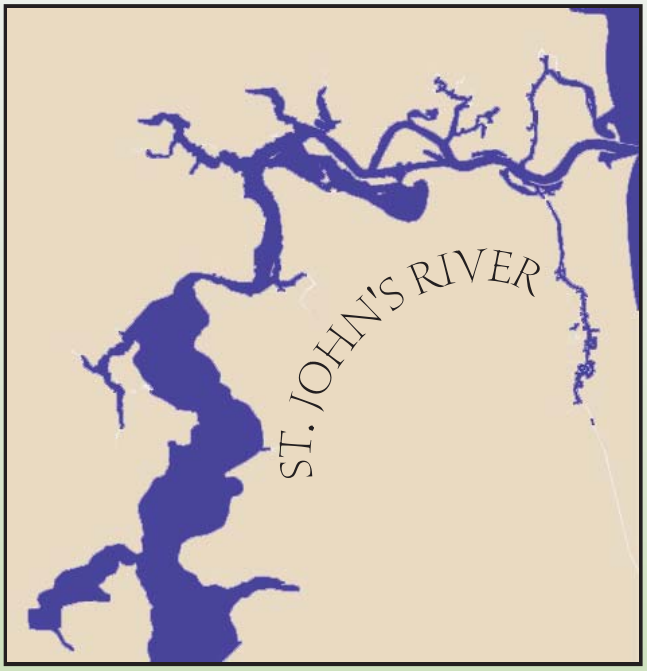
ST. JOHN'S RIVER MACROINVERTEBRATE COMMUNITY ASSESSMENT, JULY 2000



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

PREPARED BY:
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SEPTEMBER 2001

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INTRODUCTION

The St. John's River was sampled during July 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 m^2) was used to collect bottom samples at each of 7 station locations (three replicate samples were taken at each station) throughout the St. John's River. Samples were prescreened through 0.5 mm mesh seives, 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 St. John's River 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 = the number of taxa in the sample,

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

p_i = 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 and taxa richness (mean number of taxa per replicate) were Square-root transformed to meet normal assumptions. The transformed data was analyzed using one-way ANOVAs and Tukey-Kramer post-hoc tests (SAS Institute, 2000, Zar, 1999).

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 Cutis 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 7 stations are presented in Table 1 and Figures 2 and 3. Depth ranged from 1.7 m at Station 7 to 8.5 m at Station 5 (Figure 2). Salinity ranged from 10.7 at Station 1 to 34.4 at Station 7 (Figure 3). Dissolved oxygen ranged from 4.7 mg/l at Station 7 to 8.0 mg/l at Station 1 (Figure 3).

Sediment data for the 7 stations are given in Table 1 and Figures 4 through 8.

Sediment composition at the 7 stations varied throughout St. John's River (Figure 4). Sand was the dominant sediment type at each station except Station 4 (Gravel was the dominant sediment type)(Figure 5). Mean particle size ranged from 0.78 at Station 4 to 5.9 at Station 2 (Figure 6). Sorting coefficient ranged from 0.49 at Station 1 to 6.0 at Station 5 (Figure 7). The percent total organic carbon (TOC) fraction of the sediment was generally low with all values less than 6% (Table 1, Figure 8).

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 2,794 organisms, representing 143 taxa, were identified from the 7 stations (Table 3). Polychaetes were the most numerous organisms present representing 42% of the total assemblage, followed in abundance by bivalves (26%) and malacostracans (16%). Polychaetes represented 41% of the total number of taxa followed by malacostracans (22%), and bivalves (16%)(Table 3). The percentage abundance of the major taxa at the 7 stations is given in Table 4 and Figures 9 and 10.

The dominant taxa collected from the 7 stations were the polychete, *Streblospio benedicti*, the bivalve, *Gemma gemma*, the bivalve, *Mytilopsis leucophaeata*, and the polychete *Sabellaria vulgaris*, representing 17.9%, 10.5%, 9.9%, and 7.5% of the total number of individuals, respectively (Table 2). *Streblospio benedicti* was 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 7 stations in Table 6. Mean density per station ranged from 416.7 organisms·m^2 (SD = 260.2) at Station 6 to 6816.7 organisms·m^2 (SD = 1881.2) at Station 1 (Table 6; Figures 11 and 12). There were significant differences in density between stations, with Stations 1 and 5 being significantly greater than Stations 2, 4 and 6 (Tables 7 and 8). Station 7 was significantly greater then Stations 2 and 6 (Table 8). The mean number of taxa per station ranged from 7.0 taxa per replicate (SD = 1.0) at Station 6 to 42.0 taxa per replicate (SD = 2.6) at Station 5 (Table 6; Figures 13 and 14). There were significant differences in the number of taxa between stations, with Station 5 being significantly higher than Stations 1, 2, 3, 4 and 6 (Tables 7 and 8). Station 7 number of taxa was significantly higher than Stations 2 and 6 (Table 8).

