

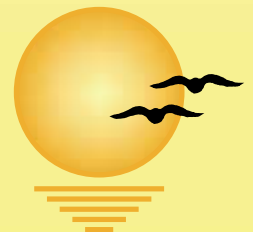
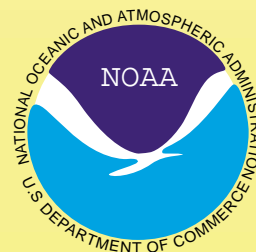
GRAY'S REEF BENTHIC MACROINVERTEBRATE COMMUNITY ASSESSMENT, APRIL 2000



SUBMITTED TO:
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE
NATION CENTERS FOR COASTAL OCEAN SCIENCE
CENTER FOR COASTAL MONITORING AND ASSESSMENT
219 FORT JOHNSON ROAD
CHARLESTON, SOUTH CAROLINA 29412

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FEBRUARY 2001



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INTRODUCTION

The Gray's Reef National Marine Sanctuary was sampled during April 2001 (Figure 1). 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).

METHODS

Sample Collection and Handling

A Young dredge (area = 0.04 m²) was used to collect bottom samples at each of 20 station locations (three replicate samples were taken at each station) throughout Gray's Reef. 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.

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 labelled 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 Appendices A1 and A2. Quality control comments on dominant LPIL taxa are given in Appendix A3.

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 the Shannon-Weaver Index (Pielou, 1966), according to the following formula:

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

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

i = is the i 'th taxon in the sample, and

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

Taxa diversity was calculated using \ln , however taxa diversity may also be calculated using \log . Both methods for calculating taxa diversity are common in scientific literature. The taxa diversity calculated in this report using \ln , can be converted to \log by multiplying the taxa diversity by 1.44270.

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, $J' = H' / H'_{\max}$.

Macroinfaunal data were graphically and statistically analyzed to identify any differences in density and number of taxa per replicate between stations. Data for density could not be normalized using standard transformations (Shapiro-Wilk W ; SAS Institute, 2000), and were analyzed using a non-parameteric Wilcoxon test and nonparametric Tukey-type multiple comparisons (Zar, 1999; SAS Institute, 1995). Data for taxa richness (mean number of taxa per replicate) was analyzed using a one-way ANOVA and Tukey-Kramer post-hoc tests (SAS Institute, 2000).

Cluster analysis of both habitat collections (normal analysis) and taxa (inverse analysis) was performed by calculating the Bray-Curtis dissimilarity for all pairs (Bray and Curtis 1957). Clusters were formed using the average linkage method between dissimilarities (Rohlf, 1998). In this method, the distance between two clusters is the average distance between pairs of observations, one in each cluster. Taxa used in these analyses were selected according to their percent abundance in the assemblage.

HABITAT CHARACTERISTICS

Water quality data for the 20 stations are presented in Table 1 and Figures 2 and 3. Depth ranged from 14.5 m at Station 8 to 21.1 m at Station 5 (Figure 2). Dissolved

oxygen ranged from 7.7 mg/l at Stations 14, 15 and 20 to 8.4 mg/l at Station 1 (Figure 3).

Sediment data for the 20 stations are given in Table 1 and Figures 4 through 6. Sediment composition at the 20 stations was uniform throughout Gray's Reef (Figure 4). Sand comprised at least of 82% of the total sediment at each station (Figure 5). The percent total organic carbon (TOC) fraction of the sediment was generally low with all values less than 3% (Table 1, Figure 6).

BENTHIC COMMUNITY CHARACTERIZATION

Faunal Composition, Abundance, and Community Structure

Table 2 provides a complete phylogenetic listing for all strata as well as data on taxa abundance and strata occurrence. Microsoft™ Excel spreadsheets are being provided separately to NOAA which include: raw data on taxa abundance and density by station, a complete taxonomic listing with strata abundance and occurrence and QA/QC comments, 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 and stratum.

A total of 21,194 organisms, representing 349 taxa, were identified from the 20 stations (Table 3). Bivalves were the most numerous organisms present representing 61% of the total assemblage, followed in abundance by polychaetes (15%) and malacostracans (7%). Polychaetes represented 44% of the total number of taxa followed by malacostracans (22%), and bivalves (11%)(Table 3). The percentage abundance of the major taxa at the 20 stations is given in Table 4 and Figure 7.

The dominant taxa collected from the 20 stations were the bivalve, *Ervilia* sp A., the gastropod, *Caecum johnsoni*, the bivalve, *Crassinella lunulata*, and the chordate Branchiostoma (LPIL) representing 55.9%, 3.4%, 3.0%, and 2.8% of the total number of individuals, respectively (Table 2).

Crassinella lunulata, *Spiophanes bombyx*, *Spio pettiboneane*, *Oxyurostylus smithi*, Tubificidae (LPIL) and Rhynchocoela (LPIL) were the most widely distributed taxa being found at 100% of the stations. The distribution of taxa representing > 10% of the total assemblage at each station is given in Table 5.

Station abundance and taxa data are summarized for the 20 stations in Table 6. Mean density per station ranged from 1641.7 organisms·m² (SD = 203.6) at Station 16 to 50,258.3 organisms·m² (SD = 24,140.5) at Station 14 (Table 6; Figures 9 and 10). There were significant differences in density between stations, with Stations 13 and 14 being significantly greater than Station 16 (Tables 7 and 8). The mean number of taxa per station ranged from 27.0 taxa per replicate (SD = 1.0) at Station 16 to 64.3 taxa per replicate (SD = 3.1) at Station 10 (Table 6; Figures 11 and 12). There were significant differences in the number of taxa between stations, with Station 10 being significantly higher than Stations 11, 7, 1, 6, and 16. (Tables 7 and 8). Station 8 number of taxa was significantly higher than Stations 7, 1, 6 and 16, Station 2 was significantly higher than Stations 6 and 16, and Station 5 was significantly higher than Station 16 (Table 8).

Taxa diversity and evenness for the Gray's Reef stations are given in Table 6 and Figures 13, 14, 15 and 16. Taxa diversity (H') varied considerably and ranged from 0.49 at Station 14 to 3.89 at Station 5 (Table 6; Figures 13 and 14). Taxa evenness (J') also exhibited considerable variation and ranged from 0.11 at Station 14 to 0.85 at Stations 5 and 16 (Table 6; Figures 15 and 16).

Cluster Analysis

Normal (station) and inverse (taxa) cluster analyses were performed on the Gray's Reef data set and displayed as dendrograms (Figures 17 and 18). Count data for the 27 taxa selected were included in a matrix of station and taxa groups (Table 9). These taxa accounted for 85.3% of the total macroinfaunal assemblage.

Clustering of the 20 stations can be interpreted at a two-group level (\gg 15 % level of dissimilarity, Table 9; Figure 17). Group A contained Stations 1-12 and 15-20. Group

B contained only Stations 13 and 14, which had the highest abundance of *Ervilia* sp. A.

Clustering of the 27 taxa in the 20 stations could be interpreted at a seven-group level (» 3 -28% dissimilarity; Table 9; Figure 18). Group 1 was represented by 21 taxa, and the remaining six groups were represented by one taxa each.

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Table 1. Summary of station location, water quality and sediment data for the Gray's Reef stations, April 2000.

Station	Latitude	Longitude	Depth (m)	Temp. (C)	Sal. (ppt)	D.O. (mg/l)	pH	% T.O.C.	% Gravel	% Sand	% Silt	% Clay	USACE Description	Median Particle Size (phi)	Sorting Coefficient	% Moisture
1	31° 25.195	80° 54.541	17.5	17.8	33.6	8.4	7.9	0.11	0.00	99.87	0.00	0.00	Sand	1.357	0.765	23.44
2	31° 24.902	80° 53.256	19.3	17.9	33.7	8.2	7.9	0.11	3.36	96.14	0.00	0.00	Sand	0.996	1.033	27.30
3	31° 25.151	80° 52.018	19.4	17.9	33.8	8.3	7.9	0.15	0.00	99.45	0.00	0.00	Sand	0.667	0.753	21.41
4	31° 24.644	80° 51.518	20.8	17.9	33.8	8.2	7.9	0.12	0.00	99.74	0.00	0.00	Sand	0.780	-	28.76
5	31° 24.923	80° 50.288	21.1	17.6	34.1	8.2	7.9	0.08	0.00	99.82	0.00	0.00	Sand	0.950	0.875	19.70
6	31° 24.366	80° 54.739	18.0	17.9	34.0	7.9	7.9	0.13	0.00	99.79	0.00	0.00	Sand	1.690	0.753	27.19
7	31° 23.509	80° 53.788	16.0	17.9	34.0	7.9	7.9	0.13	0.00	99.53	0.00	0.00	Sand	1.511	0.808	28.46
8	31° 23.688	80° 52.115	14.5	18.2	33.9	8.1	7.6	0.49	9.41	90.04	0.00	0.00	Sand	0.805	1.252	27.11
9	31° 23.694	80° 51.713	19.7	18.2	33.9	8.2	7.9	0.12	0.00	99.56	0.00	0.00	Sand	0.889	0.815	18.21
10	31° 24.348	80° 49.970	19.0	17.7	34.1	8.2	7.9	0.14	4.39	94.73	0.00	0.00	Sand	0.871	0.996	21.83
11	31° 23.470	80° 54.348	16.7	17.9	34.0	7.9	8.0	0.19	0.00	99.69	0.00	0.00	Sand	1.068	0.914	12.10
12	31° 23.390	80° 53.771	17.0	17.9	34.1	7.9	8.0	0.42	0.00	99.37	0.00	0.00	Sand	1.560	1.078	25.74
13	31° 23.215	80° 52.486	18.7	17.9	34.2	7.9	8.0	0.18	0.00	99.46	0.00	0.00	Sand	0.990	0.817	26.04
14	31° 22.971	80° 51.509	19.3	18.0	33.7	7.7	8.0	0.14	3.57	96.19	0.00	0.00	Sand	0.819	0.826	12.10
15	31° 23.003	80° 50.413	18.1	18.0	33.9	7.7	8.0	0.15	0.00	99.76	0.00	0.00	Sand	0.724	-	26.91
16	31° 22.607	80° 55.104	15.2	18.0	34.1	8.0	8.0	0.13	3.55	96.18	0.00	0.00	Sand	1.746	1.009	18.26
17	31° 22.024	80° 53.866	19.6	17.9	34.3	7.9	8.0	1.97	15.53	83.79	0.00	0.00	Sand	0.007	0.970	24.95
18	31° 22.980	80° 52.702	17.0	17.9	34.3	7.9	8.0	0.27	6.25	93.38	0.00	0.00	Sand	1.305	1.135	22.69
19	31° 21.767	80° 51.219	19.0	18.0	33.9	7.6	8.1	0.16	0.00	99.29	0.00	0.00	Sand	1.147	0.780	25.66
20	31° 22.411	80° 50.475	19.2	18.0	33.9	7.7	8.0	0.13	2.23	97.51	0.00	0.00	Sand	1.492	0.931	23.67

- indicates unable to calculate due to amount of sample retained in sieve

Table 2. Abundance and distribution of benthic macroinfaunal taxa for the Gray's Reef stations, April 2000.

Taxa	Phylum	Class	No. of Individuals	% of Total	Cumulative %	Station Occurrence	% Station Occurrence
<i>Ervilia</i> sp. A	Mol	Biva	11850	55.91	55.91	15	75
<i>Caecum johnsoni</i>	Mol	Gast	722	3.41	59.32	19	95
<i>Crassinella lunulata</i>	Mol	Biva	642	3.03	62.35	20	100
<i>Branchiostoma</i> (LPIL)	Cho	Lept	602	2.84	65.19	19	95
<i>Aspidosiphon muelleri</i>	Sip	–	522	2.46	67.65	19	95
<i>Spiophanes bombyx</i>	Ann	Poly	393	1.85	69.51	20	100
<i>Spio pettiboneae</i>	Ann	Poly	380	1.79	71.30	20	100
<i>Oxyurostylis smithi</i>	Art	Mala	372	1.76	73.05	20	100
Ophiuroidea (LPIL)	Ech	Ophi	301	1.42	74.47	18	90
Actiniaria (LPIL)	Cni	Anth	245	1.16	75.63	16	80
Tubificidae (LPIL)	Ann	Olig	185	0.87	76.50	20	100
<i>Acanthohaustorius millsii</i>	Art	Mala	180	0.85	77.35	15	75
Sipuncula (LPIL)	Sip	–	165	0.78	78.13	18	90
<i>Erichthonius brasiliensis</i>	Art	Mala	155	0.73	78.86	9	45
Rhynchocoela (LPIL)	Rhy	–	145	0.68	79.55	20	100
<i>Filogranula</i> sp. A	Ann	Poly	141	0.67	80.21	9	45
<i>Protodorvillea kefersteini</i>	Ann	Poly	136	0.64	80.85	17	85
<i>Goniadides carolinae</i>	Ann	Poly	118	0.56	81.41	16	80
<i>Dentatisyllis carolinae</i>	Ann	Poly	106	0.50	81.91	13	65
<i>Caecum pulchellum</i>	Mol	Gast	101	0.48	82.39	7	35
<i>Metharpinia floridana</i>	Art	Mala	95	0.45	82.83	18	90
<i>Tectonatica pusilla</i>	Mol	Gast	95	0.45	83.28	12	60
<i>Diplodonta punctata</i>	Mol	Biva	92	0.43	83.72	15	75
<i>Tanaisius psammophilus</i>	Art	Mala	88	0.42	84.13	17	85
<i>Acteocina lepta</i>	Mol	Gast	86	0.41	84.54	19	95
<i>Owenia fusiformis</i>	Ann	Poly	86	0.41	84.94	17	85
Maldanidae (LPIL)	Ann	Poly	78	0.37	85.31	18	90
<i>Campylaspis heardi</i>	Art	Mala	77	0.36	85.68	13	65
<i>Bhawania heteroseta</i>	Ann	Poly	73	0.34	86.02	11	55
<i>Sphaerosyllis piriferopsis</i>	Ann	Poly	70	0.33	86.35	14	70
<i>Pholoe minuta</i>	Ann	Poly	69	0.33	86.68	15	75
Bivalvia (LPIL)	Mol	Biva	65	0.31	86.98	19	95
Echinoidea (LPIL)	Ech	Echi	64	0.30	87.28	15	75
Sabellidae (LPIL)	Ann	Poly	63	0.30	87.58	10	50
<i>Bhawania goodei</i>	Ann	Poly	62	0.29	87.87	13	65
<i>Parapionosyllis longicirrata</i>	Ann	Poly	57	0.27	88.14	14	70
<i>Eudevenopus honduranus</i>	Art	Mala	54	0.25	88.40	13	65
<i>Exogone lourei</i>	Ann	Poly	54	0.25	88.65	13	65
<i>Synelmis ewingi</i>	Ann	Poly	54	0.25	88.91	14	70
<i>Ophelia denticulata</i>	Ann	Poly	53	0.25	89.16	12	60
<i>Aonides mayaguezensis</i>	Ann	Poly	52	0.25	89.40	11	55
Asciacea (LPIL)	Cho	Asci	52	0.25	89.65	8	40
Glyceridae (LPIL)	Ann	Poly	52	0.25	89.89	18	90
<i>Mediomastus</i> (LPIL)	Ann	Poly	51	0.24	90.13	16	80
<i>Protohaustorius wigleyi</i>	Art	Mala	50	0.24	90.37	11	55
<i>Semele nuculoides</i>	Mol	Biva	44	0.21	90.58	17	85
<i>Cirrophorus ilvana</i>	Ann	Poly	43	0.20	90.78	11	55
Enchytraeidae (LPIL)	Ann	Olig	42	0.20	90.98	9	45
<i>Lucina</i> (LPIL)	Mol	Biva	42	0.20	91.18	9	45
<i>Leptochelia papulata</i>	Art	Mala	41	0.19	91.37	5	25
Lucinidae (LPIL)	Mol	Biva	39	0.18	91.55	8	40
<i>Prionospio</i> (LPIL)	Ann	Poly	38	0.18	91.73	14	70
<i>Syllis cornuta</i>	Ann	Poly	35	0.17	91.90	13	65
Nephtyidae (LPIL)	Ann	Poly	33	0.16	92.05	13	65
Oligochaeta (LPIL)	Ann	Olig	33	0.16	92.21	5	25
<i>Bathyporeia parkeri</i>	Art	Mala	31	0.15	92.36	7	35

Table 2. Continued:

