2.0
	Other Taxa	9	7.8	41	10.4
	Total	**115**		**395**	
T10	Annelida	58	47.5	612	63.1
	Mollusca	31	25.4	175	18.0
	Arthropoda	23	18.9	82	8.5
	Echinodermata	1	0.8	6	0.6
	Other Taxa	9	7.4	95	9.8
	Total	**122**		**970**	
T17	Annelida	52	50.0	402	67.9
	Mollusca	19	18.3	96	16.2
	Arthropoda	23	22.1	35	5.9
	Echinodermata	4	3.8	8	1.4
	Other Taxa	6	5.8	51	8.6
	Total	**104**		**592**	

Table 7. Distribution and abundance of benthic macroinfaunal taxa for the Gray's Reef D stations, July 2003.

Taxa	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	% Station Occurrence
Laevicardium (LPIL)	Mol	Biva	28	6.97	6.97	3	75
Paraonis pygoenigmatica	Ann	Poly	24	5.97	12.94	3	75
Erichthonius brasiliensis	Art	Mala	23	5.72	18.66	3	75
Spiophanes bombyx	Ann	Poly	20	4.98	23.63	4	100
Semele nuculoides	Mol	Biva	19	4.73	28.36	4	100
Aspidosiphon muelleri	Sip	-	15	3.73	32.09	4	100
Spio pettiboneae	Ann	Poly	15	3.73	35.82	4	100
Protodorvillea kefersteini	Ann	Poly	13	3.23	39.05	3	75
Protohaustorius wigleyi	Art	Mala	13	3.23	42.29	3	75
Crassinella lunulata	Mol	Biva	12	2.99	45.27	4	100
Metharpinia floridana	Art	Mala	8	1.99	47.26	4	100
Phyllodocidae (LPIL)	Ann	Poly	8	1.99	49.25	2	50
Acanthohaustorius millsi	Art	Mala	7	1.74	51.00	3	75
Cyclaspis unicornis	Art	Mala	7	1.74	52.74	3	75
Nephtyidae (LPIL)	Ann	Poly	7	1.74	54.48	3	75
Synelmis ewingi	Ann	Poly	7	1.74	56.22	3	75
Echinoidea (LPIL)	Ech	Echi	6	1.49	57.71	2	50
Tubificidae (LPIL)	Ann	Olig	6	1.49	59.20	3	75
Ampelisca agassizi	Art	Mala	5	1.24	60.45	3	75
Cyclaspis sp. O	Art	Mala	5	1.24	61.69	2	50
Diplodonta punctata	Mol	Biva	5	1.24	62.94	3	75
Sipuncula (LPIL)	Sip	-	5	1.24	64.18	2	50
Acuminodeutopus naglei	Art	Mala	4	1.00	65.17	1	25
Ampelisca (LPIL)	Art	Mala	4	1.00	66.17	3	75
Caprella penantis	Art	Mala	4	1.00	67.16	2	50
Caulleriella sp. J	Ann	Poly	4	1.00	68.16	3	75
Ervilia concentrica	Mol	Biva	4	1.00	69.15	3	75
Mitrella lunata	Mol	Gast	4	1.00	70.15	3	75
Oxyurostylis smithi	Art	Mala	4	1.00	71.14	2	50
Processa hemphilli	Art	Mala	4	1.00	72.14	2	50
Americhelidium americanum	Art	Mala	3	0.75	72.89	2	50
Ampelisca bicarinata	Art	Mala	3	0.75	73.63	2	50
Branchiostoma (LPIL)	Cho	Lept	3	0.75	74.38	3	75
Cyclaspis pustulata	Art	Mala	3	0.75	75.12	2	50
Lembos (LPIL)	Art	Mala	3	0.75	75.87	2	50
Maldanidae (LPIL)	Ann	Poly	3	0.75	76.62	1	25
Photis (LPIL)	Art	Mala	3	0.75	77.36	1	25
Photis pugnator	Art	Mala	3	0.75	78.11	2	50
Rhynchocoela (LPIL)	Rhy	-	3	0.75	78.86	1	25
Tellinidae (LPIL)	Mol	Biva	3	0.75	79.60	1	25
Aricidea cerrutii	Ann	Poly	2	0.50	80.10	2	50
Bathyporeia parkeri	Art	Mala	2	0.50	80.60	2	50
Caecum pulchellum	Mol	Gast	2	0.50	81.09	2	50
Cirrophorus lyra	Ann	Poly	2	0.50	81.59	1	25
Eurydice (LPIL)	Art	Mala	2	0.50	82.09	1	25
Exogone rolani	Ann	Poly	2	0.50	82.59	2	50
Glycera sp. A	Ann	Poly	2	0.50	83.08	2	50
Glyceridae (LPIL)	Ann	Poly	2	0.50	83.58	2	50
Haustoriidae (LPIL)	Art	Mala	2	0.50	84.08	1	25
Heteropodarke lyonsi	Ann	Poly	2	0.50	84.58	1	25
Leptochelia (LPIL)	Art	Mala	2	0.50	85.07	1	25
Melitidae (LPIL)	Art	Mala	2	0.50	85.57	1	25
Metatiron tropakis	Art	Mala	2	0.50	86.07	1	25
Nereis acuminata	Ann	Poly	2	0.50	86.57	2	50
Ogyrides alphaerostris	Art	Mala	2	0.50	87.06	1	25
Pettiboneia duofurca	Ann	Poly	2	0.50	87.56	2	50

Table 7 continued:

Taxa	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	% Station Occurrence
Sphaerosyllis aciculata	Ann	Poly	2	0.50	88.06	2	50
Spionidae (LPIL)	Ann	Poly	2	0.50	88.56	2	50
Turbonilla sp. AG	Mol	Gast	2	0.50	89.05	1	25
Ampelisca abdita	Art	Mala	1	0.25	89.30	1	25
Ampithoidae (LPIL)	Art	Mala	1	0.25	89.55	1	25
Arabella multidentata	Ann	Poly	1	0.25	89.80	1	25
Aricidea suecica	Ann	Poly	1	0.25	90.05	1	25
Asteroidea (LPIL)	Ech	Aste	1	0.25	90.30	1	25
Asthenothaerus hemphilli	Mol	Biva	1	0.25	90.55	1	25
Bhawania goodei	Ann	Poly	1	0.25	90.80	1	25
Bivalvia (LPIL)	Mol	Biva	1	0.25	91.04	1	25
Bowmaniella (LPIL)	Art	Mala	1	0.25	91.29	1	25
Brachiopoda (LPIL)	Bra	-	1	0.25	91.54	1	25
Caecum johnsoni	Mol	Gast	1	0.25	91.79	1	25
Campylaspis heardi	Art	Mala	1	0.25	92.04	1	25
Chione (LPIL)	Mol	Biva	1	0.25	92.29	1	25
Cirrophorus ilvana	Ann	Poly	1	0.25	92.54	1	25
Cupuladria (LPIL)	Ect	Gymn	1	0.25	92.79	1	25
Cyclaspis (LPIL)	Art	Mala	1	0.25	93.03	1	25
Ebalia stimpsonii	Art	Mala	1	0.25	93.28	1	25
Eurydice personata	Art	Mala	1	0.25	93.53	1	25
Glycera americana	Ann	Poly	1	0.25	93.78	1	25
Leptocheirus plumulosus	Art	Mala	1	0.25	94.03	1	25
Leptochela papulata	Art	Mala	1	0.25	94.28	1	25
Leucothoe spinicarpa	Art	Mala	1	0.25	94.53	1	25
Liljeborgia sp. A	Art	Mala	1	0.25	94.78	1	25
Lucinidae (LPIL)	Mol	Biva	1	0.25	95.02	1	25
Magelona sp. C	Ann	Poly	1	0.25	95.27	1	25
Metatiron (LPIL)	Art	Mala	1	0.25	95.52	1	25
Mitra nodulosa	Mol	Gast	1	0.25	95.77	1	25
Onuphidae (LPIL)	Ann	Poly	1	0.25	96.02	1	25
Ophelia denticulata	Ann	Poly	1	0.25	96.27	1	25
Ophiuroidea (LPIL)	Ech	Ophi	1	0.25	96.52	1	25
Paguridae (LPIL)	Art	Mala	1	0.25	96.77	1	25
Paraprionospio pinnata	Ann	Poly	1	0.25	97.01	1	25
Parvilucina multilineata	Mol	Biva	1	0.25	97.26	1	25
Pherusa inflata	Ann	Poly	1	0.25	97.51	1	25
Phoxocephalidae (LPIL)	Art	Mala	1	0.25	97.76	1	25
Poecilochaetus (LPIL)	Ann	Poly	1	0.25	98.01	1	25
Processa (LPIL)	Art	Mala	1	0.25	98.26	1	25
Rictaxis punctostriatus	Mol	Gast	1	0.25	98.51	1	25
Scolelepis squamata	Ann	Poly	1	0.25	98.76	1	25
Semele bellastriata	Mol	Biva	1	0.25	99.00	1	25
Sphaerosyllis piriferopsis	Ann	Poly	1	0.25	99.25	1	25
Spiochaetopterus oculatus	Ann	Poly	1	0.25	99.50	1	25
Stenothoe minuta	Art	Mala	1	0.25	99.75	1	25
Tellina (LPIL)	Mol	Biva	1	0.25	100.00	1	25