Taxa diversity and evenness for the St. John's River stations are given in Table 6 and Figures 15, 16, 17 and 18. Taxa diversity (H´) varied and ranged from 1.75 at Station 6 to 2.83 at Station 5 (Table 6; Figures 15 and 16). Taxa evenness (J´) ranged from 0.53 at Station 7 to 0.87 at Station 2 (Table 6; Figures 17 and 18).

Cluster Analysis

Normal (station) and inverse (taxa) cluster analyses were performed on the St. John's River data set and displayed as dendrograms (Figures 19 and 20). Count data for the 18 taxa selected were included in a matrix of station and taxa groups (Table 9). These taxa accounted for 80.5% of the total macroinfaunal assemblage.

Clustering of the 7 stations can be interpreted at a three-group level (» 3-5 % level of dissimilarity, Table 9; Figure 19). Group 1 contained Stations 1-4 (lower salinity). Group 2 contained stations 5 and 7 (higher salinity). Group 3 contained only Station 6, which had the highest abundance of *Paraonis fulgens*.

Clustering of the 18 taxa in the 7 stations could be interpreted at a five–group level (» 1-7% dissimilarity; Table 9; Figure 20). Groups A and B were represented by 8 and 7 taxa, respectively. The remaining three groups were represented by one taxa each.

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Table 1. Summary of station location, water quality and sediment data for the St. Jonh's River stations, July 2000.

Station	Latitude	Longitude	Depth (m)	Temp. (C)	Salinity (ppt)	D.O. (mg/l)	pH	% T.O.C.	% Gravel	% Sand	% Silt	% Clay	% Silt + Clay	USACE Description	Median Particle Size (phi)	Sorting Coefficient
1	30º 08' 56.741"	81º 41' 56.637"	3.9	30.9	10.7	8.0	8.2	1.1	1.88	96.75	–	–	1.37	Sand	2.461	0.490
2	30º 16' 36.986"	81º 42' 41.066"	2.3	30.7	17.8	6.5	7.9	5.1	0.38	36.70	31.49	31.43	–	Sandy Clay	5.928	3.960
3	30º 21' 34.256"	81º 37' 10.608"	3.3	30.1	23.5	6.1	8.0	3.0	0.19	52.02	20.29	27.51	–	Clayey Sand	3.886	3.905
4	30º 23' 28.704"	81º 39' 18.708"	2.1	30.1	28.1	6.2	8.0	4.0	41.73	16.77	11.98	29.53	–	N/A	0.788	5.958
5	30º 23' 00.690"	81º 33' 42.144"	8.5	29.7	30.0	6.9	8.1	0.4	5.55	59.84	8.78	25.83	–	N/A	2.817	6.042
6	30º 22' 44.347"	81º 32' 19.742"	3.5	28.9	32.4	6.4	8.1	0.2	0.00	99.73	–	–	0.27	Sand	2.459	0.546
7	30º 26' 03.956"	81º 30' 27.171"	1.7	29.0	34.4	4.1	7.6	0.3	0.00	99.58	–	–	0.42	Sand	2.313	0.619

Table 2. Abundance and distribution of benthic macroinfaunal taxa for the St. John's River stations, July 2000.