Taxa	Phylum	Class	No. of Individuals	% of Total	Cumulative %	Station Occurrence	% Station Occurrence
<i>Glycera</i> sp. A	Ann	Poly	31	0.15	92.50	11	55
Haustoriidae (LPIL)	Art	Mala	31	0.15	92.65	13	65
<i>Aspidosiphon</i> (LPIL)	Sip	–	28	0.13	92.78	9	45
<i>Cyclaspis</i> sp. U	Art	Mala	28	0.13	92.91	10	50
Spionidae (LPIL)	Ann	Poly	28	0.13	93.05	12	60
<i>Crenella divaricata</i>	Mol	Biva	25	0.12	93.16	9	45
<i>Exogone verugera</i>	Ann	Poly	25	0.12	93.28	11	55
Serpulidae (LPIL)	Ann	Poly	25	0.12	93.40	9	45
<i>Sphaerosyllis aciculata</i>	Ann	Poly	23	0.11	93.51	9	45
<i>Apseudes olympiae</i>	Art	Mala	22	0.10	93.61	7	35
<i>Glycera</i> (LPIL)	Ann	Poly	22	0.10	93.72	9	45
<i>Nephtys simoni</i>	Ann	Poly	22	0.10	93.82	12	60
<i>Paramphunome</i> sp. B	Ann	Poly	21	0.10	93.92	12	60
<i>Podocerus kleidus</i>	Art	Mala	21	0.10	94.02	9	45
<i>Armandia maculata</i>	Ann	Poly	20	0.09	94.11	10	50
Phyllodocidae (LPIL)	Ann	Poly	20	0.09	94.21	14	70
<i>Sphaerosyllis</i> (LPIL)	Ann	Poly	20	0.09	94.30	5	25
<i>Acanthohaustorius shoemakeri</i>	Art	Mala	19	0.09	94.39	9	45
<i>Pionosyllis gesae</i>	Ann	Poly	19	0.09	94.48	11	55
<i>Exogone rolandi</i>	Ann	Poly	18	0.08	94.56	9	45
<i>Cyclaspis pustulata</i>	Art	Mala	17	0.08	94.64	11	55
<i>Phyllodoce</i> (LPIL)	Ann	Poly	17	0.08	94.72	9	45
<i>Asabellides oculata</i>	Ann	Poly	16	0.08	94.80	9	45
Onuphidae (LPIL)	Ann	Poly	16	0.08	94.88	8	40
Polyplacophora (LPIL)	Mol	Polyp	16	0.08	94.95	9	45
<i>Heteropodarke lyonsi</i>	Ann	Poly	15	0.07	95.02	6	30
<i>Bowmaniella portoricensis</i>	Art	Mala	14	0.07	95.09	5	25
<i>Encope aberrans</i>	Ech	Echi	14	0.07	95.15	6	30
<i>Galathowenia oculata</i>	Ann	Poly	14	0.07	95.22	7	35
Gastropoda (LPIL)	Mol	Gast	14	0.07	95.29	9	45
<i>Lembos</i> (LPIL)	Art	Mala	14	0.07	95.35	8	40
Ampharetidae (LPIL)	Ann	Poly	13	0.06	95.41	7	35
Melitidae (LPIL)	Art	Mala	13	0.06	95.48	5	25
Semelidae (LPIL)	Mol	Biva	13	0.06	95.54	6	30
<i>Ervilia concentrica</i>	Mol	Biva	12	0.06	95.59	6	30
<i>Nephtys picta</i>	Ann	Poly	12	0.06	95.65	8	40
<i>Paraonis pygoenigmatica</i>	Ann	Poly	12	0.06	95.71	5	25
<i>Sigalion arenicola</i>	Ann	Poly	12	0.06	95.76	8	40
Tellinidae (LPIL)	Mol	Biva	12	0.06	95.82	6	30
<i>Acanthohaustorius</i> (LPIL)	Art	Mala	11	0.05	95.87	5	25
<i>Ampelisca</i> (LPIL)	Art	Mala	11	0.05	95.92	6	30
<i>Corbula contracta</i>	Mol	Biva	11	0.05	95.98	5	25
<i>Deutella incerta</i>	Art	Mala	11	0.05	96.03	7	35
Echinodermata (LPIL)	Ech	–	11	0.05	96.08	1	5
<i>Photis pugnator</i>	Art	Mala	11	0.05	96.13	4	20
<i>Plakosyllis quadrioculata</i>	Ann	Poly	11	0.05	96.18	6	30
<i>Pleuromeris tridentata</i>	Mol	Biva	11	0.05	96.23	6	30
<i>Rictaxis punctostriatus</i>	Mol	Gast	11	0.05	96.29	7	35
<i>Strombiformis</i> (LPIL)	Mol	Gast	11	0.05	96.34	6	30
<i>Acanthohaustorius intermedius</i>	Art	Mala	10	0.05	96.39	5	25
<i>Axiothella mucosa</i>	Ann	Poly	10	0.05	96.43	4	20
<i>Cirrophorus lyra</i>	Ann	Poly	10	0.05	96.48	5	25
<i>Haustorius</i> (LPIL)	Art	Mala	10	0.05	96.53	1	5
<i>Ampelisca bicarinata</i>	Art	Mala	9	0.04	96.57	4	20
Goniadidae (LPIL)	Ann	Poly	9	0.04	96.61	6	30
<i>Mitrella lunata</i>	Mol	Gast	9	0.04	96.65	4	20
<i>Pisione remota</i>	Ann	Poly	9	0.04	96.70	7	35

Table 2. Continued:

Taxa	Phylum	Class	No. of Individuals	% of Total	Cumulative %	Station Occurrence	% Station Occurrence
Syllidae (LPIL)	Ann	Poly	9	0.04	96.74	4	20
<i>Syllis danieli</i>	Ann	Poly	9	0.04	96.78	3	15
<i>Vermiliopsis annulata</i>	Ann	Poly	9	0.04	96.82	5	25
<i>Arene tricarinata</i>	Mol	Gast	8	0.04	96.86	5	25
<i>Argissa hamatipes</i>	Art	Mala	8	0.04	96.90	5	25
<i>Bogaea enigmatica</i>	Ann	Poly	8	0.04	96.94	4	20
<i>Caecum floridanum</i>	Mol	Gast	8	0.04	96.98	4	20
<i>Glycera</i> sp. D	Ann	Poly	8	0.04	97.01	3	15
<i>Heteropodarke formalis</i>	Ann	Poly	8	0.04	97.05	5	25
Lineidae (LPIL)	Rhy	Anop	8	0.04	97.09	7	35
<i>Lysidice notata</i>	Ann	Poly	8	0.04	97.13	4	20
<i>Nereiphylla fragilis</i>	Ann	Poly	8	0.04	97.16	4	20
<i>Petaloproctus socialis</i>	Ann	Poly	8	0.04	97.20	5	25
<i>Pseudunciola obliquua</i>	Art	Mala	8	0.04	97.24	4	20
<i>Semele</i> (LPIL)	Mol	Biva	8	0.04	97.28	4	20
<i>Tellina</i> (LPIL)	Mol	Biva	8	0.04	97.32	4	20
<i>Tellina listeri</i>	Mol	Biva	8	0.04	97.35	3	15
Turbellaria (LPIL)	Pla	Turb	8	0.04	97.39	5	25
<i>Aspidosiphon albus</i>	Sip	-	7	0.03	97.42	4	20
Columbellidae (LPIL)	Mol	Gast	7	0.03	97.46	4	20
<i>Cyclaspis</i> (LPIL)	Art	Mala	7	0.03	97.49	5	25
Nereididae (LPIL)	Ann	Poly	7	0.03	97.52	5	25
<i>Onuphis eremita</i>	Ann	Poly	7	0.03	97.56	5	25
<i>Schistomeringos pectinata</i>	Ann	Poly	7	0.03	97.59	6	30
<i>Syllis</i> (LPIL)	Ann	Poly	7	0.03	97.62	4	20
<i>Bowmaniella</i> (LPIL)	Art	Mala	6	0.03	97.65	6	30
<i>Chone</i> (LPIL)	Ann	Poly	6	0.03	97.68	4	20
<i>Cirrophorus</i> (LPIL)	Ann	Poly	6	0.03	97.71	4	20
<i>Grubeosyllis clavata</i>	Ann	Poly	6	0.03	97.74	5	25
<i>Hemipodus roseus</i>	Ann	Poly	6	0.03	97.76	3	15
<i>Marginella</i> (LPIL)	Mol	Gast	6	0.03	97.79	3	15
<i>Monticellina dorsobranchialis</i>	Ann	Poly	6	0.03	97.82	3	15
Naticidae (LPIL)	Mol	Gast	6	0.03	97.85	4	20
<i>Nereis pelagica</i>	Ann	Poly	6	0.03	97.88	5	25
<i>Paranaitis speciosa</i>	Ann	Poly	6	0.03	97.91	4	20
<i>Podarke obscura</i>	Ann	Poly	6	0.03	97.93	4	20
<i>Semele purpurascens</i>	Mol	Biva	6	0.03	97.96	2	10
<i>Sphaerosyllis taylora</i>	Ann	Poly	6	0.03	97.99	4	20
<i>Verticordia ornata</i>	Mol	Biva	6	0.03	98.02	4	20
<i>Apoprionospio pygmaea</i>	Ann	Poly	5	0.02	98.04	1	5
<i>Batea catharinensis</i>	Art	Mala	5	0.02	98.07	3	15
<i>Dipolydora socialis</i>	Ann	Poly	5	0.02	98.09	4	20
<i>Euceramus praelongus</i>	Art	Mala	5	0.02	98.11	4	20
<i>Eurydice littoralis</i>	Art	Mala	5	0.02	98.14	4	20
<i>Eurythoe complanata</i>	Ann	Poly	5	0.02	98.16	4	20
<i>Kurtziella limonitella</i>	Mol	Gast	5	0.02	98.18	1	5
Microparasellidae Genus A	Art	Mala	5	0.02	98.21	2	10
Mysidae (LPIL)	Art	Mala	5	0.02	98.23	4	20
<i>Nematonereis hebes</i>	Ann	Poly	5	0.02	98.25	4	20
Oedicerotidae (LPIL)	Art	Mala	5	0.02	98.28	4	20
<i>Parametopella cypris</i>	Art	Mala	5	0.02	98.30	5	25
<i>Schwartziella catesbyana</i>	Mol	Gast	5	0.02	98.32	1	5
<i>Turbonulla</i> (LPIL)	Mol	Gast	5	0.02	98.35	5	25
Aoridae (LPIL)	Art	Mala	4	0.02	98.37	3	15
<i>Autolytus</i> (LPIL)	Ann	Poly	4	0.02	98.39	2	10
<i>Calyptrea centralis</i>	Mol	Gast	4	0.02	98.41	3	15
Cirratulidae (LPIL)	Ann	Poly	4	0.02	98.42	3	15

Table 2. Continued:

Taxa	Phylum	Class	No. of Individuals	% of Total	Cumulative %	Station Occurrence	% Station Occurrence
Diastylidae (LPIL)	Art	Mala	4	0.02	98.44	3	15
<i>Diopatra cuprea</i>	Ann	Poly	4	0.02	98.46	3	15
<i>Ensis minor</i>	Mol	Biva	4	0.02	98.48	3	15
<i>Lima pellucida</i>	Mol	Biva	4	0.02	98.50	3	15
<i>Lucina radians</i>	Mol	Biva	4	0.02	98.52	4	20
<i>Magelona papillicornis</i>	Ann	Poly	4	0.02	98.54	4	20
<i>Metatiron tropakis</i>	Art	Mala	4	0.02	98.56	3	15
<i>Nephtys squamosa</i>	Ann	Poly	4	0.02	98.58	4	20
<i>Nereis</i> (LPIL)	Ann	Poly	4	0.02	98.59	3	15
<i>Nereis acuminata</i>	Ann	Poly	4	0.02	98.61	3	15
<i>Nereis falsa</i>	Ann	Poly	4	0.02	98.63	3	15
<i>Olivella dealbata</i>	Mol	Gast	4	0.02	98.65	3	15
Opheliidae (LPIL)	Ann	Poly	4	0.02	98.67	4	20
<i>Ovalipes stephensoni</i>	Art	Mala	4	0.02	98.69	3	15
Oweniidae (LPIL)	Ann	Poly	4	0.02	98.71	4	20
Paraonidae (LPIL)	Ann	Poly	4	0.02	98.73	4	20
<i>Podarkeopsis levifuscina</i>	Ann	Poly	4	0.02	98.74	3	15
<i>Shoemakerella cubensis</i>	Art	Mala	4	0.02	98.76	3	15
<i>Syllides bansei</i>	Ann	Poly	4	0.02	98.78	3	15
Turridae (LPIL)	Mol	Gast	4	0.02	98.80	3	15
<i>Acteocina</i> (LPIL)	Mol	Gast	3	0.01	98.82	1	5
<i>Amakusanthura magnifica</i>	Art	Mala	3	0.01	98.83	3	15
<i>Americhelidium americanum</i>	Art	Mala	3	0.01	98.84	2	10
<i>Ampelisca vadorum</i>	Art	Mala	3	0.01	98.86	2	10
<i>Arabella multidentata</i>	Ann	Poly	3	0.01	98.87	3	15
<i>Aricidea</i> (LPIL)	Ann	Poly	3	0.01	98.89	3	15
<i>Chama</i> (LPIL)	Mol	Biva	3	0.01	98.90	2	10
<i>Chama congregata</i>	Mol	Biva	3	0.01	98.91	3	15
<i>Chione cancellata</i>	Mol	Biva	3	0.01	98.93	2	10
Cyclostrematidae Genus A	Mol	Gast	3	0.01	98.94	3	15
<i>Encope</i> (LPIL)	Ech	Echi	3	0.01	98.96	2	10
Eulepethidae (LPIL)	Ann	Poly	3	0.01	98.97	2	10
<i>Hesionura elongata</i>	Ann	Poly	3	0.01	98.99	2	10
<i>Litocorsa antennata</i>	Ann	Poly	3	0.01	99.00	2	10
<i>Opisthodonta</i> sp. B	Ann	Poly	3	0.01	99.01	3	15
Paguridae (LPIL)	Art	Mala	3	0.01	99.03	2	10
<i>Petaloproctus</i> (LPIL)	Ann	Poly	3	0.01	99.04	2	10
<i>Phascolton</i> (LPIL)	Sip	-	3	0.01	99.06	1	5
Phoxocephalidae (LPIL)	Art	Mala	3	0.01	99.07	2	10
<i>Phtisica marina</i>	Art	Mala	3	0.01	99.08	2	10
<i>Phyllodoce arenae</i>	Ann	Poly	3	0.01	99.10	2	10
<i>Polycirrus eximius</i>	Ann	Poly	3	0.01	99.11	3	15
<i>Processa</i> (LPIL)	Art	Mala	3	0.01	99.13	2	10
<i>Pteromeris perplana</i>	Mol	Biva	3	0.01	99.14	3	15
<i>Semele bellastrata</i>	Mol	Biva	3	0.01	99.16	3	15
<i>Stenothoe minuta</i>	Art	Mala	3	0.01	99.17	3	15
<i>Syllis hyalina</i>	Ann	Poly	3	0.01	99.18	1	5
<i>Tellina versicolor</i>	Mol	Biva	3	0.01	99.20	3	15
<i>Acuminodeutopus naglei</i>	Art	Mala	2	0.01	99.21	2	10
<i>Apoprionospio dayi</i>	Ann	Poly	2	0.01	99.22	2	10
<i>Aricidea taylori</i>	Ann	Poly	2	0.01	99.23	2	10
<i>Armandia</i> (LPIL)	Ann	Poly	2	0.01	99.24	2	10
<i>Armandia agilis</i>	Ann	Poly	2	0.01	99.25	2	10
Asteroidea (LPIL)	Ech	Aste	2	0.01	99.25	1	5
<i>Brania wellfleetensis</i>	Ann	Poly	2	0.01	99.26	2	10
Capitellidae (LPIL)	Ann	Poly	2	0.01	99.27	2	10
<i>Caulleriella cf. alata</i>	Ann	Poly	2	0.01	99.28	1	5

Table 2. Continued:

Taxa	Phylum	Class	No. of Individuals	% of Total	Cumulative %	Station Occurrence	% Station Occurrence
<i>Caulleriella</i> sp. J	Ann	Poly	2	0.01	99.29	2	10
<i>Chione</i> (LPIL)	Mol	Biva	2	0.01	99.30	1	5
<i>Chione intapurpurea</i>	Mol	Biva	2	0.01	99.31	2	10
<i>Cyclaspis unicornis</i>	Art	Mala	2	0.01	99.32	2	10
<i>Cymatoica orientalis</i>	Mol	Biva	2	0.01	99.33	2	10
<i>Dentimargo aureocincta</i>	Mol	Gast	2	0.01	99.34	2	10
<i>Eptonnum</i> (LPIL)	Mol	Gast	2	0.01	99.35	1	5
<i>Eumida sanguinea</i>	Ann	Poly	2	0.01	99.36	2	10
<i>Gibberosus myersi</i>	Art	Mala	2	0.01	99.37	2	10
Hesionidae (LPIL)	Ann	Poly	2	0.01	99.38	2	10
Liljeborgiidae (LPIL)	Art	Mala	2	0.01	99.39	2	10
Limidae (LPIL)	Mol	Biva	2	0.01	99.40	1	5
<i>Limopsis cristata</i>	Mol	Biva	2	0.01	99.41	1	5
<i>Magelona pettiboneae</i>	Ann	Poly	2	0.01	99.41	2	10
Marginellidae (LPIL)	Mol	Gast	2	0.01	99.42	2	10
<i>Mesochaetopterus</i> (LPIL)	Ann	Poly	2	0.01	99.43	2	10
Montacutidae (LPIL)	Mol	Biva	2	0.01	99.44	2	10
Mytilidae (LPIL)	Mol	Biva	2	0.01	99.45	1	5
<i>Niso aeglees</i>	Mol	Gast	2	0.01	99.46	2	10
<i>Phyllodoce groenlandica</i>	Ann	Poly	2	0.01	99.47	2	10
Portunidae (LPIL)	Art	Mala	2	0.01	99.48	2	10
<i>Portunus</i> (LPIL)	Art	Mala	2	0.01	99.49	1	5
<i>Protohaustorius</i> (LPIL)	Art	Mala	2	0.01	99.50	1	5
Scaphandridae (LPIL)	Mol	Gast	2	0.01	99.51	1	5
<i>Serolis mgrayi</i>	Art	Mala	2	0.01	99.52	2	10
<i>Sigatica carolinensis</i>	Mol	Gast	2	0.01	99.53	2	10
Terebellidae (LPIL)	Ann	Poly	2	0.01	99.54	2	10
Thraciidae (LPIL)	Mol	Biva	2	0.01	99.55	2	10
<i>Trichobranchus glacialis</i>	Ann	Poly	2	0.01	99.56	2	10
<i>Tritonia bayeri</i>	Mol	Gast	2	0.01	99.57	1	5
<i>Turbonilla</i> sp. AG	Mol	Gast	2	0.01	99.58	2	10
Amphipoda (LPIL)	Art	Mala	1	0.00	99.58	1	5
<i>Anachis lafresnayi</i>	Mol	Gast	1	0.00	99.58	1	5
<i>Aricidea cerrutii</i>	Ann	Poly	1	0.00	99.59	1	5
<i>Aricidea suecica</i>	Ann	Poly	1	0.00	99.59	1	5
<i>Aricidea wassi</i>	Ann	Poly	1	0.00	99.60	1	5
<i>Asthenothaerus hemphilli</i>	Mol	Biva	1	0.00	99.60	1	5
Bullidae (LPIL)	Mol	Gast	1	0.00	99.61	1	5
<i>Cadulus quadridentatus</i>	Mol	Scap	1	0.00	99.61	1	5
<i>Caecum</i> (LPIL)	Mol	Gast	1	0.00	99.62	1	5
<i>Caecum cooperi</i>	Mol	Gast	1	0.00	99.62	1	5
<i>Callinectes</i> (LPIL)	Art	Mala	1	0.00	99.63	1	5
Calyptraeidae (LPIL)	Mol	Gast	1	0.00	99.63	1	5
<i>Campylaspis</i> (LPIL)	Art	Mala	1	0.00	99.64	1	5
<i>Campylaspis</i> sp. E	Art	Mala	1	0.00	99.64	1	5
Carditidae (LPIL)	Mol	Biva	1	0.00	99.65	1	5
<i>Cerapus</i> (LPIL)	Art	Mala	1	0.00	99.65	1	5
<i>Ceratonereis</i> (LPIL)	Ann	Poly	1	0.00	99.66	1	5
<i>Chione grus</i>	Mol	Biva	1	0.00	99.66	1	5
<i>Chloeia viridis</i>	Ann	Poly	1	0.00	99.66	1	5
<i>Cirrophorus branchiatus</i>	Ann	Poly	1	0.00	99.67	1	5
<i>Conus jaspideus</i>	Mol	Gast	1	0.00	99.67	1	5
<i>Cyathura burbancki</i>	Art	Mala	1	0.00	99.68	1	5
Cyclostrematidae (LPIL)	Mol	Gast	1	0.00	99.68	1	5
<i>Dasybranchus lunulatus</i>	Ann	Poly	1	0.00	99.69	1	5
<i>Dipolydora</i> (LPIL)	Ann	Poly	1	0.00	99.69	1	5
<i>Dodecaceria corallii</i>	Ann	Poly	1	0.00	99.70	1	5

Table 2. Continued:

Taxa	Phylum	Class	No. of Individuals	% of Total	Cumulative %	Station Occurrence	% Station Occurrence
Eunicidae (LPIL)	Ann	Poly	1	0.00	99.70	1	5
<i>Eurypanopeus depressus</i>	Art	Mala	1	0.00	99.71	1	5
<i>Fabricinuda trilobata</i>	Ann	Poly	1	0.00	99.71	1	5
<i>Fimbriosthenelais</i> sp. A	Ann	Poly	1	0.00	99.72	1	5
<i>Gammaropsis</i> (LPIL)	Art	Mala	1	0.00	99.72	1	5
<i>Glycera americana</i>	Ann	Poly	1	0.00	99.73	1	5
<i>Gouldia cerina</i>	Mol	Biva	1	0.00	99.73	1	5
<i>Grubeosyllis rugulosa</i>	Ann	Poly	1	0.00	99.74	1	5
<i>Kalliapseudes</i> sp. C	Art	Mala	1	0.00	99.74	1	5
<i>Kurtziella rubella</i>	Mol	Gast	1	0.00	99.75	1	5
<i>Laevicardium laevigatum</i>	Mol	Biva	1	0.00	99.75	1	5
<i>Leptocheilia</i> (LPIL)	Art	Mala	1	0.00	99.75	1	5
<i>Levinsenia gracilis</i>	Ann	Poly	1	0.00	99.76	1	5
<i>Listriella barnardi</i>	Art	Mala	1	0.00	99.76	1	5
<i>Lumbrineris latreilli</i>	Ann	Poly	1	0.00	99.77	1	5
<i>Macoma tenta</i>	Mol	Biva	1	0.00	99.77	1	5
<i>Marginella apicina</i>	Mol	Gast	1	0.00	99.78	1	5
<i>Mediomastus californiensis</i>	Ann	Poly	1	0.00	99.78	1	5
<i>Microphthalmus hartmanae</i>	Ann	Poly	1	0.00	99.79	1	5
<i>Mooreonuphis nebulosa</i>	Ann	Poly	1	0.00	99.79	1	5
<i>Notomastus</i> (LPIL)	Ann	Poly	1	0.00	99.80	1	5
<i>Notomastus latericeus</i>	Ann	Poly	1	0.00	99.80	1	5
<i>Nudibranchia</i> (LPIL)	Mol	Gast	1	0.00	99.81	1	5
<i>Ogyrides alphaerostris</i>	Art	Mala	1	0.00	99.81	1	5
<i>Okenia sapelona</i>	Mol	Gast	1	0.00	99.82	1	5
<i>Ophelina cylindricauda</i>	Ann	Poly	1	0.00	99.82	1	5
<i>Ophiolepis elegans</i>	Ech	Ophi	1	0.00	99.83	1	5
<i>Ougia tenuidentis</i>	Ann	Poly	1	0.00	99.83	1	5
<i>Pagurus</i> (LPIL)	Art	Mala	1	0.00	99.83	1	5
<i>Pandora trilineata</i>	Mol	Biva	1	0.00	99.84	1	5
Pandoridae (LPIL)	Mol	Biva	1	0.00	99.84	1	5
<i>Pettiboneia duofurca</i>	Ann	Poly	1	0.00	99.85	1	5
<i>Pherusa inflata</i>	Ann	Poly	1	0.00	99.85	1	5
<i>Pinnotheres ostreum</i>	Art	Mala	1	0.00	99.86	1	5
Pinnotheridae (LPIL)	Art	Mala	1	0.00	99.86	1	5
<i>Polycirrus</i> (LPIL)	Ann	Poly	1	0.00	99.87	1	5
<i>Polygordius</i> (LPIL)	Ann	Poly	1	0.00	99.87	1	5
Porifera (LPIL)	Por	-	1	0.00	99.88	1	5
<i>Promysis atlantica</i>	Art	Mala	1	0.00	99.88	1	5
<i>Pseudovermilia occidentalis</i>	Ann	Poly	1	0.00	99.89	1	5
<i>Renilla reniformis</i>	Cni	Anth	1	0.00	99.89	1	5
<i>Sabellaria vulgaris</i>	Ann	Poly	1	0.00	99.90	1	5
<i>Scotelepis</i> (LPIL)	Ann	Poly	1	0.00	99.90	1	5
<i>Scolecopsis squamata</i>	Ann	Poly	1	0.00	99.91	1	5
<i>Scolecopsis texana</i>	Ann	Poly	1	0.00	99.91	1	5
<i>Sicyonia laevigata</i>	Art	Mala	1	0.00	99.92	1	5
<i>Sigambra bassi</i>	Ann	Poly	1	0.00	99.92	1	5
<i>Sinum perspectivum</i>	Mol	Gast	1	0.00	99.92	1	5
<i>Solen viridis</i>	Mol	Biva	1	0.00	99.93	1	5
Solenidae (LPIL)	Mol	Biva	1	0.00	99.93	1	5
Sphaerodoridae (LPIL)	Ann	Poly	1	0.00	99.94	1	5
<i>Spiochaetopterus oculatus</i>	Ann	Poly	1	0.00	99.94	1	5
<i>Streptosyllis arenae</i>	Ann	Poly	1	0.00	99.95	1	5
<i>Strigilla mirabilis</i>	Mol	Biva	1	0.00	99.95	1	5
<i>Strombiformis</i> sp. J	Mol	Gast	1	0.00	99.96	1	5
<i>Syllis gracilis</i>	Ann	Poly	1	0.00	99.96	1	5
Synopiidae (LPIL)	Art	Mala	1	0.00	99.97	1	5

Table 2. Continued:

Taxa	Phylum	Class	No. of Individuals	% of Total	Cumulative %	Station Occurrence	% Station Occurrence
<i>Thyone deichmannae</i>	Ech	Holo	1	0.00	99.97	1	5
<i>Travisia parva</i>	Ann	Poly	1	0.00	99.98	1	5
Trochidae (LPIL)	Mol	Gast	1	0.00	99.98	1	5
<i>Trypanosyllis coeliaca</i>	Ann	Poly	1	0.00	99.99	1	5
<i>Tubulanus</i> (LPIL)	Rhy	Anop	1	0.00	99.99	1	5
Veneridae (LPIL)	Mol	Biva	1	0.00	100.00	1	5
Vitrinellidae (LPIL)	Mol	Gast	1	0.00	100.00	1	5

Taxa Key

Ann=Annelida	Ech=Echinodermata	Pla=Platyhelminthes
Olig=Oligochaeta	Aste=Asteroidea	Turb=Turbellaria
Poly=Polychaeta	Echi=Echinoidea	Por=Porifera
Art=Arthropoda	Holo=Holothuroidea	Rhy=Rhynchochoela
Mala=Malacostraca	Ophi=Ophiuroidea	Anop=Anopla
Cho=Chordata	Mol=Mollusca	Sip=Sipuncula
Asci=Asciacea	Biva=Bivalvia	
Lept=Leptocardia	Gast=Gastropoda	
Cni=Cnidaria	Polyp=Polyplacophora	
Anth=Anthozoa	Scap=Scaphopoda	

Table 3. Summary of overall abundance of major benthic macroinfaunal taxonomic groups for the Gray's Reef stations, April 2000.

Taxa	Total No. Taxa	% of Total	Total No. Individuals	% of Total
Annelida				
Oligochaeta	3	0.9	260	1.2
Polychaeta	154	44.1	3,095	14.6
Mollusca				
Bivalvia	47	13.5	12,952	61.1
Gastropoda	44	12.6	1,148	5.4
Scaphopoda	1	0.3	1	0.0
Polyplacophora	1	0.3	16	0.1
Sipuncula	5	1.4	725	3.4
Arthropoda				
Malacostraca	77	22.1	1,537	7.3
Echinodermata				
Asteroidea	1	0.3	11	0.1
Echinoidea	1	0.3	2	0.0
Echinoidea	3	0.9	81	0.4
Holothuroidea	1	0.3	1	0.0
Ophiuroidea	2	0.6	302	1.4
Chordata				
Ascidiacea	1	0.3	52	0.2
Leptocardia	1	0.3	602	2.8
Other Taxa	7	2.0	409	1.9
Total	349		21,194	

Table 4. Summary of abundance of major benthic macroinfaunal taxonomic groups by station for the Gray's Reef stations, April 2000.

Station	Taxa	Total No.		Total No.	
		Taxa	% of Total	Individuals	% of Total
1	Annelida	30	45.5	75	24.6
	Mollusca	15	22.7	93	30.5
	Arthropoda	13	19.7	63	20.7
	Echinodermata	2	3.0	2	0.7
	Other Taxa	6	9.1	72	23.6
	Total	66		305	
2	Annelida	60	53.1	209	30.2
	Mollusca	25	22.1	151	21.8
	Arthropoda	19	16.8	49	7.1
	Echinodermata	2	1.8	10	1.4
	Other Taxa	7	6.2	274	39.5
	Total	113		693	
3	Annelida	48	47.1	181	28.9
	Mollusca	28	27.5	168	26.8
	Arthropoda	18	17.6	63	10.1
	Echinodermata	1	1.0	20	3.2
	Other Taxa	7	6.9	194	31.0
	Total	102		626	
4	Annelida	52	54.2	167	31.0
	Mollusca	20	20.8	146	27.1
	Arthropoda	14	14.6	64	11.9
	Echinodermata	3	3.1	10	1.9
	Other Taxa	7	7.3	152	28.2
	Total	96		539	
5	Annelida	54	55.1	201	41.0
	Mollusca	21	21.4	93	19.0
	Arthropoda	14	14.3	35	7.1
	Echinodermata	3	3.1	10	2.0
	Other Taxa	6	6.1	151	30.8
	Total	98		490	
6	Annelida	28	45.2	81	25.8
	Mollusca	13	21.0	141	44.9
	Arthropoda	14	22.6	82	26.1
	Echinodermata	3	4.8	4	1.3
	Other Taxa	4	6.5	6	1.9
	Total	62		314	

Table 4. Continued:

Station	Taxa	Total No.		Total No.	
		Taxa	% of Total	Individuals	% of Total
7	Annelida	20	35.1	60	22.4
	Mollusca	18	31.6	93	34.7
	Arthropoda	13	22.8	83	31.0
	Echinodermata	1	1.8	5	1.9
	Other Taxa	5	8.8	27	10.1
	Total	57		268	
8	Annelida	63	53.8	291	24.6
	Mollusca	20	17.1	604	51.1
	Arthropoda	24	20.5	156	13.2
	Echinodermata	2	1.7	56	4.7
	Other Taxa	8	6.8	75	6.3
	Total	117		1,182	
9	Annelida	39	46.4	92	24.5
	Mollusca	15	17.9	138	36.8
	Arthropoda	22	26.2	89	23.7
	Echinodermata	2	2.4	15	4.0
	Other Taxa	6	7.1	41	10.9
	Total	84		375	
10	Annelida	65	56.5	353	36.9
	Mollusca	21	18.3	161	16.8
	Arthropoda	17	14.8	61	6.4
	Echinodermata	2	1.7	45	4.7
	Other Taxa	10	8.7	336	35.1
	Total	115		956	
11	Annelida	28	39.4	63	7.9
	Mollusca	17	23.9	631	79.1
	Arthropoda	16	22.5	70	8.8
	Echinodermata	2	2.8	3	0.4
	Other Taxa	8	11.3	31	3.9
	Total	71		798	
12	Annelida	39	40.6	164	23.0
	Mollusca	23	24.0	303	42.6
	Arthropoda	25	26.0	139	19.5
	Echinodermata	1	1.0	59	8.3
	Other Taxa	8	8.3	47	6.6
	Total	96		712	

Table 4. Continued:

Station	Taxa	Total No.		Total No.	
		Taxa	% of Total	Individuals	% of Total
13	Annelida	41	50.6	169	3.5
	Mollusca	17	21.0	4,566	93.6
	Arthropoda	15	18.5	91	1.9
	Echinodermata	2	2.5	18	0.4
	Other Taxa	6	7.4	33	0.7
	Total	81		4,877	
14	Annelida	37	41.6	120	2.0
	Mollusca	23	25.8	5,776	95.8
	Arthropoda	17	19.1	51	0.8
	Echinodermata	4	4.5	40	0.7
	Other Taxa	8	9.0	44	0.7
	Total	89		6,031	
15	Annelida	48	51.1	278	53.9
	Mollusca	18	19.1	143	27.7
	Arthropoda	20	21.3	46	8.9
	Echinodermata	2	2.1	11	2.1
	Other Taxa	6	6.4	38	7.4
	Total	94		516	
16	Annelida	24	45.3	81	41.1
	Mollusca	10	18.9	31	15.7
	Arthropoda	13	24.5	23	11.7
	Echinodermata	2	3.8	13	6.6
	Other Taxa	4	7.5	49	24.9
	Total	53		197	
17	Annelida	52	65.0	290	67.0
	Mollusca	15	18.8	91	21.0
	Arthropoda	9	11.3	25	5.8
	Echinodermata	0	0.0	0	0.0
	Other Taxa	4	5.0	27	6.2
	Total	80		433	
18	Annelida	36	42.4	110	15.5
	Mollusca	17	20.0	401	56.6
	Arthropoda	24	28.2	148	20.9
	Echinodermata	3	3.5	22	3.1
	Other Taxa	5	5.9	27	3.8
	Total	85		708	

Table 4. Continued:

Station	Taxa	Total No.		Total No.	
		Taxa	% of Total	Individuals	% of Total
19	Annelida	41	45.1	191	28.6
	Mollusca	19	20.9	247	37.0
	Arthropoda	19	20.9	77	11.5
	Echinodermata	6	6.6	28	4.2
	Other Taxa	6	6.6	125	18.7
	Total	91		668	
20	Annelida	40	46.5	179	35.4
	Mollusca	14	16.3	140	27.7
	Arthropoda	22	25.6	122	24.1
	Echinodermata	2	2.3	26	5.1
	Other Taxa	8	9.3	39	7.7
	Total	86		506	

Table 6. Summary of the benthic macroinfaunal data for the Gray's Reef stations, April 2000.