Taxa Key

Ann=Annelida
Olig=Oligochaeta
Poly=Polychaeta
Art=Arthropoda
Mala=Malacostraca
Bra=Brachiopoda
Cho=Chordata
Lept=Leptocardia
Ech=Echinodermata
Aste=Asteroidea
Echi=Echinoidea
Ophi=Ophiuroidea
Ect=Ectoprocta
Gymn=Gymnolaemata
Mol=Mollusca
Biva=Bivalvia
Gast=Gastropoda
Rhy=Rhynchocoela
Sip=Sipuncula

Table 8. Distribution and abundance of benthic macroinfaunal taxa for the Gray's Reef T stations, 2003

Taxa	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	% Station Occurrence
Sphaerosyllis piriferopsis	Ann	Poly	163	8.36	8.36	2	67
Spiophanes bombyx	Ann	Poly	97	4.98	13.34	3	100
Fabricinuda trilobata	Ann	Poly	95	4.87	18.21	3	100
Caecum johnsoni	Mol	Gast	85	4.36	22.58	3	100
Bhawania goodei	Ann	Poly	80	4.10	26.68	3	100
Exogone lourei	Ann	Poly	76	3.90	30.58	3	100
Dentatisyllis carolinae	Ann	Poly	63	3.23	33.81	3	100
Branchiostoma (LPIL)	Cho	Lept	60	3.08	36.89	3	100
Taylorpholoe hirsuta	Ann	Poly	51	2.62	39.51	3	100
Armandia maculata	Ann	Poly	43	2.21	41.71	2	67
Laevicardium (LPIL)	Mol	Biva	41	2.10	43.82	3	100
Crassinella lunulata	Mol	Biva	38	1.95	45.77	3	100
Tubificidae (LPIL)	Ann	Olig	36	1.85	47.61	3	100
Goniadides carolinae	Ann	Poly	34	1.74	49.36	3	100
Syllis cornuta	Ann	Poly	34	1.74	51.10	2	67
Exogone rolani	Ann	Poly	31	1.59	52.69	3	100
Sipuncula (LPIL)	Sip	-	31	1.59	54.28	3	100
Caecum pulchellum	Mol	Gast	30	1.54	55.82	1	33
Semele nuculoides	Mol	Biva	30	1.54	57.36	2	67
Spio pettiboneae	Ann	Poly	30	1.54	58.90	3	100
Protodorvillea kefersteini	Ann	Poly	24	1.23	60.13	3	100
Aspidosiphon albus	Sip	-	23	1.18	61.31	2	67
Vermiliopsis annulata	Ann	Poly	21	1.08	62.39	1	33
Aspidosiphon muelleri	Sip	-	19	0.97	63.37	3	100
Chone (LPIL)	Ann	Poly	19	0.97	64.34	3	100
Campylaspis heardi	Art	Mala	18	0.92	65.26	2	67
Polyplacophora (LPIL)	Mol	Polyp	17	0.87	66.14	3	100
Spionidae (LPIL)	Ann	Poly	17	0.87	67.01	3	100
Acteocina lepta	Mol	Gast	16	0.82	67.83	2	67
Rhynchocoela (LPIL)	Rhy	-	16	0.82	68.65	2	67
Tellina (LPIL)	Mol	Biva	16	0.82	69.47	2	67
Galathowenia oculata	Ann	Poly	15	0.77	70.24	3	100
Maldanidae (LPIL)	Ann	Poly	15	0.77	71.01	3	100
Pisione remota	Ann	Poly	14	0.72	71.73	3	100
Syllis danieli	Ann	Poly	14	0.72	72.45	2	67
Owenia fusiformis	Ann	Poly	13	0.67	73.11	3	100
Ampelisca (LPIL)	Art	Mala	12	0.62	73.73	3	100
Ophiuroidea (LPIL)	Ech	Ophi	12	0.62	74.35	3	100
Apoprionospio dayi	Ann	Poly	11	0.56	74.91	1	33
Heteropodarke formalis	Ann	Poly	11	0.56	75.47	2	67
Leptochelia (LPIL)	Art	Mala	11	0.56	76.04	3	100
Photis (LPIL)	Art	Mala	11	0.56	76.60	2	67
Prionospio (LPIL)	Ann	Poly	11	0.56	77.17	3	100
Cirrophorus ilvana	Ann	Poly	9	0.46	77.63	2	67
Nephtys picta	Ann	Poly	9	0.46	78.09	2	67
Onuphidae (LPIL)	Ann	Poly	9	0.46	78.55	3	100
Plakosyllis quadrioculata	Ann	Poly	9	0.46	79.01	2	67
Rictaxis punctostriatus	Mol	Gast	9	0.46	79.48	2	67
Apseudes olympiae	Art	Mala	8	0.41	79.89	3	100
Asabellides oculata	Ann	Poly	8	0.41	80.30	3	100

Table 8 continued:

Taxa	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	% Station Occurrence
Diopatra cuprea	Ann	Poly	8	0.41	80.71	1	33
Gammaropsis (LPIL)	Art	Mala	8	0.41	81.12	3	100
Lima pellucida	Mol	Biva	8	0.41	81.53	2	67
Phyllodocidae (LPIL)	Ann	Poly	8	0.41	81.94	3	100
Syllidae (LPIL)	Ann	Poly	8	0.41	82.35	3	100
Ampelisca agassizi	Art	Mala	7	0.36	82.71	3	100
Oxyurostylis smithi	Art	Mala	7	0.36	83.07	2	67
Acuminodeutopus naglei	Art	Mala	6	0.31	83.38	1	33
Bhawania heteroseta	Ann	Poly	6	0.31	83.68	2	67
Brachiopoda (LPIL)	Bra	-	6	0.31	83.99	2	67
Caulleriella (LPIL)	Ann	Poly	6	0.31	84.30	3	100
Cupuladria (LPIL)	Ect	Gymn	6	0.31	84.61	1	33
Glycera robusta	Ann	Poly	6	0.31	84.92	2	67
Paramphinome sp. B	Ann	Poly	6	0.31	85.22	2	67
Acteocina bidentata	Mol	Gast	5	0.26	85.48	1	33
Ampharetidae (LPIL)	Ann	Poly	5	0.26	85.74	3	100
Aoridae (LPIL)	Art	Mala	5	0.26	85.99	1	33
Asteroidea (LPIL)	Ech	Aste	5	0.26	86.25	2	67
Cnidaria (LPIL)	Cni	-	5	0.26	86.51	2	67
Lembos (LPIL)	Art	Mala	5	0.26	86.76	1	33
Lineidae (LPIL)	Rhy	Anop	5	0.26	87.02	2	67
Lumbriculidae (LPIL)	Ann	Olig	5	0.26	87.28	2	67
Maera caroliniana	Art	Mala	5	0.26	87.53	3	100
Acteocina recta	Mol	Gast	4	0.21	87.74	1	33
Bivalvia (LPIL)	Mol	Biva	4	0.21	87.94	3	100
Caecum floridanum	Mol	Gast	4	0.21	88.15	2	67
Columbellidae (LPIL)	Mol	Gast	4	0.21	88.35	1	33
Cyclaspis unicornis	Art	Mala	4	0.21	88.56	2	67
Cyclostremiscus (LPIL)	Mol	Gast	4	0.21	88.76	2	67
Diplodonta (LPIL)	Mol	Biva	4	0.21	88.97	2	67
Diplodonta punctata	Mol	Biva	4	0.21	89.17	2	67
Filogranula sp. A	Ann	Poly	4	0.21	89.38	1	33
Ophiuridae (LPIL)	Ech	Ophi	4	0.21	89.58	1	33
Parapionosyllis longicirrata	Ann	Poly	4	0.21	89.79	1	33
Photis sp. N	Art	Mala	4	0.21	89.99	1	33
Phyllodoce arenae	Ann	Poly	4	0.21	90.20	1	33
Scoloplos rubra	Ann	Poly	4	0.21	90.41	1	33
Turbonilla (LPIL)	Mol	Gast	4	0.21	90.61	1	33
Apseudes propinquus	Art	Mala	3	0.15	90.76	1	33
Aricidea suecica	Ann	Poly	3	0.15	90.92	2	67
Aricidea taylori	Ann	Poly	3	0.15	91.07	1	33
Automate (LPIL)	Art	Mala	3	0.15	91.23	1	33
Cirratulidae (LPIL)	Ann	Poly	3	0.15	91.38	2	67
Crenella divaricata	Mol	Biva	3	0.15	91.53	2	67
Lucinidae (LPIL)	Mol	Biva	3	0.15	91.69	2	67
Ophelia denticulata	Ann	Poly	3	0.15	91.84	3	100
Poecilochaetus (LPIL)	Ann	Poly	3	0.15	92.00	1	33
Ptilanthura tenuis	Art	Mala	3	0.15	92.15	1	33
Rildardanus laminosa	Art	Mala	3	0.15	92.30	1	33
Turbellaria (LPIL)	Pla	Turb	3	0.15	92.46	1	33
Acanthohaustorius millsi	Art	Mala	2	0.10	92.56	1	33

Table 8 continued:

Taxa	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	% Station Occurrence
Actiniaria (LPIL)	Cni	Anth	2	0.10	92.66	1	33
Antalis (LPIL)	Mol	Scap	2	0.10	92.77	1	33
Caulleriella sp. J	Ann	Poly	2	0.10	92.87	1	33
Cirrophorus (LPIL)	Ann	Poly	2	0.10	92.97	1	33
Corbula contracta	Mol	Biva	2	0.10	93.07	1	33
Ervilia concentrica	Mol	Biva	2	0.10	93.18	1	33
Eulepethidae (LPIL)	Ann	Poly	2	0.10	93.28	1	33
Eurydice personata	Art	Mala	2	0.10	93.38	1	33
Glyceridae (LPIL)	Ann	Poly	2	0.10	93.48	2	67
Haustoriidae (LPIL)	Art	Mala	2	0.10	93.59	1	33
Lepidonotus sp. A	Ann	Poly	2	0.10	93.69	2	67
Liljeborgia sp. A	Art	Mala	2	0.10	93.79	2	67
Lysidice notata	Ann	Poly	2	0.10	93.89	1	33
Macrochaeta sp. A	Ann	Poly	2	0.10	94.00	1	33
Magelona sp. C	Ann	Poly	2	0.10	94.10	2	67
Magelona sp. H	Ann	Poly	2	0.10	94.20	1	33
Metharpinia floridana	Art	Mala	2	0.10	94.30	1	33
Monticellina dorsobranchialis	Ann	Poly	2	0.10	94.41	2	67
Onuphis eremita oculata	Ann	Poly	2	0.10	94.51	2	67
Paguridae (LPIL)	Art	Mala	2	0.10	94.61	2	67
Paraonidae (LPIL)	Ann	Poly	2	0.10	94.72	1	33
Phascolion strombi	Sip	-	2	0.10	94.82	1	33
Photis pugnator	Art	Mala	2	0.10	94.92	1	33
Phyllodoce (LPIL)	Ann	Poly	2	0.10	95.02	1	33
Podarke obscura	Ann	Poly	2	0.10	95.13	2	67
Processa (LPIL)	Art	Mala	2	0.10	95.23	1	33
Sabellidae (LPIL)	Ann	Poly	2	0.10	95.33	1	33
Semele bellastriata	Mol	Biva	2	0.10	95.43	2	67
Spio (LPIL)	Ann	Poly	2	0.10	95.54	1	33
Trypanosyllis coeliaca	Ann	Poly	2	0.10	95.64	2	67
Aclididae (LPIL)	Mol	Gast	1	0.05	95.69	1	33
Albunea paretii	Art	Mala	1	0.05	95.74	1	33
Albuneidae (LPIL)	Art	Mala	1	0.05	95.79	1	33
Alpheidae (LPIL)	Art	Mala	1	0.05	95.84	1	33
Ampelisca vadorum	Art	Mala	1	0.05	95.90	1	33
Anomia simplex	Mol	Biva	1	0.05	95.95	1	33
Apoprionospio pygmaea	Ann	Poly	1	0.05	96.00	1	33
Aricidea cerrutii	Ann	Poly	1	0.05	96.05	1	33
Armandia agilis	Ann	Poly	1	0.05	96.10	1	33
Autolytus (LPIL)	Ann	Poly	1	0.05	96.15	1	33
Axiothella mucosa	Ann	Poly	1	0.05	96.20	1	33
Caecidae (LPIL)	Mol	Gast	1	0.05	96.25	1	33
Caecum cooperi	Mol	Gast	1	0.05	96.31	1	33
Cancellaria reticulata	Mol	Gast	1	0.05	96.36	1	33
Caulleriella cf. alata	Ann	Poly	1	0.05	96.41	1	33
Ceratonereis (LPIL)	Ann	Poly	1	0.05	96.46	1	33
Chiridotea (LPIL)	Art	Mala	1	0.05	96.51	1	33
Cirrophorus branchiatus	Ann	Poly	1	0.05	96.56	1	33
Cirrophorus lyra	Ann	Poly	1	0.05	96.61	1	33
Conus jaspideus stearnsi	Mol	Gast	1	0.05	96.66	1	33
Crepidula (LPIL)	Mol	Gast	1	0.05	96.72	1	33

Table 8 continued:

Taxa	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	% Station Occurrence
Crepidula plana	Mol	Gast	1	0.05	96.77	1	33
Cumingia tellinoides	Mol	Biva	1	0.05	96.82	1	33
Cyclaspis pustulata	Art	Mala	1	0.05	96.87	1	33
Cyclaspis sp. N	Art	Mala	1	0.05	96.92	1	33
Cymatoica orientalis	Mol	Biva	1	0.05	96.97	1	33
Dentimargo aureocincta	Mol	Gast	1	0.05	97.02	1	33
Dispio uncinata	Ann	Poly	1	0.05	97.08	1	33
Ehlersia ferrugina	Ann	Poly	1	0.05	97.13	1	33
Elasmopus levis	Art	Mala	1	0.05	97.18	1	33
Encope aberrans	Ech	Echi	1	0.05	97.23	1	33
Eulimidae (LPIL)	Mol	Gast	1	0.05	97.28	1	33
Gastropoda (LPIL)	Mol	Gast	1	0.05	97.33	1	33
Glycera (LPIL)	Ann	Poly	1	0.05	97.38	1	33
Glycera americana	Ann	Poly	1	0.05	97.43	1	33
Glycinde solitaria	Ann	Poly	1	0.05	97.49	1	33
Goneplacidae (LPIL)	Art	Mala	1	0.05	97.54	1	33
Goniadidae (LPIL)	Ann	Poly	1	0.05	97.59	1	33
Gouldia cerina	Mol	Biva	1	0.05	97.64	1	33
Hemipodus roseus	Ann	Poly	1	0.05	97.69	1	33
Hemus cristulipes	Art	Mala	1	0.05	97.74	1	33
Hypoconcha arcuata	Art	Mala	1	0.05	97.79	1	33
Isaeidae (LPIL)	Art	Mala	1	0.05	97.85	1	33
Leptochela (LPIL)	Art	Mala	1	0.05	97.90	1	33
Lima (LPIL)	Mol	Biva	1	0.05	97.95	1	33
Lithadia granulosa	Art	Mala	1	0.05	98.00	1	33
Magelona (LPIL)	Ann	Poly	1	0.05	98.05	1	33
Marginella (LPIL)	Mol	Gast	1	0.05	98.10	1	33
Marginellidae (LPIL)	Mol	Gast	1	0.05	98.15	1	33
Microcharon sp. A	Art	Mala	1	0.05	98.20	1	33
Mitra nodulosa	Mol	Gast	1	0.05	98.26	1	33
Mitrella lunata	Mol	Gast	1	0.05	98.31	1	33
Montacutidae (LPIL)	Mol	Biva	1	0.05	98.36	1	33
Neomegamphopus (LPIL)	Art	Mala	1	0.05	98.41	1	33
Neomegamphopus kalanii	Art	Mala	1	0.05	98.46	1	33
Nephtys squamosa	Ann	Poly	1	0.05	98.51	1	33
Odostomia (LPIL)	Mol	Gast	1	0.05	98.56	1	33
Olivella mutica	Mol	Gast	1	0.05	98.61	1	33
Opisthodonta sp. B	Ann	Poly	1	0.05	98.67	1	33
Orbiniidae (LPIL)	Ann	Poly	1	0.05	98.72	1	33
Pandora trilineata	Mol	Biva	1	0.05	98.77	1	33
Pectinidae (LPIL)	Mol	Biva	1	0.05	98.82	1	33
Pettiboneia duofurca	Ann	Poly	1	0.05	98.87	1	33
Phoronis (LPIL)	Pho	-	1	0.05	98.92	1	33
Phtisica marina	Art	Mala	1	0.05	98.97	1	33
Pleuromeris tridentata	Mol	Biva	1	0.05	99.03	1	33
Podocerus kleidus	Art	Mala	1	0.05	99.08	1	33
Podochela (LPIL)	Art	Mala	1	0.05	99.13	1	33
Polycirrus (LPIL)	Ann	Poly	1	0.05	99.18	1	33
Prionospio lighti	Ann	Poly	1	0.05	99.23	1	33
Pyrgocythara coxi	Mol	Gast	1	0.05	99.28	1	33
Sabellaria vulgaris	Ann	Poly	1	0.05	99.33	1	33

Table 8 continued:

Taxa	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	% Station Occurrence
Semele purpurascens	Mol	Biva	1	0.05	99.38	1	33
Sigalion arenicola	Ann	Poly	1	0.05	99.44	1	33
Solemya velum	Mol	Biva	1	0.05	99.49	1	33
Spiochaetopterus oculatus	Ann	Poly	1	0.05	99.54	1	33
Streblospio benedicti	Ann	Poly	1	0.05	99.59	1	33
Strombiformis (LPIL)	Mol	Gast	1	0.05	99.64	1	33
Tanaissus psammophilus	Art	Mala	1	0.05	99.69	1	33
Tectonatica pusilla	Mol	Gast	1	0.05	99.74	1	33
Terebellidae (LPIL)	Ann	Poly	1	0.05	99.79	1	33
Terebra dislocata	Mol	Gast	1	0.05	99.85	1	33
Unciola irrorata	Art	Mala	1	0.05	99.90	1	33
Veneridae (LPIL)	Mol	Biva	1	0.05	99.95	1	33
Xanthidae (LPIL)	Art	Mala	1	0.05	100.00	1	33

Taxa Key

Ann=Annelida
  Olig=Oligochaeta
  Poly=Polychaeta
Art=Arthropoda
  Mala=Malacostraca
Bra=Brachiopoda
Cho=Chordata
  Lept=Leptocardia
Cni=Cnidaria
  Anth=Anthozoa
Ech=Echinodermata
  Aste=Asteroidea
  Echi=Echinoidea
  Ophi=Ophiuroidea
Ect=Ectoprocta
  Gymn=Gymnolaemata
Mol=Mollusca
  Biva=Bivalvia
  Gast=Gastropoda
  Polyp=Polyplacophora
  Scap=Scaphopoda
Pho=Phoronida
Pla=Platyhelminthes
  Turb=Turbellaria
Rhy=Rhynchocoela
  Anop=Anopla
Sip=Sipuncula

Table 9. Percentage abundance of dominant benthic macroinfaunal taxa (>5% of the total) for the Gray's Reef D stations, July 2003.

Taxa	D01	D10	D25	D75
Annelida				
Polychaeta				
Paraonis pygoenigmatica		7.3	12.3	
Protodorvillea kefersteini		8.9		
Spio pettiboneae	7.8			
Spiophanes bombyx		5.6		5.3
Arthropoda				
Malacostraca				
Erichthonius brasiliensis			19.8	
Protohaustorius wigleyi	14.1			
Echinodermata				
Echinoidea				
Echinoidea (LPIL)	7.8			
Mollusca				
Bivalvia				
Laevicardium (LPIL)		6.5		12.8
Semele nuculoides				7.5
Sipuncula				
Aspidosiphon muelleri		6.5		

Table 10. Percentage abundance of dominant benthic macroinfaunal taxa (>5% of the total) for the Gray's Reef T stations, July 2003.

Taxa	T03	T10	T17
Annelida			
Polychaeta			
Bhawania goodei			11.0
Exogone lourei			5.1
Fabricinuda trilobata		7.0	
Sphaerosyllis piriferopsis		10.1	11.1
Spiophanes bombyx	6.1		5.8
Mollusca			
Gastropoda			
Caecum johnsoni		5.1	5.8
Caecum pulchellum	7.6		

Table 11. Summary of the benthic macroinfaunal data for the Gray's Reef D stations, July 2003.