Taxa	Phylum	Class	No. of Individuals	% of Total	Cumulative %	Station Occurrence	% Station Occurrence
Streblospio benedicti	Ann	Poly	499	17.86	17.86	7	100
Gemma gemma	Mol	Biva	292	10.45	28.31	1	14
Mytilopsis leucophaeata	Mol	Biva	277	9.91	38.22	1	14
Sabellaria vulgaris	Ann	Poly	209	7.48	45.71	2	29
Paracaprella pusilla	Art	Mala	127	4.55	50.25	3	43
Actiniaria (LPIL)	Cni	Anth	120	4.29	54.55	3	43
Odostomia impressa	Mol	Gast	88	3.15	57.70	1	14
Batea catharinensis	Art	Mala	72	2.58	60.27	3	43
Nereis succinea	Ann	Poly	72	2.58	62.85	4	57
Melitidae (LPIL)	Art	Mala	60	2.15	65.00	5	71
Porifera (LPIL)	Por	–	56	2.00	67.00	1	14
Dipolydora socialis	Ann	Poly	54	1.93	68.93	3	43
Rhynchocoela (LPIL)	Rhy	–	49	1.75	70.69	5	71
Mediomastus (LPIL)	Ann	Poly	47	1.68	72.37	4	57
Tubulanus (LPIL)	Rhy	Anop	47	1.68	74.05	3	43
Mediomastus ambiseta	Ann	Poly	38	1.36	75.41	2	29
Ampelisca (LPIL)	Art	Mala	29	1.04	76.45	3	43
Macoma mitchelli	Mol	Biva	29	1.04	77.49	3	43
Paraonis fulgens	Ann	Poly	29	1.04	78.53	1	14
Eusarsiella zostericola	Art	Ostr	28	1.00	79.53	3	43
Ischadium recurvum	Mol	Biva	27	0.97	80.49	2	29
Rangia cuneata	Mol	Biva	26	0.93	81.42	4	57
Cyclaspis varians	Art	Mala	21	0.75	82.18	2	29
Diopatra cuprea	Ann	Poly	21	0.75	82.93	2	29
Melita (LPIL)	Art	Mala	19	0.68	83.61	3	43
Xanthidae (LPIL)	Art	Mala	19	0.68	84.29	3	43
Tellinidae (LPIL)	Mol	Biva	18	0.64	84.93	5	71
Grandidierella bonnieroides	Art	Mala	15	0.54	85.47	2	29
Leucon americanus	Art	Mala	13	0.47	85.93	2	29
Pista quadrilobata	Ann	Poly	13	0.47	86.40	1	14
Ascidiacea (LPIL)	Cho	Asci	12	0.43	86.83	3	43
Hypereteone (LPIL)	Ann	Poly	12	0.43	87.26	3	43
Lucina multilineata	Mol	Biva	12	0.43	87.69	1	14
Marenzellaria viridis	Ann	Poly	12	0.43	88.12	1	14
Assiminea succinea	Mol	Gast	11	0.39	88.51	2	29
Polydora cornuta	Ann	Poly	11	0.39	88.90	2	29
Sigambra tentaculata	Ann	Poly	11	0.39	89.30	3	43
Aeginellidae (LPIL)	Art	Mala	10	0.36	89.66	1	14
Nereis lamellosa	Ann	Poly	10	0.36	90.01	2	29
Sphenia antillensis	Mol	Biva	9	0.32	90.34	1	14
Corophium (LPIL)	Art	Mala	8	0.29	90.62	1	14
Mactridae (LPIL)	Mol	Biva	7	0.25	90.87	5	71
Nucula proxima	Mol	Biva	7	0.25	91.12	3	43
Anadara transversa	Mol	Biva	6	0.21	91.34	1	14
Exogone (LPIL)	Ann	Poly	6	0.21	91.55	1	14
Hydroides dianthus	Ann	Poly	6	0.21	91.77	1	14
Leitoscoloplos robustus	Ann	Poly	6	0.21	91.98	1	14
Nereis micromma	Ann	Poly	6	0.21	92.20	1	14
Paraprionospio pinnata	Ann	Poly	6	0.21	92.41	2	29
Podarkeopsis levifuscina	Ann	Poly	6	0.21	92.63	3	43
Ampelisca abdita	Art	Mala	5	0.18	92.81	1	14
Amphilochidae (LPIL)	Art	Mala	5	0.18	92.98	2	29
Cyathura polita	Art	Mala	5	0.18	93.16	2	29
Heteromastus filiformis	Ann	Poly	5	0.18	93.34	1	14
Aoridae (LPIL)	Art	Mala	4	0.14	93.49	2	29
Bivalvia (LPIL)	Mol	Biva	4	0.14	93.63	3	43

Table 2. Continued:

Taxa	Phylum	Class	No. of Individuals	% of Total	Cumulative %	Station Occurrence	% Station Occurrence
Cirrophorus (LPIL)	Ann	Poly	4	0.14	93.77	1	14
Demonax (LPIL)	Ann	Poly	4	0.14	93.92	2	29
Edotia triloba	Art	Mala	4	0.14	94.06	2	29
Magelona sp. H	Ann	Poly	4	0.14	94.20	1	14
Nereis (LPIL)	Ann	Poly	4	0.14	94.35	2	29
Ophiuroidea (LPIL)	Ech	Ophi	4	0.14	94.49	1	14
Podarke obscura	Ann	Poly	4	0.14	94.63	2	29
Prionospio (LPIL)	Ann	Poly	4	0.14	94.77	2	29
Tubificoides heterochaetus	Ann	Olig	4	0.14	94.92	1	14
Abra aequalis	Mol	Biva	3	0.11	95.03	1	14
Aglaophamus verrilli	Ann	Poly	3	0.11	95.13	2	29
Americhelidium americanum	Art	Mala	3	0.11	95.24	1	14
Armandia maculata	Ann	Poly	3	0.11	95.35	2	29
Capitella capitata	Ann	Poly	3	0.11	95.45	1	14
Cerapus benthophilus	Art	Mala	3	0.11	95.56	2	29
Clinotanypus (LPIL)	Art	Imse	3	0.11	95.67	1	14
Corbulidae (LPIL)	Mol	Biva	3	0.11	95.78	1	14
Corophium lacustre	Art	Mala	3	0.11	95.88	1	14
Crassostrea virginica	Mol	Biva	3	0.11	95.99	1	14
Gyptis pluriseta	Ann	Poly	3	0.11	96.10	1	14
Latreutes parvulus	Art	Mala	3	0.11	96.21	2	29
Leitoscoloplos (LPIL)	Ann	Poly	3	0.11	96.31	2	29
Leptosynapta tenuis	Ech	Holo	3	0.11	96.42	1	14
Mytilidae (LPIL)	Mol	Biva	3	0.11	96.53	2	29
Nereiphylla fragilis	Ann	Poly	3	0.11	96.64	2	29
Ogyrides alphaerostris	Art	Mala	3	0.11	96.74	1	14
Panopeus herbstii	Art	Mala	3	0.11	96.85	2	29
Serpulidae (LPIL)	Ann	Poly	3	0.11	96.96	1	14
Tubificidae (LPIL)	Ann	Olig	3	0.11	97.07	1	14
Ampelisca vadorum	Art	Mala	2	0.07	97.14	1	14
Bateidae (LPIL)	Art	Mala	2	0.07	97.21	1	14
Ceratonereis irritabilis	Ann	Poly	2	0.07	97.28	1	14
Cryptochironomus (LPIL)	Art	Imse	2	0.07	97.35	1	14
Eobrolgus spinosus	Art	Mala	2	0.07	97.42	2	29
Euceramus praelongus	Art	Mala	2	0.07	97.49	1	14
Gastropoda (LPIL)	Mol	Gast	2	0.07	97.57	2	29
Lepidonotus sublevis	Ann	Poly	2	0.07	97.64	1	14
Lepidonotus variabilis	Ann	Poly	2	0.07	97.71	1	14
Melita longisetosa	Art	Mala	2	0.07	97.78	2	29
Mitrella lunata	Mol	Gast	2	0.07	97.85	1	14
Nephtys picta	Ann	Poly	2	0.07	97.92	1	14
Nereis riisei	Ann	Poly	2	0.07	98.00	2	29
Notomastus hemipodus	Ann	Poly	2	0.07	98.07	1	14
Paraeupolymnia sp. A	Ann	Poly	2	0.07	98.14	1	14
Phyllodoce arenae	Ann	Poly	2	0.07	98.21	2	29
Piromis roberti	Ann	Poly	2	0.07	98.28	2	29
Sabaco americanus	Ann	Poly	2	0.07	98.35	1	14
Sabellidae (LPIL)	Ann	Poly	2	0.07	98.43	1	14
Scoloplos rubra	Ann	Poly	2	0.07	98.50	1	14
Tellina (LPIL)	Mol	Biva	2	0.07	98.57	1	14
Terebellidae (LPIL)	Ann	Poly	2	0.07	98.64	1	14
Tharyx acutus	Ann	Poly	2	0.07	98.71	1	14
Vitrinellidae (LPIL)	Mol	Gast	2	0.07	98.78	1	14
Acteocina canaliculata	Mol	Gast	1	0.04	98.82	1	14
Ampharetidae (LPIL)	Ann	Poly	1	0.04	98.85	1	14
Amygdalum papyria	Mol	Biva	1	0.04	98.89	1	14
Anachis lafresnayi	Mol	Gast	1	0.04	98.93	1	14
Capitellidae (LPIL)	Ann	Poly	1	0.04	98.96	1	14