Station	Rep	No. of Taxa	No. of Indvs	Density (no/m ²)	Mean No. Taxa	Taxa (SD)	Mean Density	Density (SD)	Total No. Taxa	Total No. Individuals	H' Diversity	J' Evenness
1	A	35	111	2775	32.0	6.1	2541.7	284.3	66	305	3.44	0.82
	B	25	89	2225								
	C	36	105	2625								
2	A	74	365	9125	58.3	13.6	5775.0	2905.1	113	693	3.54	0.75
	B	50	158	3950								
	C	51	170	4250								
3	A	56	199	4975	53.3	3.8	5216.7	530.5	102	626	3.64	0.79
	B	49	194	4850								
	C	55	233	5825								
4	A	45	212	5300	51.7	9.1	4491.7	853.1	96	539	3.67	0.80
	B	62	183	4575								
	C	48	144	3600								
5	A	50	96	2400	56.7	10.7	4083.3	2355.4	98	490	3.89	0.85
	B	51	123	3075								
	C	69	271	6775								
6	A	32	122	3050	31.0	2.6	2616.7	605.4	62	314	3.04	0.74
	B	33	115	2875								
	C	28	77	1925								
7	A	39	99	2475	32.3	7.6	2233.3	985.0	57	268	3.37	0.83
	B	24	46	1150								
	C	34	123	3075								
8	A	50	137	3425	59.0	7.9	9850.0	6889.4	117	1182	2.97	0.62
	B	62	360	9000								
	C	65	685	17125								
9	A	44	186	4650	41.3	6.4	3125.0	1466.5	84	375	3.58	0.81
	B	46	120	3000								
	C	34	69	1725								
10	A	61	346	8650	64.3	3.1	7966.7	1271.2	115	956	3.34	0.70
	B	67	350	8750								
	C	65	260	6500								
11	A	44	381	9525	34.0	10.0	6650.0	2512.6	71	798	1.64	0.38
	B	34	222	5550								
	C	24	195	4875								
12	A	57	236	5900	49.3	9.3	5933.3	152.8	96	712	3.13	0.69
	B	52	244	6100								
	C	39	232	5800								
13	A	40	963	24075	40.0	4.0	40641.7	14608.3	81	4877	0.57	0.13
	B	36	1847	46175								
	C	44	2067	51675								
14	A	48	2967	74175	44.7	14.3	50258.3	24140.5	89	6031	0.49	0.11
	B	29	2028	50700								
	C	57	1036	25900								
15	A	33	160	4000	46.3	15.9	4300.0	700.0	94	516	3.31	0.73
	B	42	152	3800								
	C	64	204	5100								
16	A	26	60	1500	27.0	1.0	1641.7	203.6	53	197	3.38	0.85
	B	28	62	1550								
	C	27	75	1875								
17	A	48	175	4375	42.3	4.9	3608.3	775.1	80	433	3.49	0.80
	B	40	113	2825								
	C	39	145	3625								
18	A	35	75	1875	41.3	7.8	5900.0	6501.0	85	708	2.52	0.57
	B	39	97	2425								
	C	50	536	13400								

Table 6. Continued:

Station	Rep	No. of Taxa	No. of Indvs	Density (no/m ²)	Mean No. Taxa	Taxa (SD)	Mean Density	Density (SD)	Total No. Taxa	Total No. Individuals	H' Diversity	J' Evenness
19	A	52	188	4700	47.3	8.1	5566.7	1858.3	91	668	3.40	0.75
	B	52	308	7700								
	C	38	172	4300								
20	A	53	183	4575	45.0	7.0	4216.7	423.0	86	506	3.69	0.83
	B	40	173	4325								
	C	42	150	3750								

Table 7. Statistical analysis for density and taxa differences among stations for the Gray's Reef stations, April 2000.

DENSITY DATA

Shapiro-Wilk W Test for Normality

W= 0.52 Prob < W = 0.00

One-Way Test, ChiSquare Approximation

ChiSquare	DF	Prob>ChiSq
43.57	19	0.0011

TAXA DATA

Shapiro-Wilk W Test for Normality

W= 0.96 Prob < W = 0.17

ANOVA Table

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	19	6158.27	324.12	4.40	<0.0001
Error	40	2944.67	73.62		
Total	59	9102.93			

Table 8. Density and taxa post-hoc results for the Gray's Reef stations, April 2000.

Density	14	13	10	11	12	8	3	19	2	4	15	20	5	18	17	9	6	1	7	16	
16	*	*																			
7																					
1																					
6																					
9																					
17																					
18																					
5																					
20																					
15																					
4																					
2																					
19																					
3																					
8																					
11																					
12																					
10																					

Taxa	10	8	2	5	3	4	12	19	15	20	14	17	18	9	13	11	7	1	6	16
10																*	*	*	*	*
8																	*	*	*	*
2																			*	*
5																				*
3																				
4																				
12																				
19																				
15																				
20																				
14																				
17																				
18																				
9																				
13																				
11																				
7																				
1																				
6																				
16																				

* indicates pairs of means that are significantly different.

Table 9. Two-way matrix of station and species groups for the Gray's Reef stations, April 2000.

	A																		B		
	1	2	3	4	5	6	7	8	9	10	11	12	15	16	17	18	19	20	13	14	
<i>Acanthohaustorius millsii</i>			1			13	12	18	13	1	4	46	1	1		10	3	26	25	6	
<i>Acteocina lepta</i>		5	8	4	4	2	7	4	3	16	2	1	2	2	4	5	7	2	2	6	
<i>Branchiostoma</i> (LPIL)	15	19	55	45	18		1	14	13	270	1	4	11	10	18	16	75	8	2	7	
<i>Caecum johnsoni</i>	21	66	56	71	17		2	106	21	75	4	12	40	6	62	14	98	7	16	28	
<i>Crassinella lunulata</i>	37	28	47	26	29	24	51	9	75	31	32	12	53	8	4	6	99	26	10	35	
<i>Dentatisyllis carolinae</i>		7	2	6	6	1		7		58			9		3	3	1		2	1	
<i>Diplodonta punctata</i>				14	11	4	3	6	9	4	6	4	3	5		1		14	4	4	
<i>Filogranula</i> sp. A	5	9	28	24	5			3		59			2	6							
<i>Goniadides carolinae</i>		10	2	2	5			9	4	3		6	2	11	10	8	1	3	37	5	
Maldanidae (LPIL)	3	11	8	9	7	1	1	3	1	11		3	4	5		2	1	2	4	2	
<i>Metharpinia floridana</i>		7	2	5	4	7		1	2	1	8	1	5	2		3	8	14	10	8	1
Ophiuroidea (LPIL)	1	3	20	6	6	1		53	13	40	2	59	7	10		19	12	15	17	17	
<i>Owenia fusiformis</i>	5	8	8	3	6	12	1	5	5	7		13		1	6	1	1	3		1	
<i>Oxyurostylis smithi</i>	21	8	19	20	9	35	21	9	15	13	26	43	12	8	11	19	18	35	19	11	
<i>Protodorvillea kefersteini</i>	6	18	5	2	8			19	6	1		3	3	1	9	7	18	1	26	3	
Rhynchocoela (LPIL)	1	3	4	15	24	1	3	22	3	4	2	9	11	3	6	1	11	8	4	10	
Sipuncula (LPIL)		75	108	80	83	3	12	31	23	39		25	14	36	2	8	31	16	23	18	
<i>Spio pettiboneae</i>	8	5	4	6	6	1	3	5	7	1	6	11	143	7	51	15	36	31	11	23	
<i>Spiophanes bombyx</i>	8	13	24	13	24	12	18	31	11	14	14	33	19	16	22	23	19	31	20	28	
<i>Tanaissus psammophilus</i>	6	7	12	2	4		3	4	1	5	3		4	3	2	3	17	6		6	
Tubificidae (LPIL)	7	10	17	4	17	3	4	14	3	10	4	5	6	8	23	3	12	8	18	9	
<i>Actiniaria</i> (LPIL)		164	18	9	24		11	4	1	1	1	1	1		1	2	3	1		3	2
<i>Tectonatica pusilla</i>		1		1		1	1	2			1	2	1	3		1			29	52	3
<i>Erichthonius brasiliensis</i>		1	2				1	90				5	2		1	51			2		4
<i>Caecum pulchellum</i>		1		1	1	93	2				2									1	5
<i>Aspidosiphon muelleri</i>	45										15										6
<i>Ervilia</i> sp. A					4		4	455	12	4	567	232	21	1	4	358	12	64	4483	5629	7

Figure 1. Station locations for the Gray's Reef stations, April 2000.

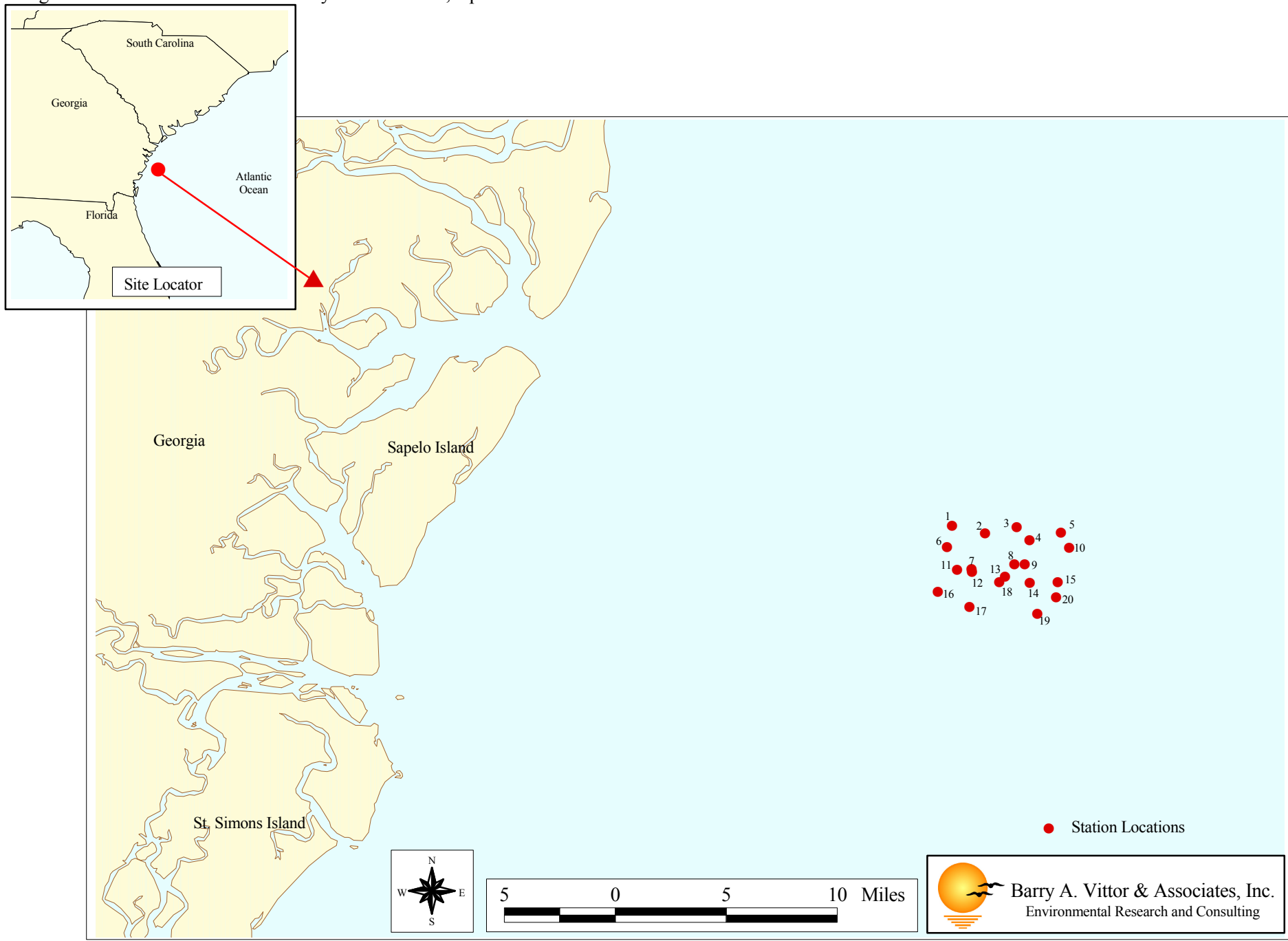


Figure 2. Depth and temperature data for the Gray's Reef stations, April 2000.