Station	Rep	No. of Taxa	No. of Indvs	Density (no/m2)	Mean No. Taxa	Taxa (SD)	Mean Density	Density (SD)	Total No. Taxa	Total No. Individuals	H' Diversity	J' Evenness
D01	1	7	7	986	10.4	2.8	1803.0	502.1	37	64	3.34	0.92
	2	13	14	1972								
	3	8	12	1690								
	4	11	15	2113								
	5	13	16	2254								
D10	1	15	22	3099	16.2	2.2	3493.2	502.0	44	124	3.44	0.91
	2	13	21	2958								
	3	17	28	3944								
	4	18	29	4085								
	5	18	24	3380								
D25	1	7	9	1268	10.8	5.1	2281.6	1679.3	37	81	3.18	0.88
	2	5	6	845								
	3	13	18	2535								
	4	18	36	5070								
	5	11	12	1690								
D75	1	20	30	4225	16.8	2.6	3746.2	1047.4	59	133	3.67	0.90
	2	17	37	5211								
	3	13	17	2394								
	4	18	24	3380								
	5	16	25	3521								

Table 12. Summary of the benthic macroinfaunal data for the Gray's Reef T stations, July 2003.

Station	Rep	No. of Taxa	No. of Indvs	Density (no/m2)	Mean No. Taxa	Taxa (SD)	Mean Density	Density (SD)	Total No. Taxa	Total No. Individuals	H' Diversity	J' Evenness
T03	1	76	213	5325	50.3	22.4	3291.7	1795.4	115	50.3	4.26	0.90
	2	35	105	2625								
	3	40	77	1925								
T10	1	70	229	5725	73.3	10.4	8083.3	2198.1	122	73.3	3.92	0.82
	2	85	403	10075								
	3	65	338	8450								
T17	1	60	185	4625	53.7	10.1	4866.7	2670.7	104	53.7	3.70	0.80
	2	59	306	7650								
	3	42	93	2325								

Figure 1. Station locations for the NOAA Gray's Reef stations, July 2003.

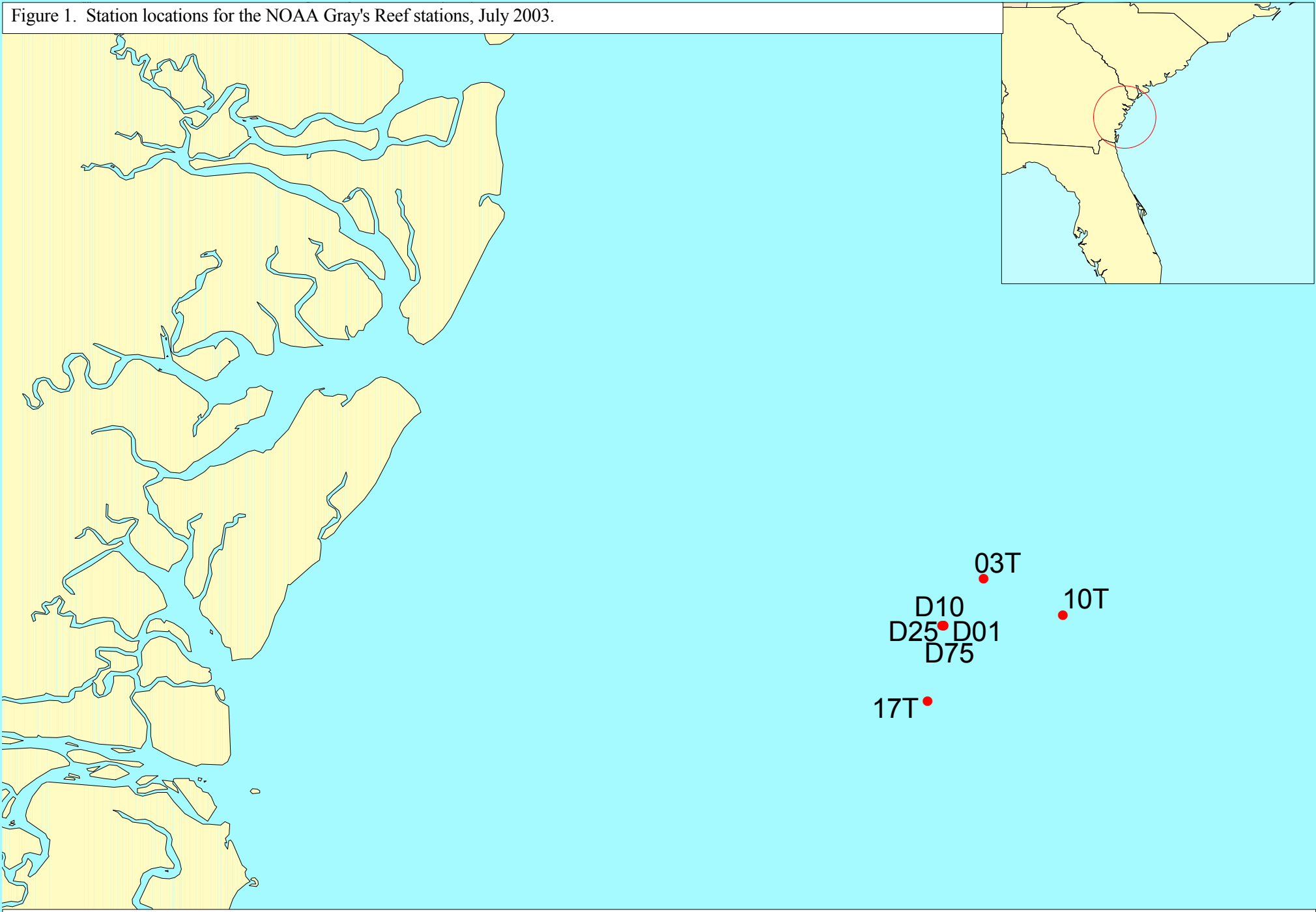
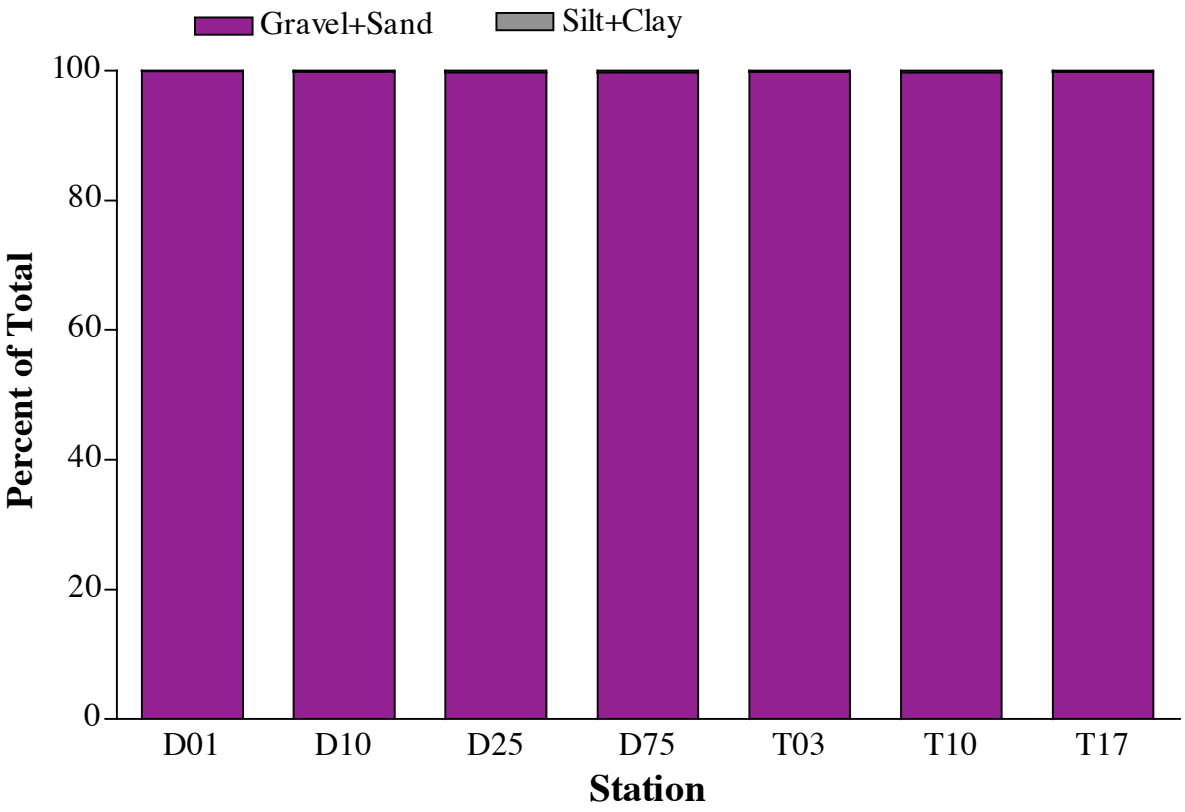


Figure 2. Sediment texture and Total Organic Carbon (TOC) data for the Gray's Reef stations, 2003.