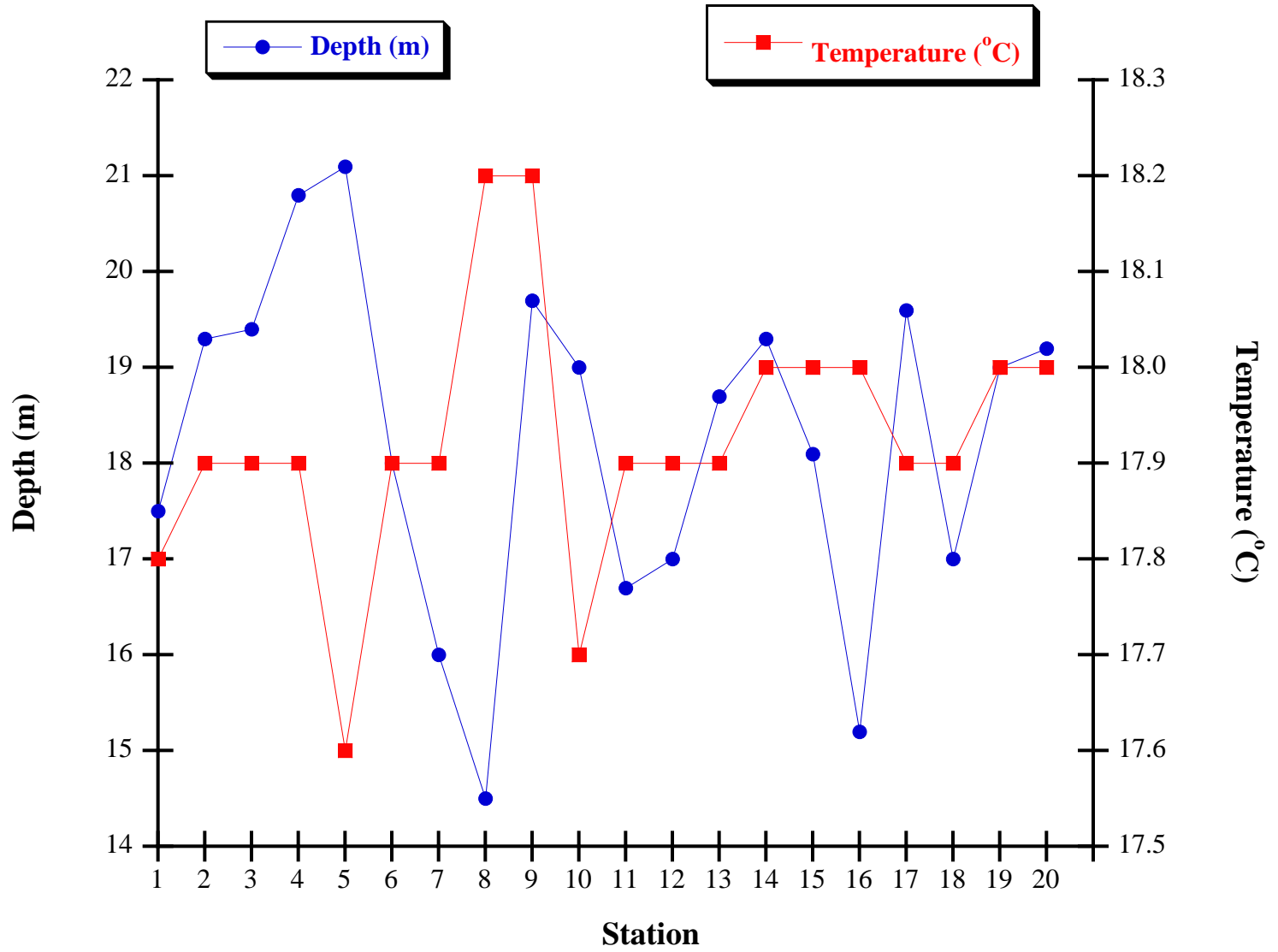


Figure 3. Salinity and dissolved oxygen data for the Gray's Reef stations, April 2000.

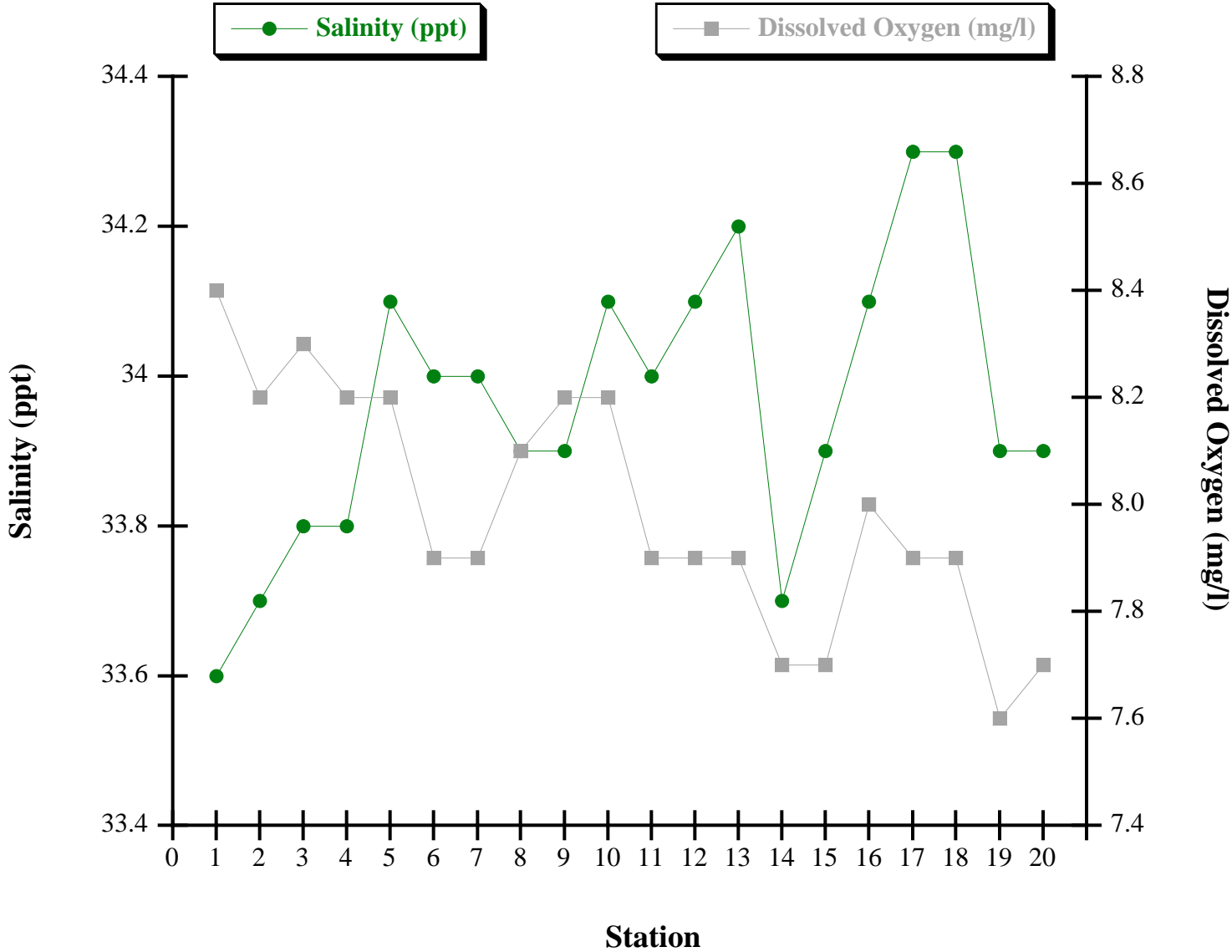


Figure 4. Sediment composition for the Gray's Reef stations, April 2000.

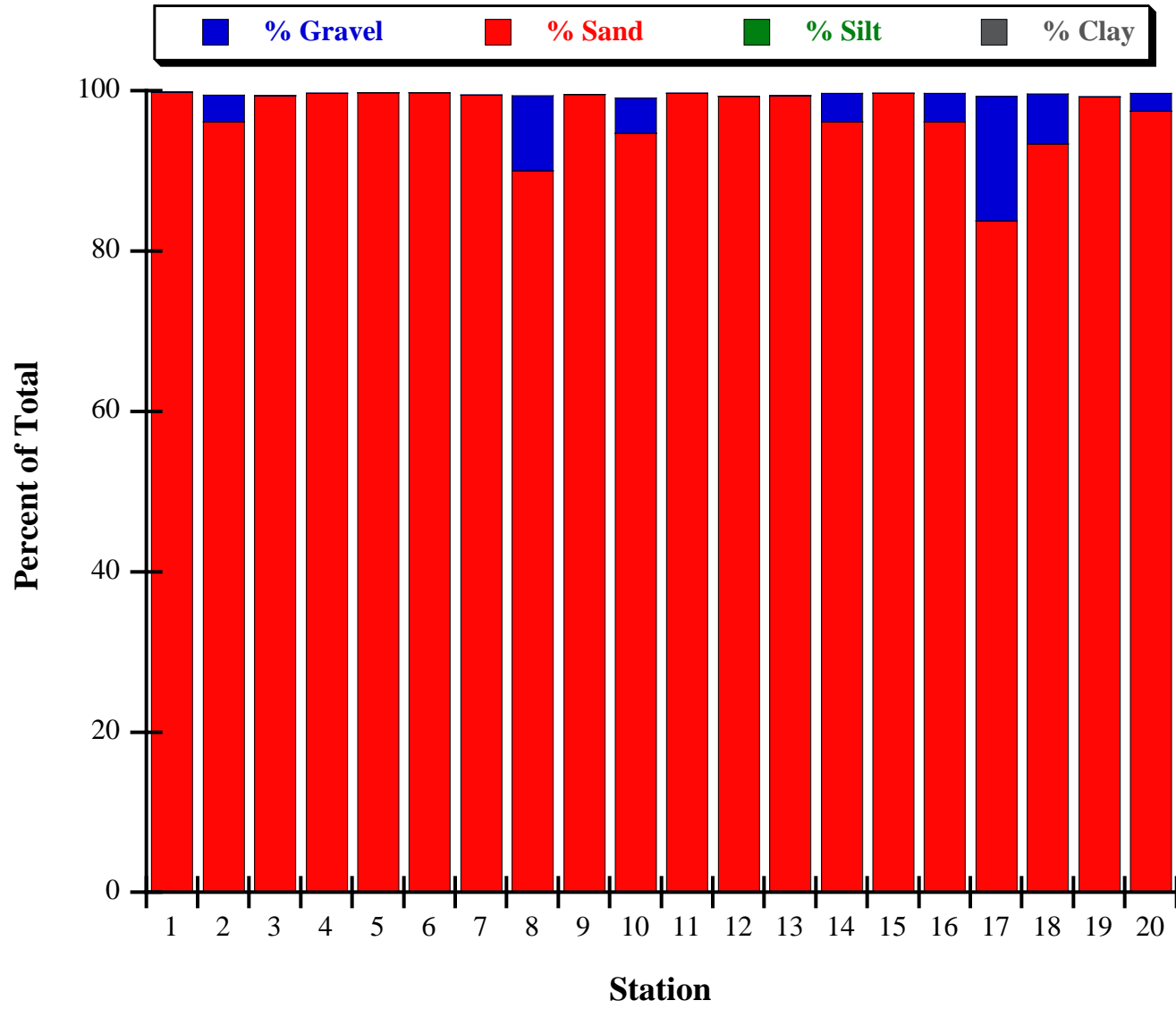


Figure 5. Spatial distribution of sediment composition for the Gray's Reef stations, April 2000.

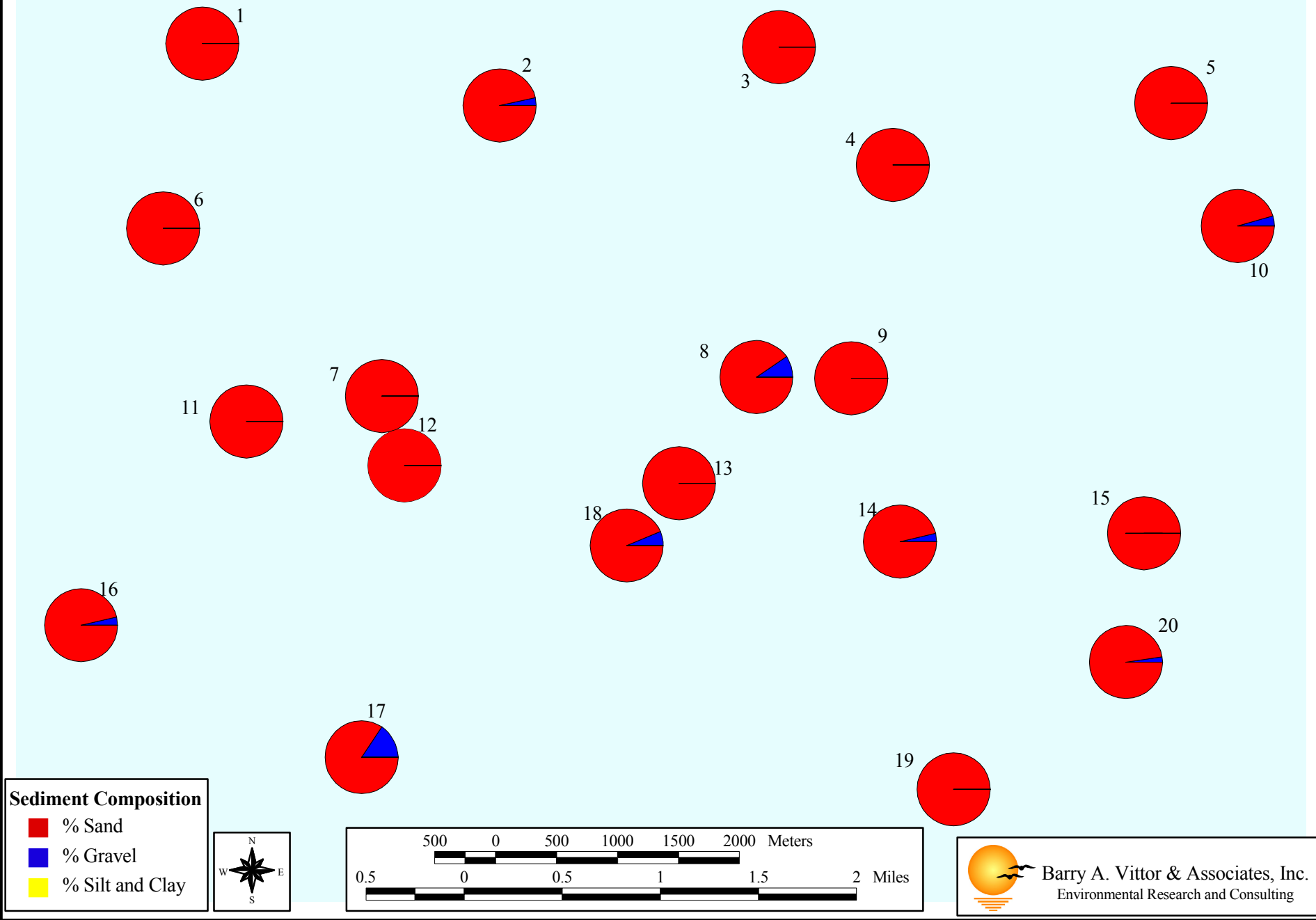


Figure 6. Percent total organic carbon (TOC) for the Gray's Reef stations, April 2000.

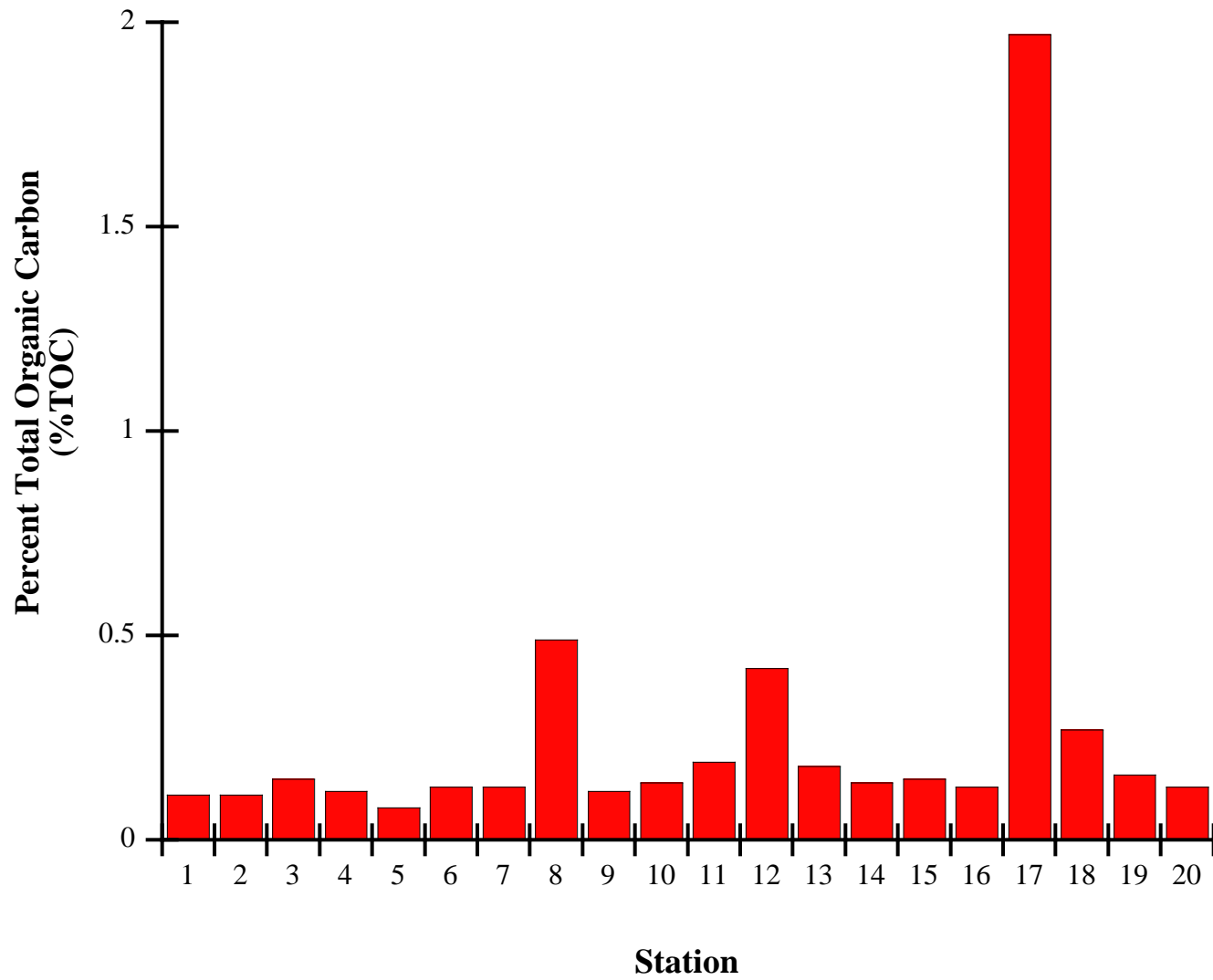


Figure 7. Percent abundance of major taxonomic groups for the Gray's Reef stations, April 2000.

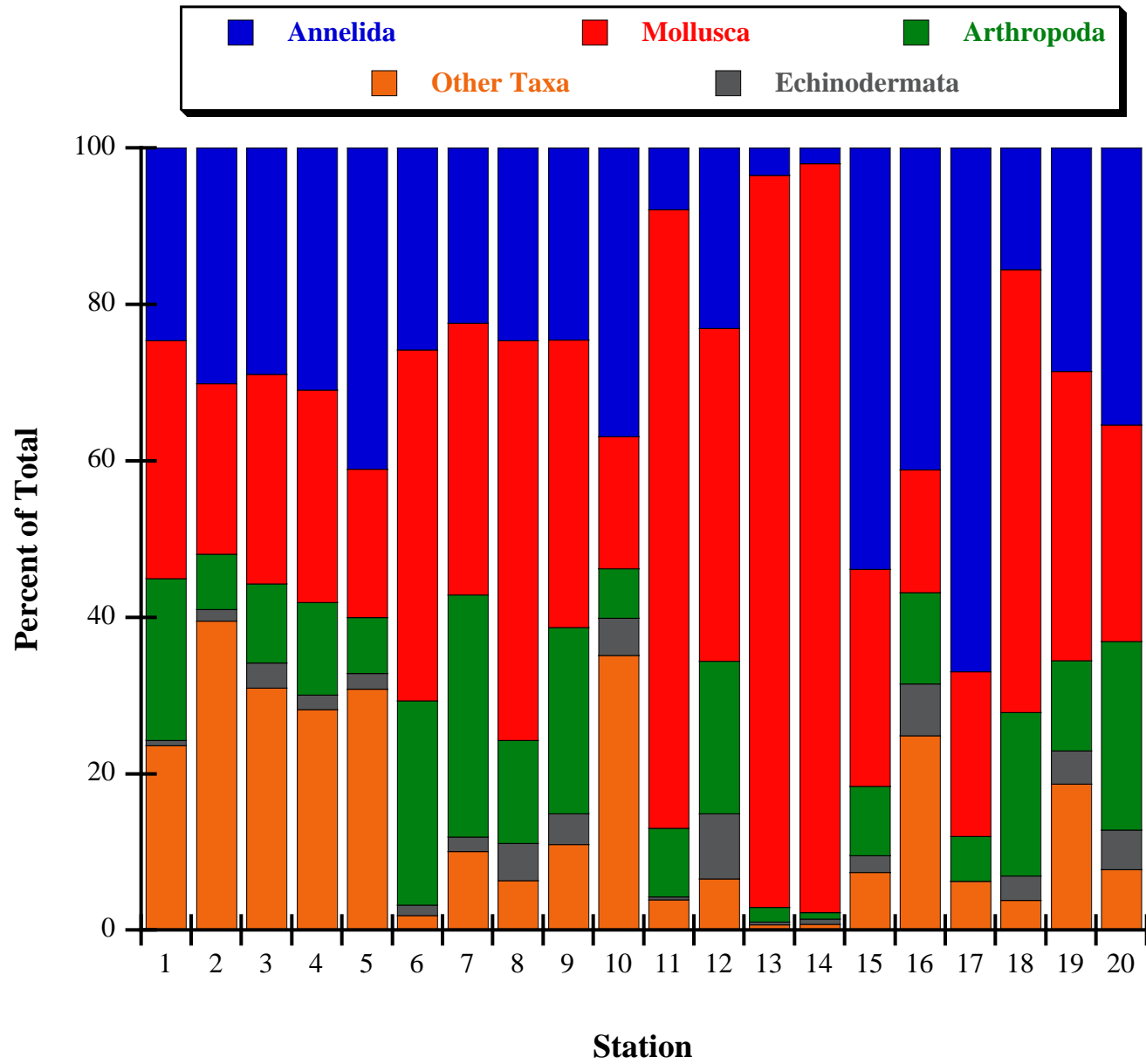


Figure 8. Spatial distribution of major taxonomic groups for the Gray's Reef stations, April 2000.

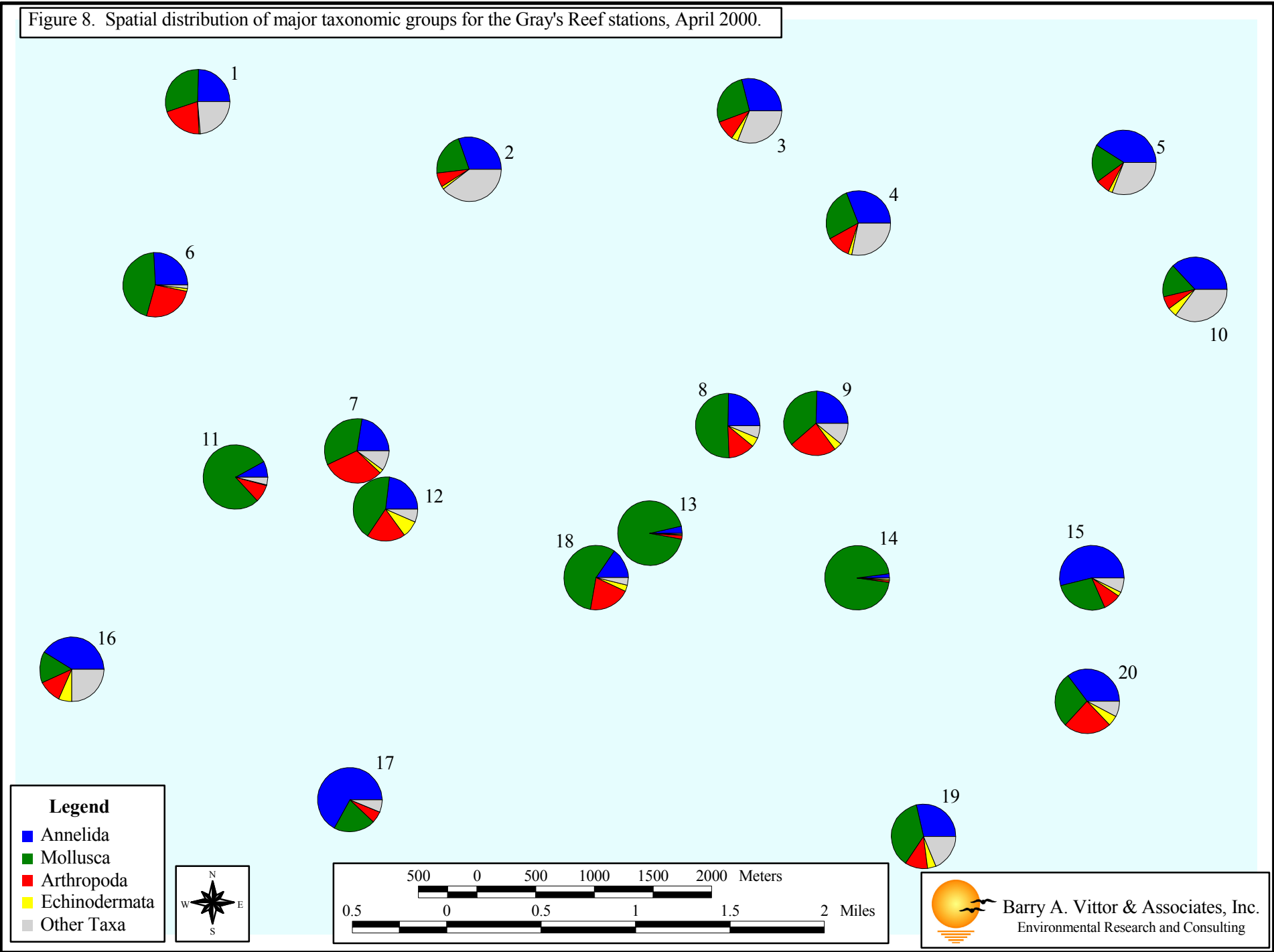


Figure 9. Mean macroinvertebrate density for the Gray's Reef stations, April 2000.

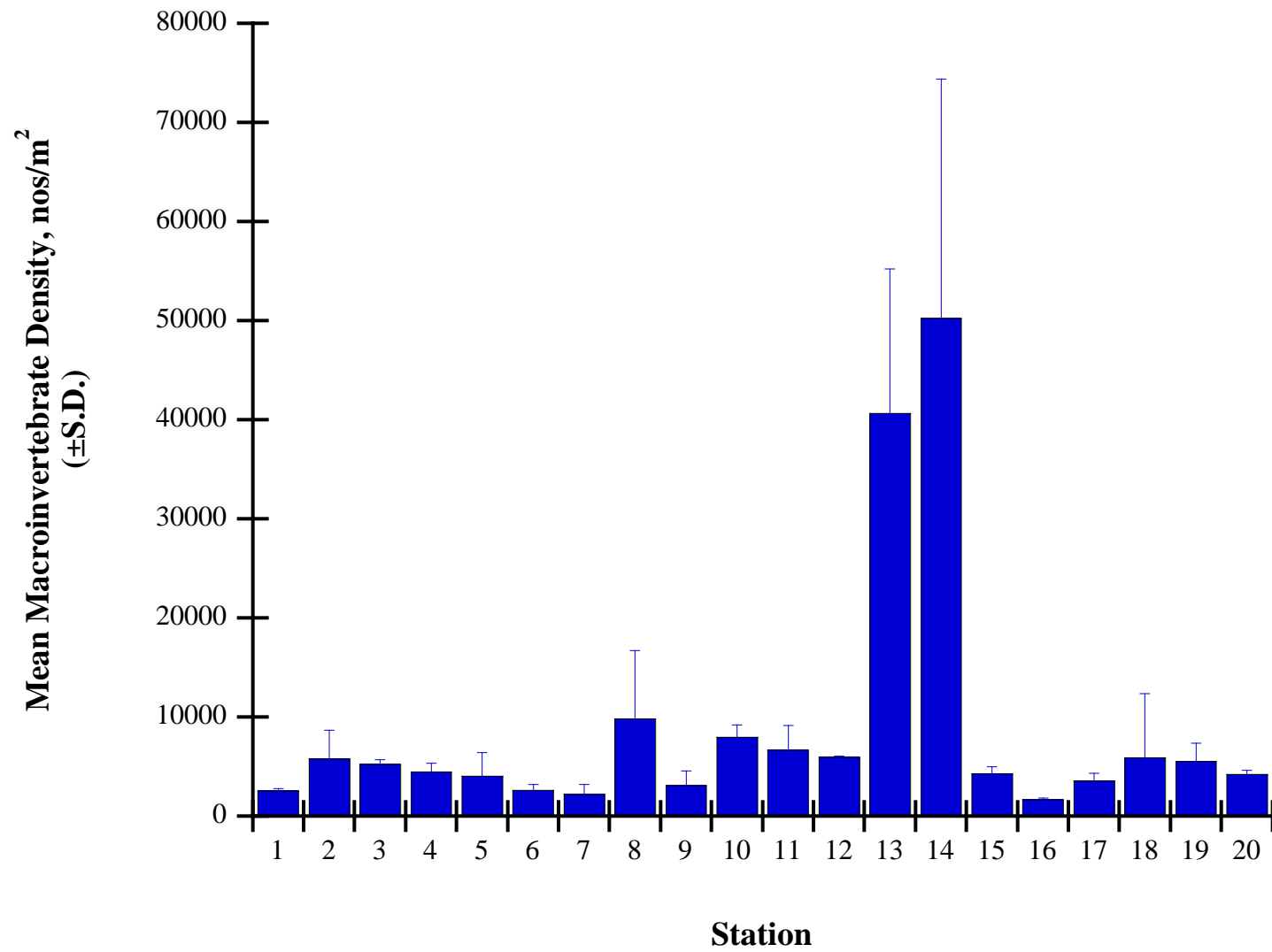


Figure 10. Spatial distribution of mean macroinvertebrate density for the Gray's Reef stations, April 2000.

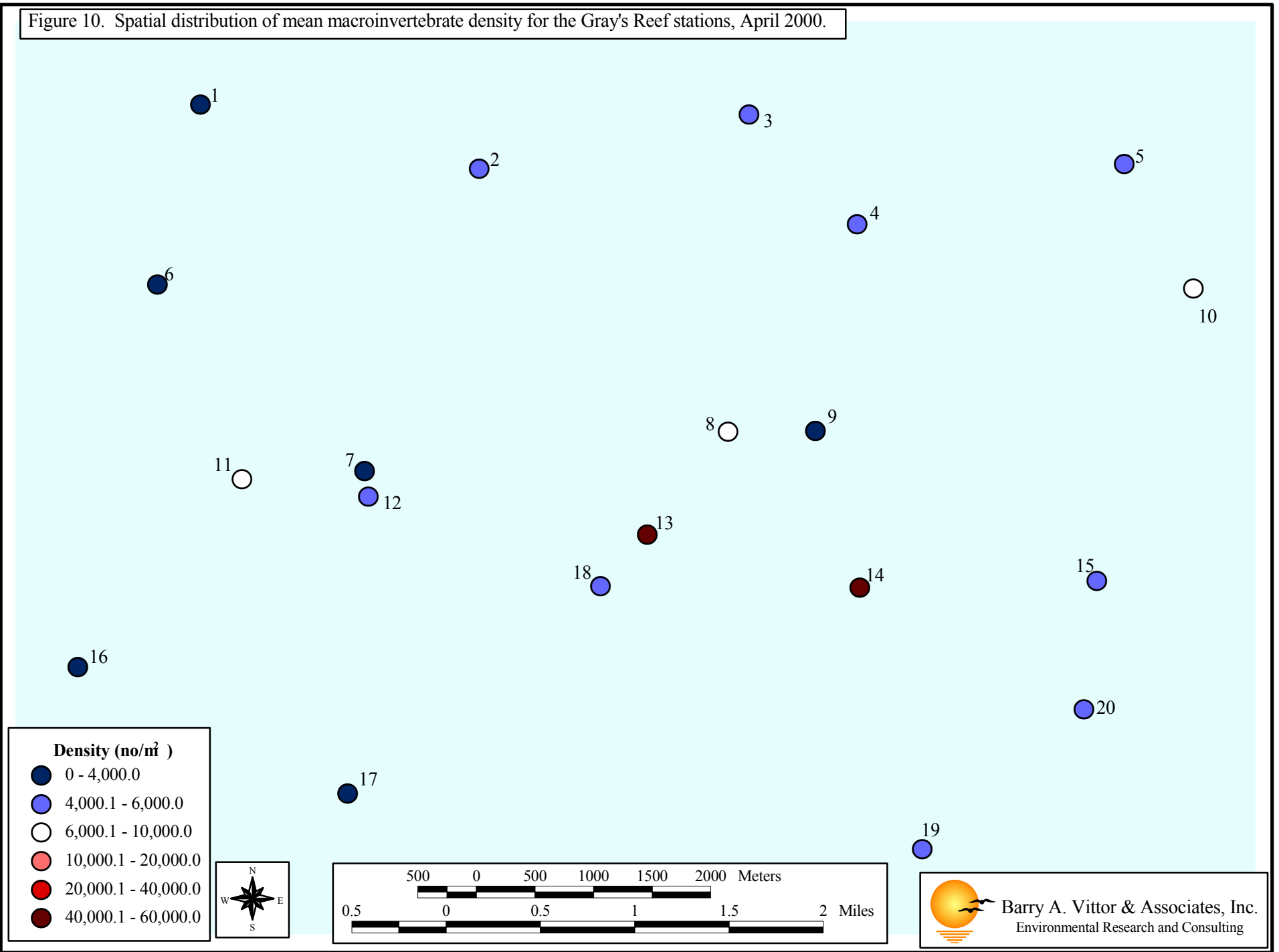


Figure 11. Mean number of taxa per replicate for the Gray's Reef stations, April 2000.