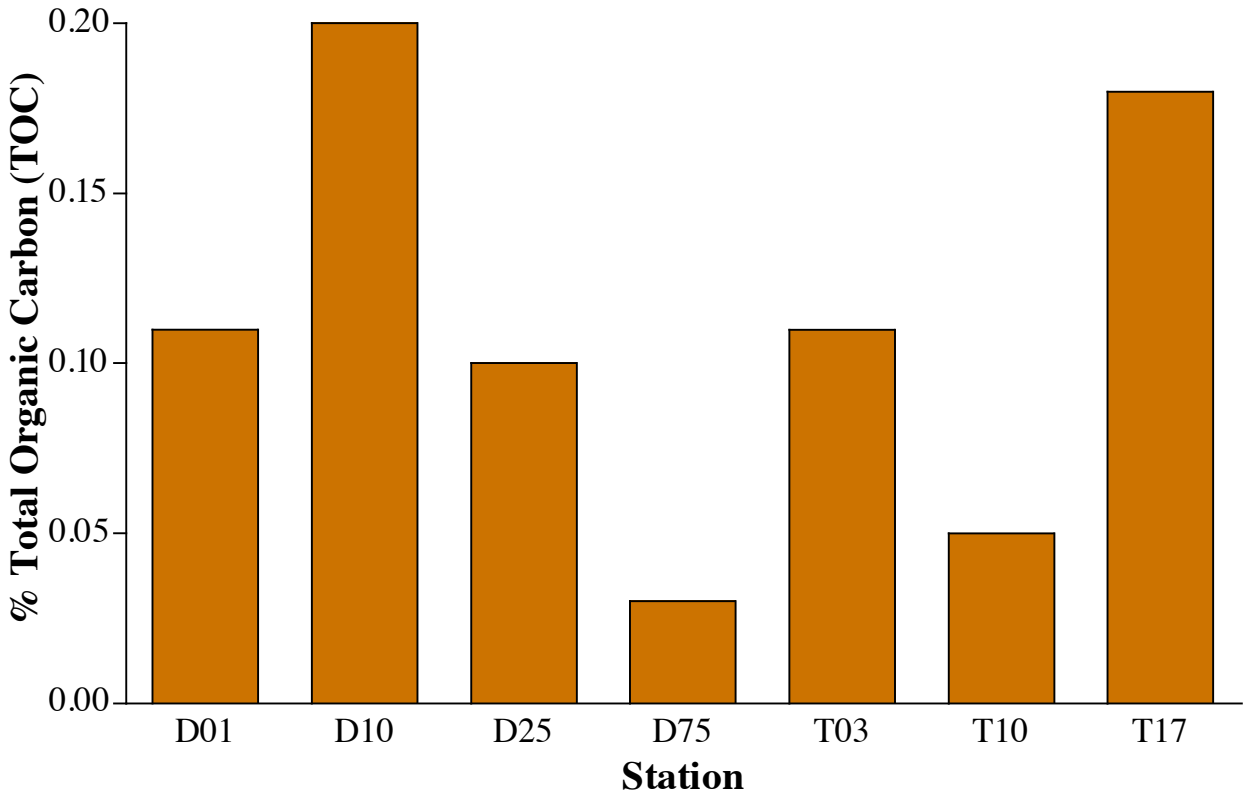


Figure 3. Percent abundance of major taxonomic groups for the Gray's Reef stations, 2003.

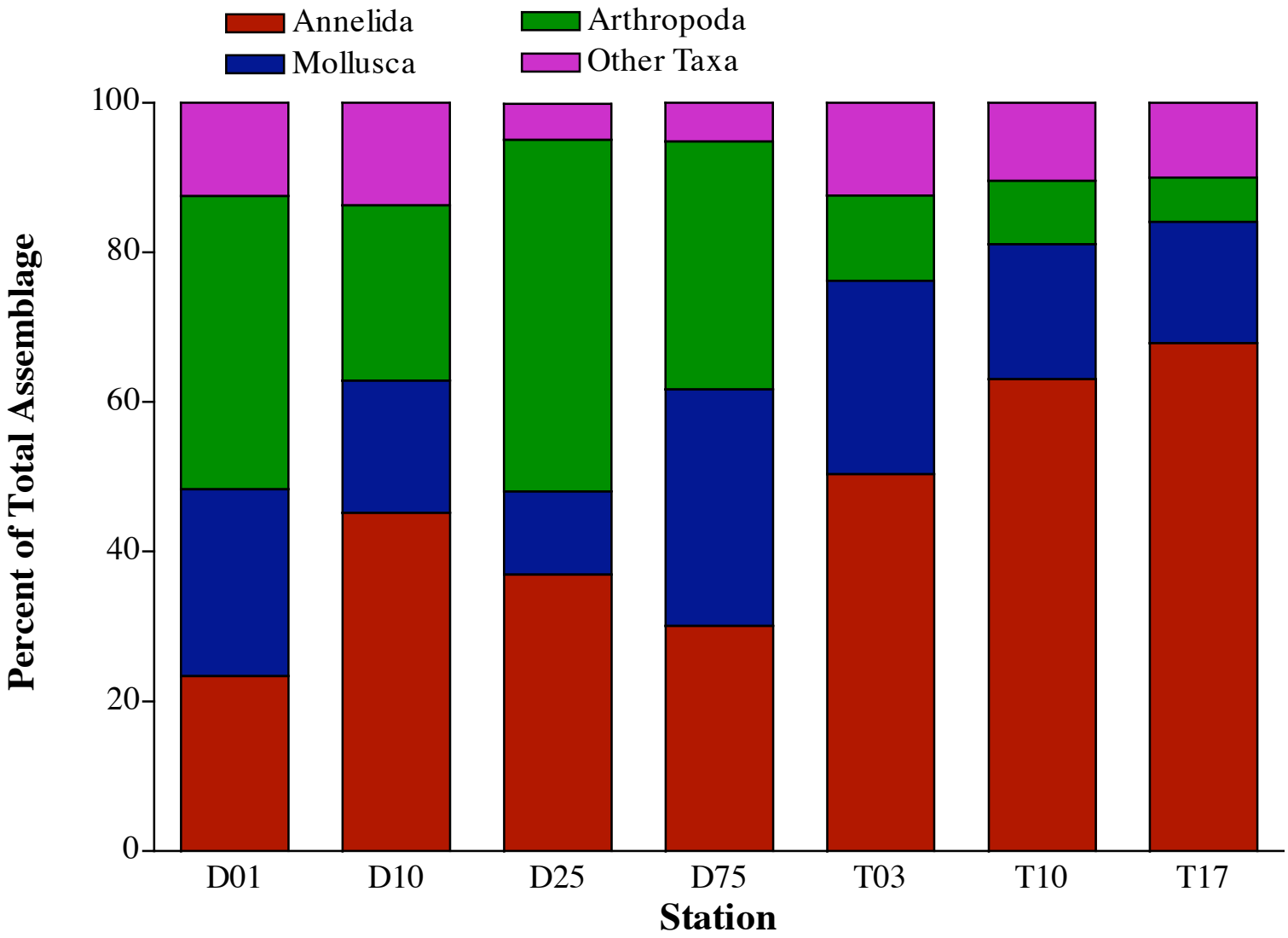


Figure 4. Taxa richness data for the Gray's Reef stations, 2003.