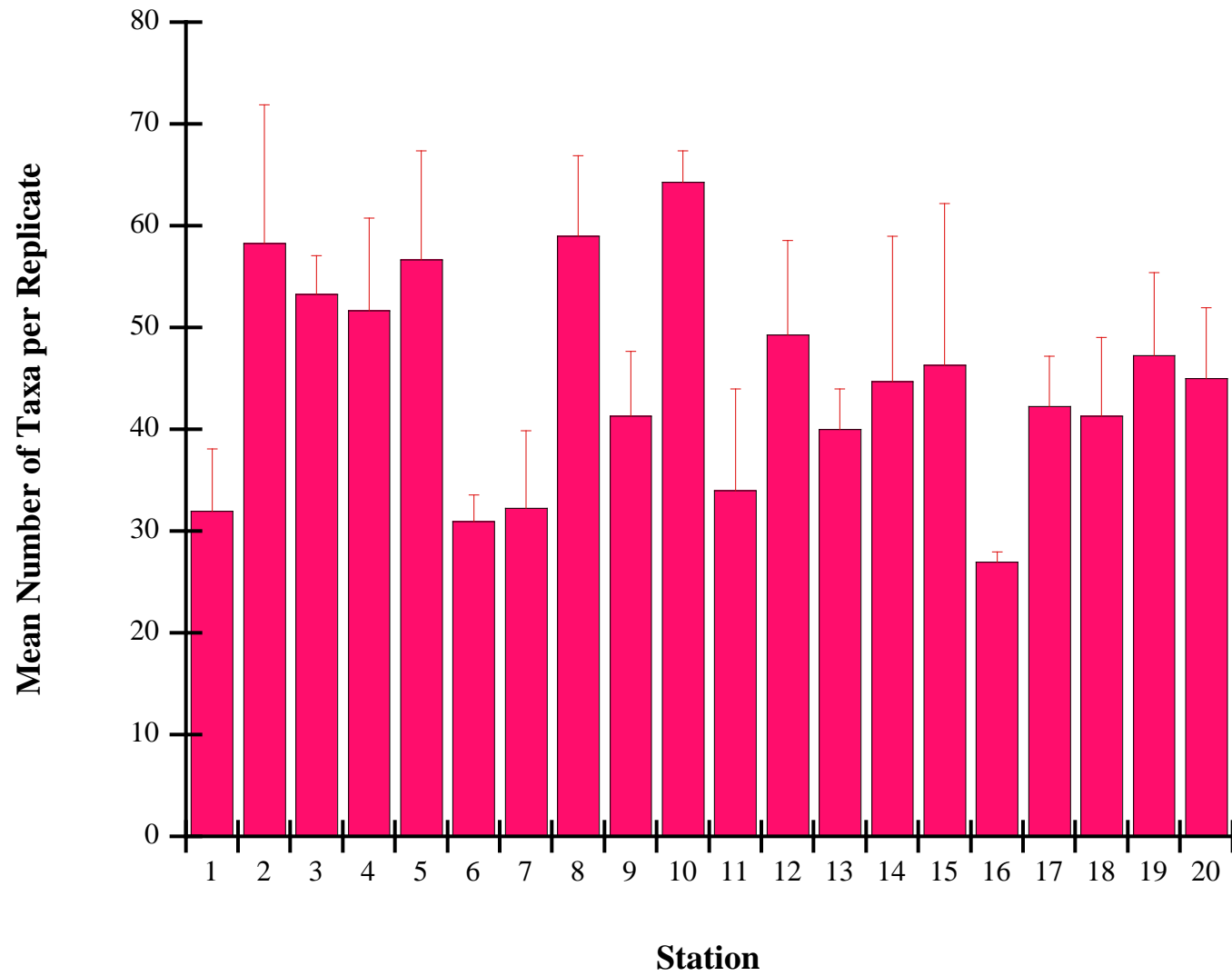


Figure 12. Spatial distribution of mean number of taxa per replicate for the Gray's Reef stations, April 2000.

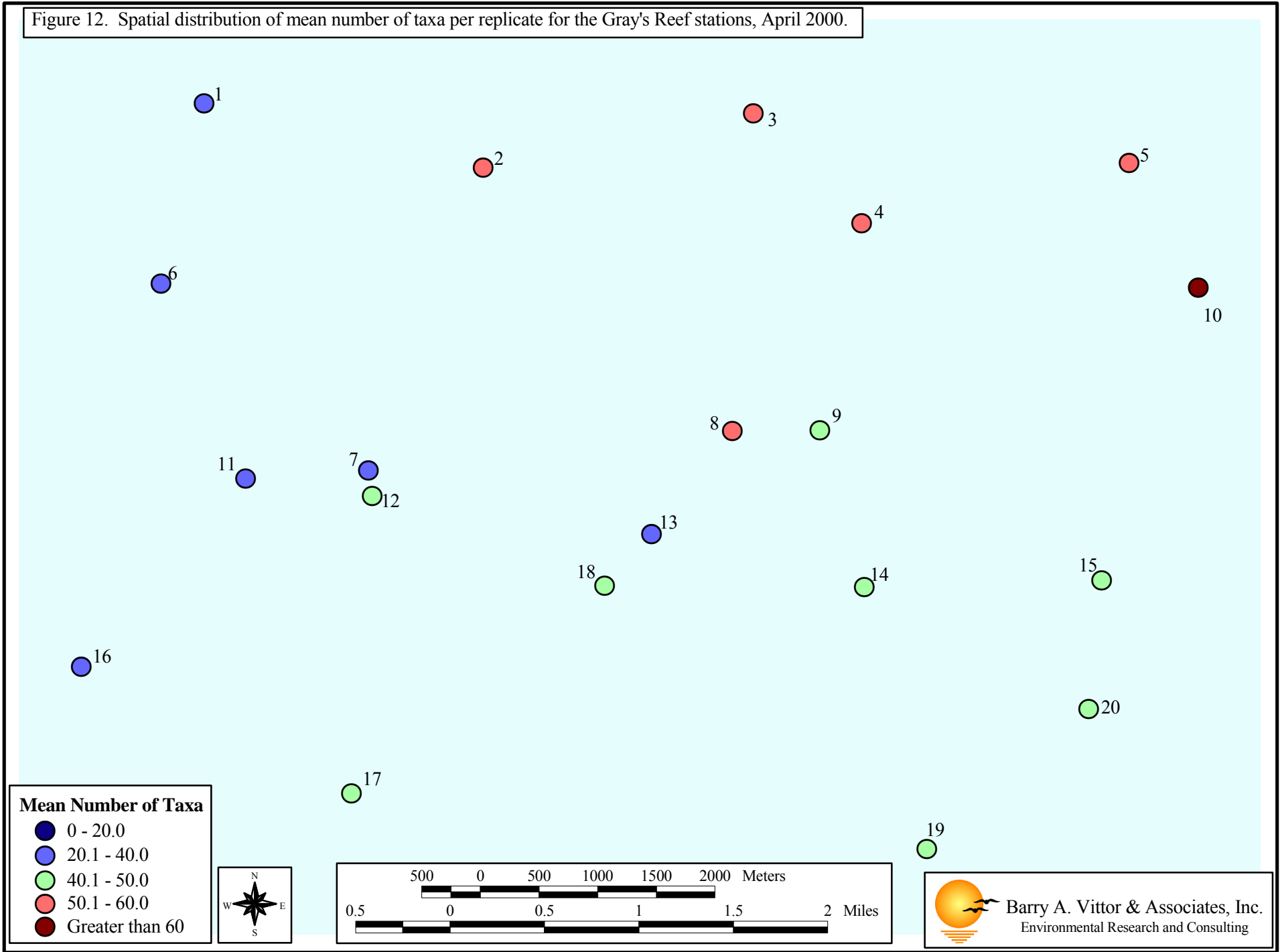


Figure 13. Taxa diversity (H') for the Gray's Reef stations, April 2000.

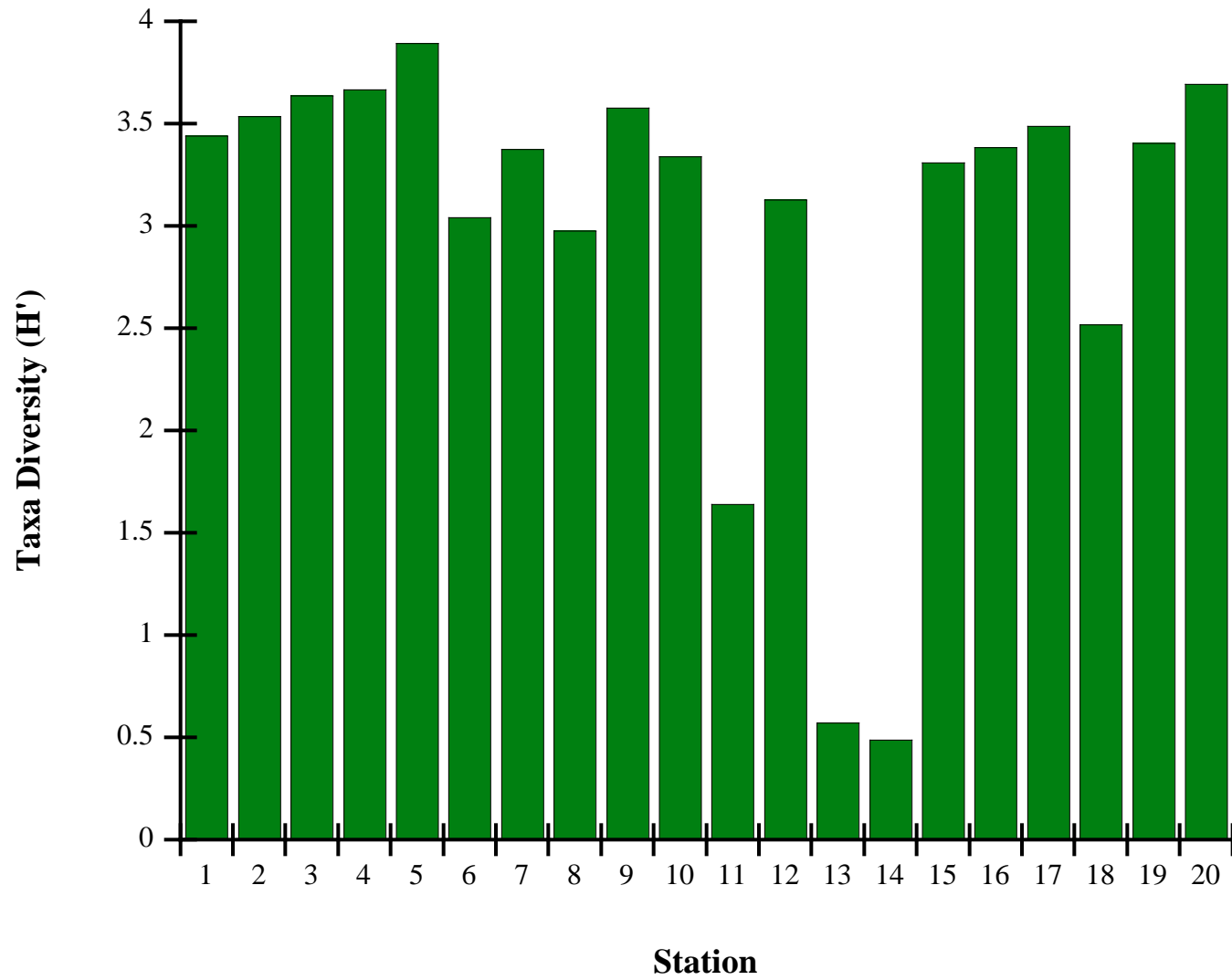


Figure 14. Spatial distribution of taxa diversity (H') for the Gray's Reef stations, April 2000.

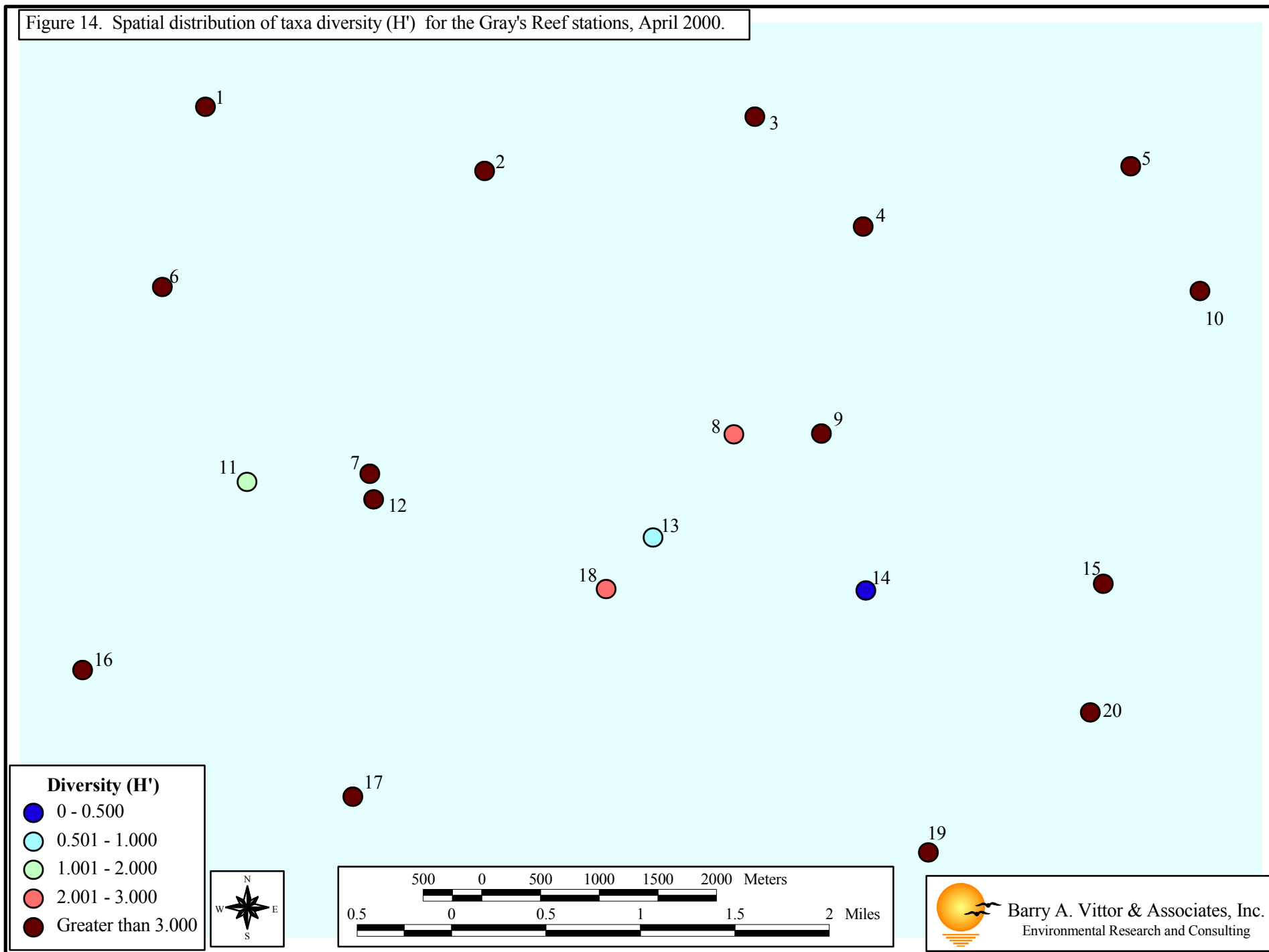


Figure 15. Taxa evenness (J') for the Gray's Reef stations, April 2000.