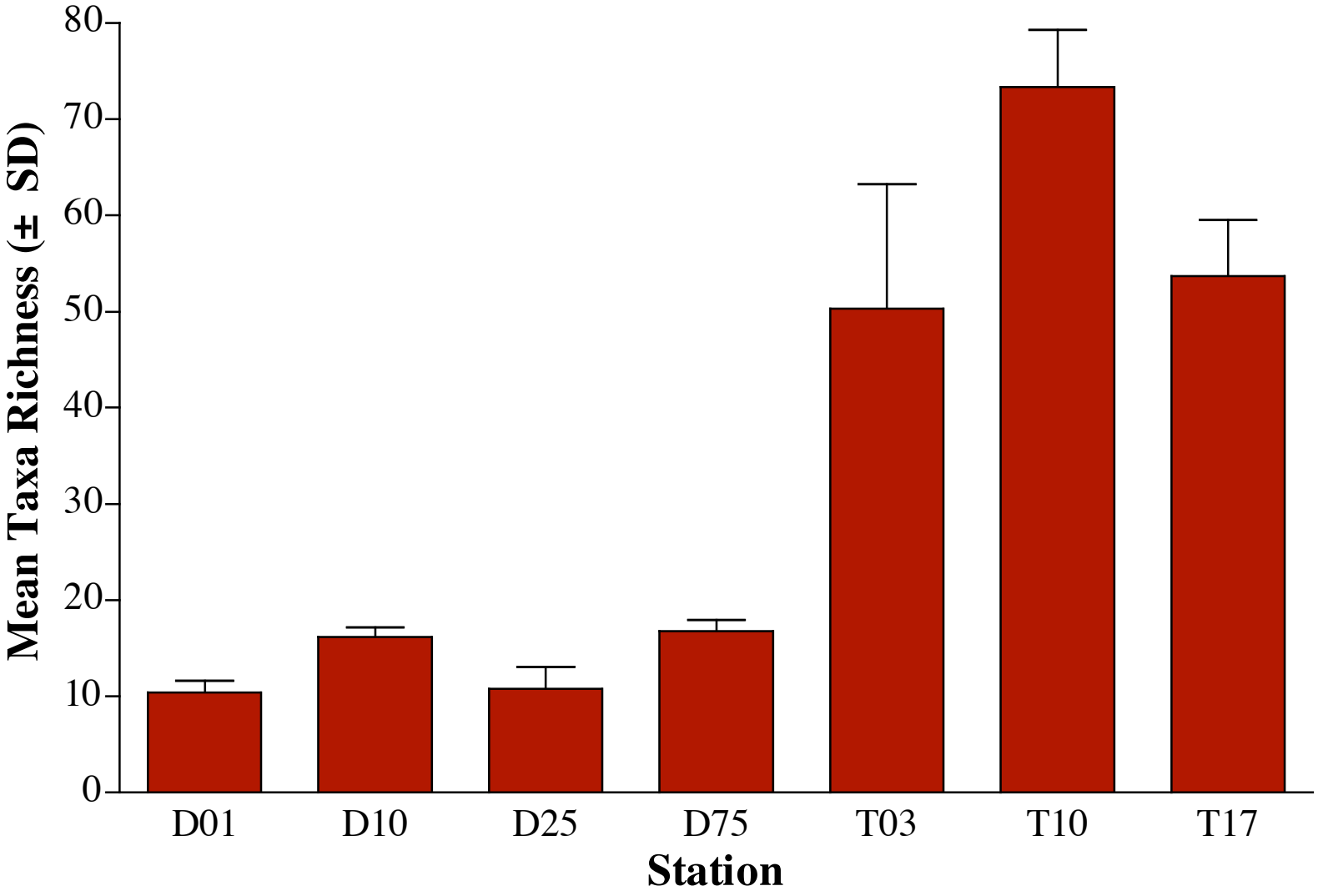


Figure 5. Mean macroinvertebrate densities for the Gray's Reef stations, 2003.