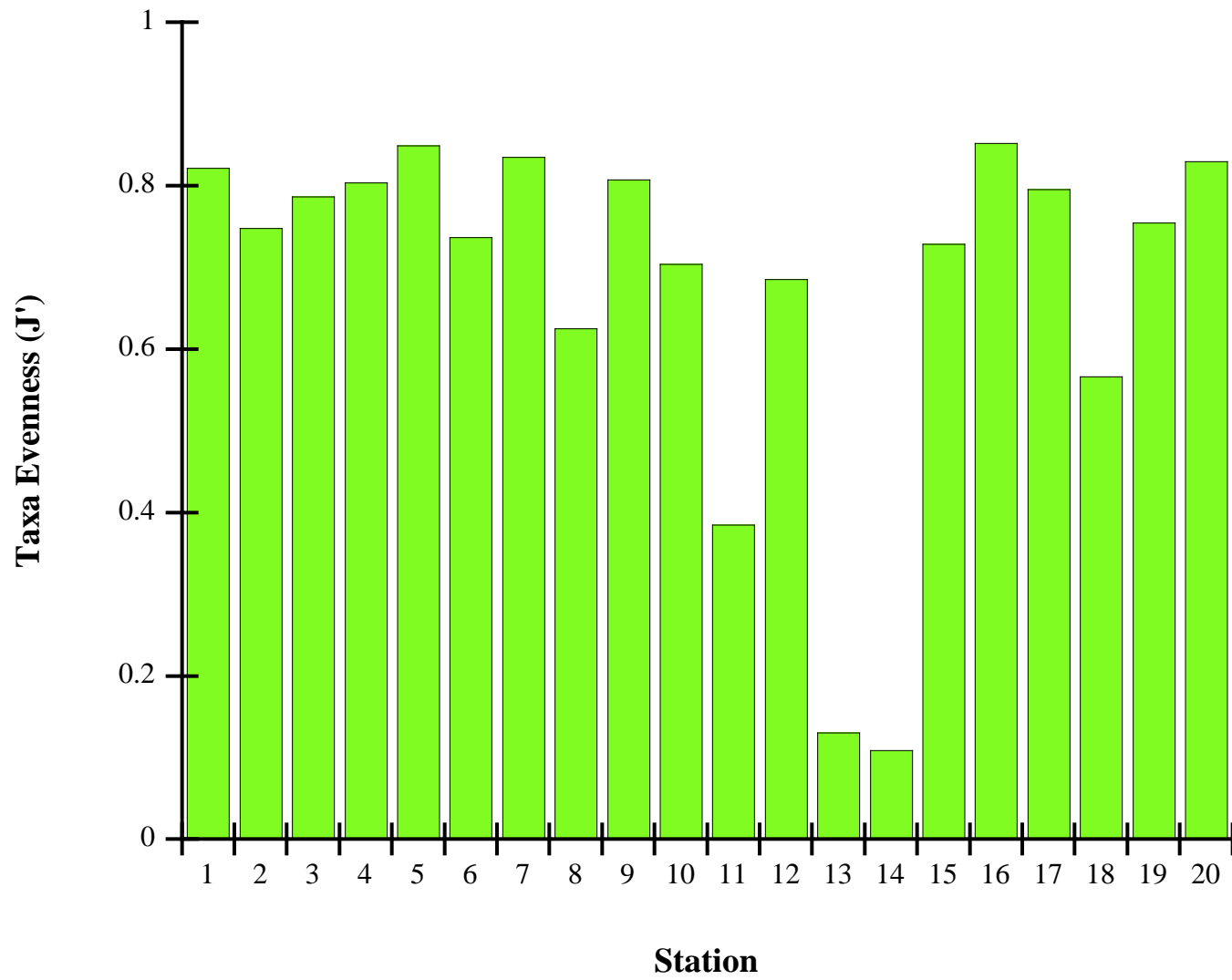


Figure 16. Spatial distribution of taxa evenness (J') for the Gray's Reef stations, April 2000.

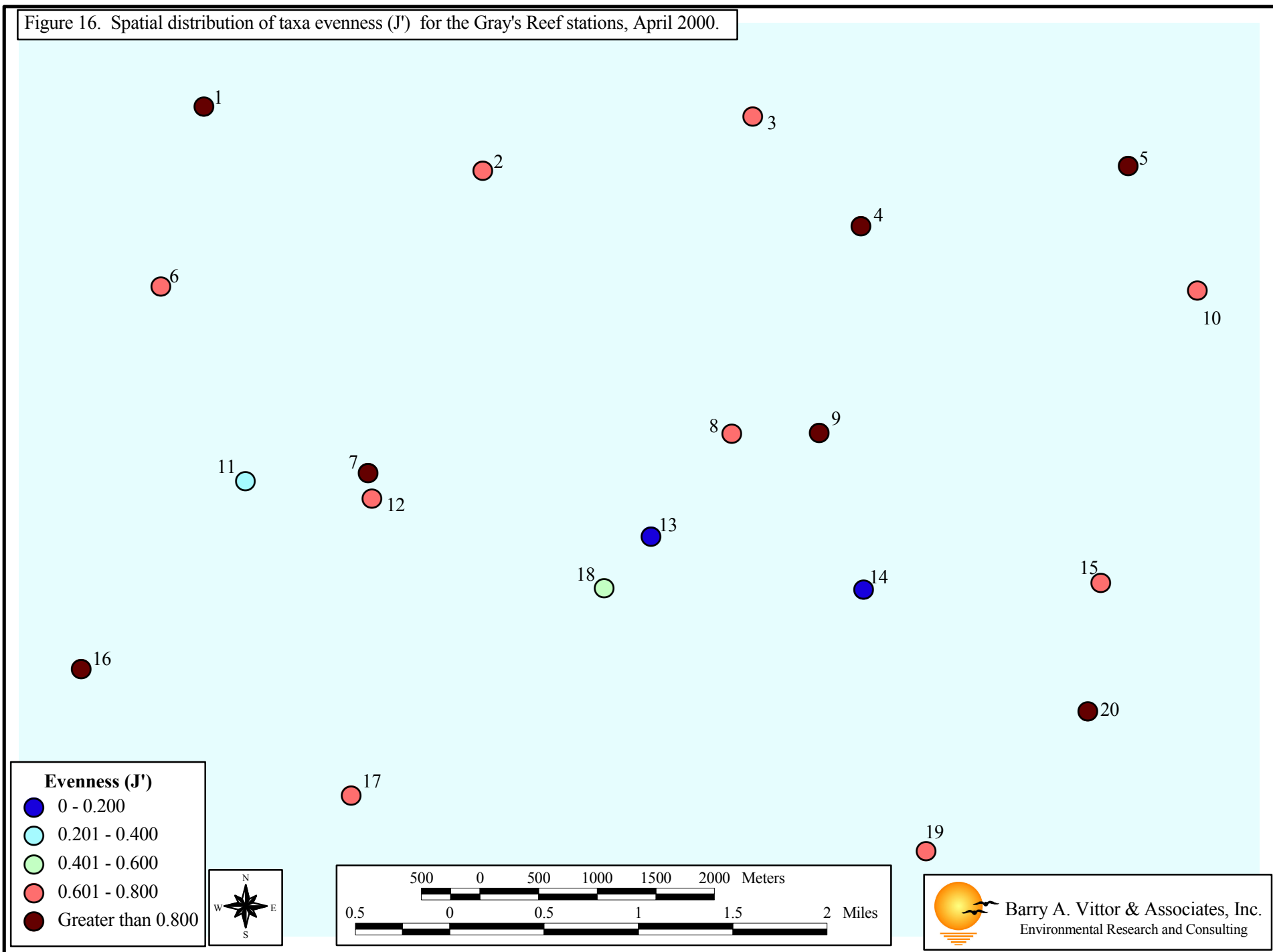


Figure 17. Station dendrogram from the cluster analysis for the Gray's Reef stations, April 2000.

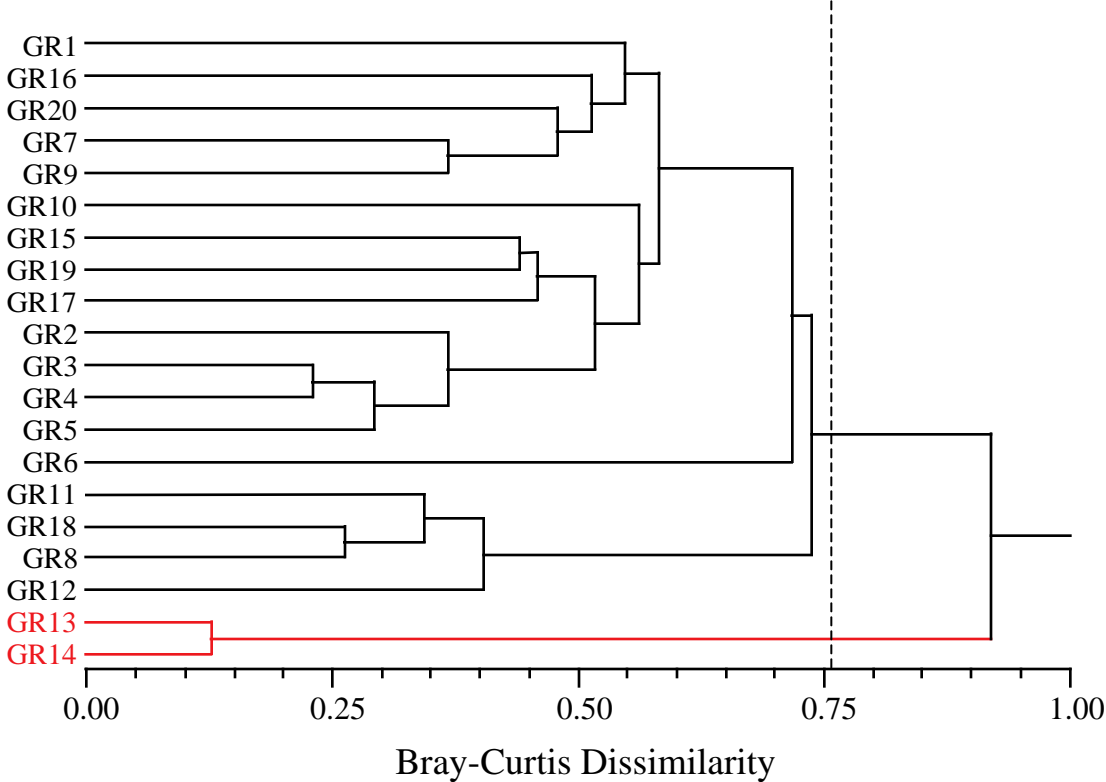
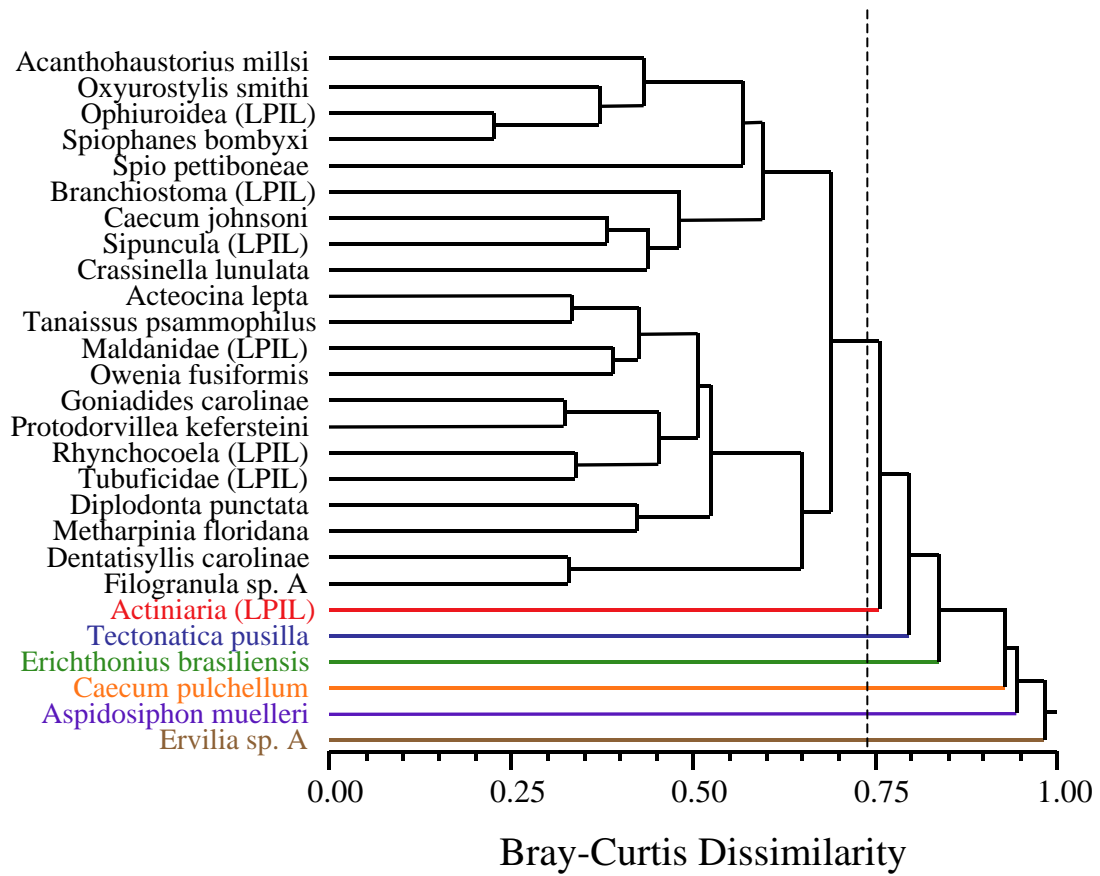


Figure 18. Taxa dendrogram from the cluster analysis for the Gray's Reef stations, April 2000.



APPENDIX A1

QUALITY ASSURANCE STATEMENT

Client/Project [NOAA](#)

Work Assignment Title [Gray's Reef 2000](#)

Work Assignment Number

Task Number [DOI](#)

Description of Data Set or Deliverable: [60 Benthic macroinvertebrate samples collected April3-6, 2000; 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:
[Ervilia sp. A accounted for 56% of the individuals identified in the project. Several specimens of Ervilia sp. A were sent to Dr. Tim Pearce, Curator of Molluscs, at the Delaware Museum of Natural History \(DMNH\). Dr. Pearce compared the specimens to the eight species of Ervilia contained in the DMNH archives. Dr. Pearce believes the specimen is most closely related to Ervilia concentrica, but there were several differences between the two specimen types. Dr. Pearce indicated that the Gray's Reef specimens may be a subspecies of E. concentrica. However, pending further verifications, Dr. Pearce and BVA mutually decided on the name Ervilia sp. A.](#)

Signature of QA Officer or Reviewer

Date

Signature of Project Manager

Date

QUALITY CONTROL REWORKS

Client/Project NOAA-Gray's Reef 2000

Task Number DO 1

Sorting Results:	Sample #	% Accuracy
	GR-16-1	100%
	GR-6-1	100%
	GR-16-2	100%
	GR-1-1	99%
	GR-7-2	100%
	GR-11-1	100%
	GR-5-3	100%

Taxonomy Results:	Sample #	Taxa	% Accuracy
	GR-9-2	Crust./Moll.	95%
	GR-6-2	Crust./Moll.	97%
	GR-2-1	Crust./Moll.	97%
	GR-17-1	Crust./Moll.	100%
	GR-10-2	Crust./Moll.	99%
	GR-14-3	Crust./Moll.	97%
	GR-5-3	Crust./Moll.	97%
	GR-19-2	Poly./Misc.	97%
	GR-1-2	Poly./Misc.	100%
	GR-3-2	Poly./Misc.	100%
	GR-6-2	Poly./Misc.	100%
	GR-9-1	Poly./Misc.	100%
	GR-11-2	Poly./Misc.	100%
	GR-16-3	Poly./Misc.	100%
	GR-19-3	Poly./Misc.	98%

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

 Signature of QA Officer or Reviewer

Date

Appendix A3. Lowest practical taxa level definitions for the Gray's Reef stations, April 2000.

Taxa	Definition
<i>Acanthohaustorius millsii</i>	
<i>Acteocina leptota</i>	
<i>Branchiostoma</i> (LPIL)	genus is lowest identification level
<i>Caecum johnsoni</i>	
<i>Crassinella lunulata</i>	
<i>Dentatisyllis carolinae</i>	
<i>Diplodonta punctata</i>	
<i>Filogranula</i> sp. A	
<i>Goniadides carolinae</i>	
Maldanidae (LPIL)	fragmented portion, pygidium necessary for positive identification.
<i>Metharpinia floridana</i>	
Ophiuroidea (LPIL)	central disk missing characters.
<i>Owenia fusiformis</i>	
<i>Oxyurostylis smithi</i>	
<i>Protodorvillea kefersteini</i>	
Rhynchocoela (LPIL)	no identifiable characters.
Sipuncula (LPIL)	juvenile specimen or missing characters
<i>Spio pettiboneae</i>	
<i>Spiophanes bombyx</i>	
<i>Tanaissus psammophilus</i>	
Tubificidae (LPIL)	sexually immature
<i>Actinaria</i> (LPIL)	order is lowest identification level.
<i>Tectonatica pusilla</i>	
<i>Erichthonius brasiliensis</i>	
<i>Caecum pulchellum</i>	
<i>Aspidosiphon muelleri</i>	
<i>Ervilia</i> sp. A	