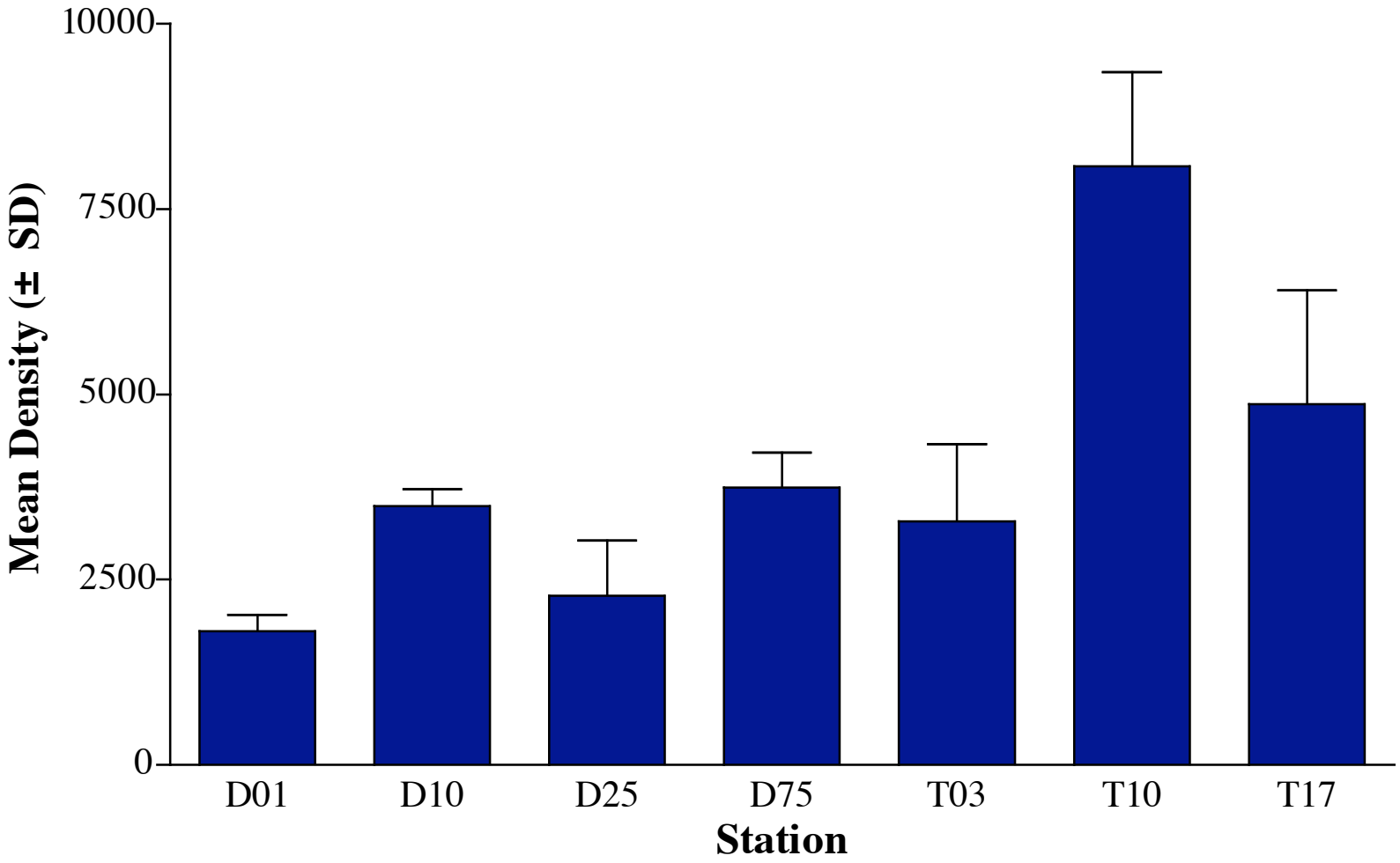
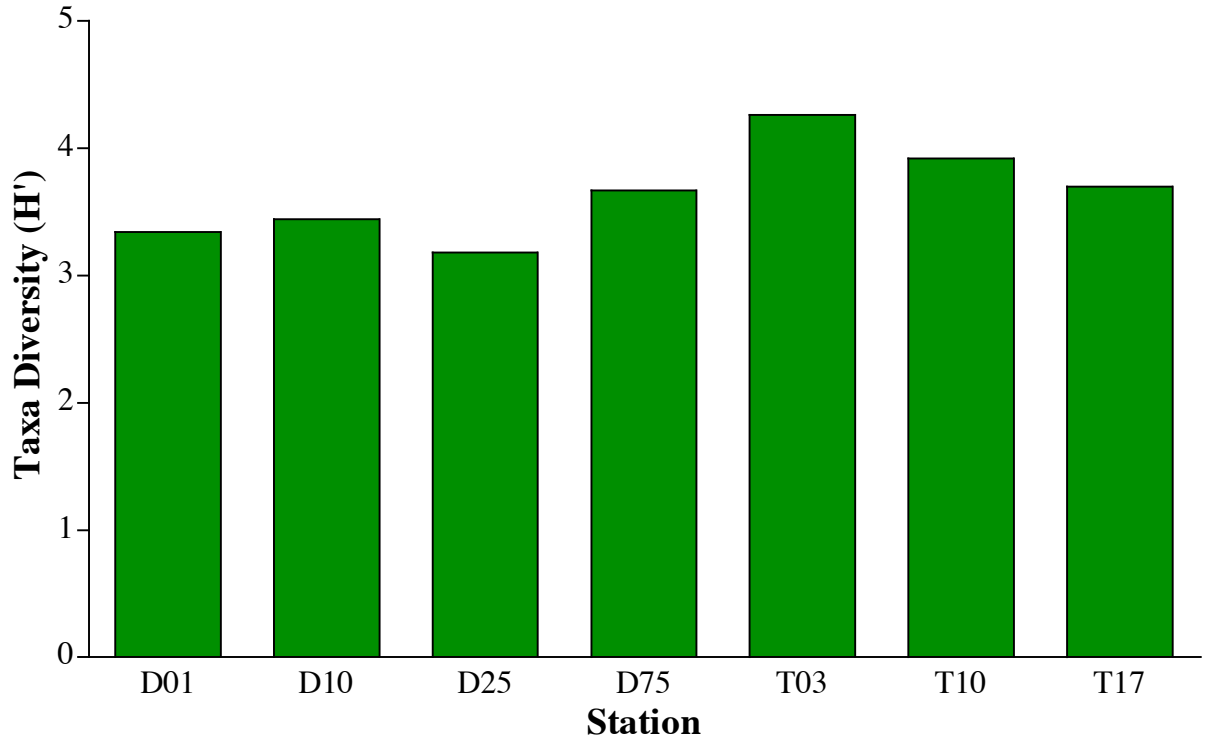
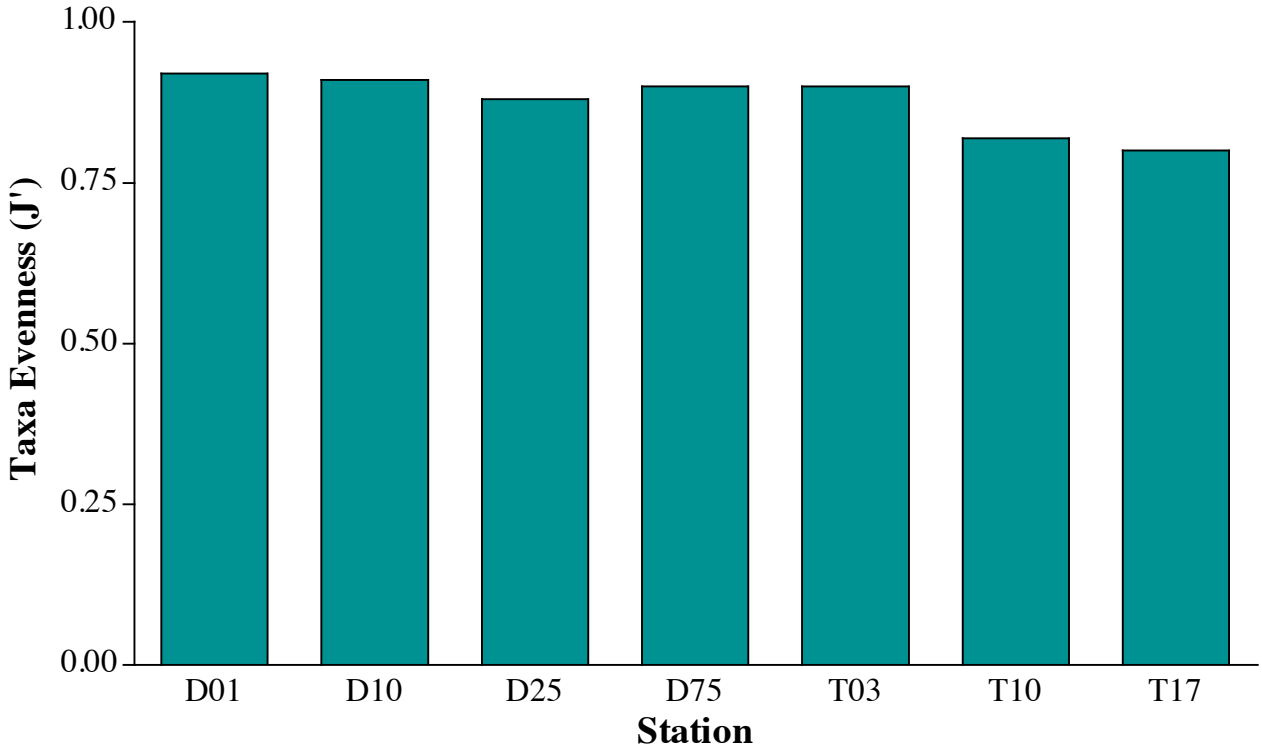


Figure 6. Taxa diversity (H') and evenness (J') for the Gray's Reef stations, 2003.





APPENDICES

QUALITY ASSURANCE STATEMENT

Client/Project; NOAA

Work Assignment Title: GRNMS 2003

Task Number: Opt 3-4

Description of Data Set or Deliverable: 29 Benthic macroinvertebrate samples collected in May of 2003; 3 stations with 3 replicates collected with 0.04m2 young grab, and 1 75m transect with 4 stations and 5 replicates collected with a 0.0071m2 diver core.

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-GRNMS 2003
Task Number: Opt 3-4

Sorting Results:

Sample #	% Accuracy
GR03-D25-2	100%
GR03-D01-1	100%
GR03-D10-1	100%
GR03-D10-5	100%

Taxonomy Results:

Sample #	Taxa	% Accuracy
GR03-D25-2	Crust./Moll.	100%
GR03-D75-4	Crust./Moll.	100%
GR03-10T-2	Crust./Moll.	97%
GR03-17T-3	Poly./Misc.	97%
GR03-03T-3	Poly./Misc.	100%
GR03-D75-1	Poly./Misc.	100%

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

Signature of QA Officer or Reviewer Date