Table 2. Continued:

Taxa	Phylum	Class	No. of Individuals	% of Total	Cumulative %	Station Occurrence	% Station Occurrence
Cerapus (LPIL)	Art	Mala	1	0.04	99.00	1	14
Chione intapurpurea	Mol	Biva	1	0.04	99.03	1	14
Cirratulidae (LPIL)	Ann	Poly	1	0.04	99.07	1	14
Columbellidae (LPIL)	Mol	Gast	1	0.04	99.11	1	14
Corbula (LPIL)	Mol	Biva	1	0.04	99.14	1	14
Diplodonta (LPIL)	Mol	Biva	1	0.04	99.18	1	14
Epitonium (LPIL)	Mol	Gast	1	0.04	99.21	1	14
Epitonium multistriatum	Mol	Gast	1	0.04	99.25	1	14
Glycinde solitaria	Ann	Poly	1	0.04	99.28	1	14
Hydrobiidae (LPIL)	Mol	Gast	1	0.04	99.32	1	14
Ilyanassa trivittata	Mol	Gast	1	0.04	99.36	1	14
Mediomastus californiensis	Ann	Poly	1	0.04	99.39	1	14
Monoculodes (LPIL)	Art	Mala	1	0.04	99.43	1	14
Nassarius vibex	Mol	Gast	1	0.04	99.46	1	14
Odostomia (LPIL)	Mol	Gast	1	0.04	99.50	1	14
Owenia fusiformis	Ann	Poly	1	0.04	99.53	1	14
Phoronis (LPIL)	Pho	–	1	0.04	99.57	1	14
Pinnotheridae (LPIL)	Art	Mala	1	0.04	99.61	1	14
Polypedilum scalaenum group	Art	Imse	1	0.04	99.64	1	14
Porcellanidae (LPIL)	Art	Mala	1	0.04	99.68	1	14
Spiochaetopterus oculatus	Ann	Poly	1	0.04	99.71	1	14
Spionidae (LPIL)	Ann	Poly	1	0.04	99.75	1	14
Streblosoma hartmanae	Ann	Poly	1	0.04	99.79	1	14
Streptosyllis pettiboneae	Ann	Poly	1	0.04	99.82	1	14
Syllis (LPIL)	Ann	Poly	1	0.04	99.86	1	14
Synidotea (LPIL)	Art	Mala	1	0.04	99.89	1	14
Ungulinidae (LPIL)	Mol	Biva	1	0.04	99.93	1	14
Veneridae (LPIL)	Mol	Biva	1	0.04	99.96	1	14
Vitrinella floridana	Mol	Gast	1	0.04	100.00	1	14

Taxa Key

Ann=Annelida
  Poly=Polychaeta
  Olig=Oligochaeta
Art=Arthropoda
  Inse=Insecta
  Mala=Malacostraca
  Ostr=Ostracoda
Cho=Chordata
  Asci=Ascidiacea
Cni=Cnidaria
  Anth=Anthozoa
Ech=Echinodermata
  Holo=Holothuroidea
  Ophi=Ophiuroidea
Mol=Mollusca
  Biva=Bivalvia
  Gast=Gastropoda
Pho=Phoronida
Por=Porifera
Rhy=Rhynchocoela
  Anop=Anopla

Table 3. Summary of overall abundance of major benthic macroinfaunal taxonomic groups for the St. John's River stations, July 2000.

Taxa	Total No. Taxa	% of Total	Total No. Individuals	% of Total
Annelida				
Oligochaeta	2	1.4	7	0.3
Polychaeta	59	41.3	1,163	41.6
Mollusca				
Bivalvia	23	16.1	734	26.3
Gastropoda	15	10.5	115	4.1
Cnidaria				
Anthozoa	1	0.7	120	4.3
Arthropoda				
Insecta	3	2.1	6	0.2
Malacostraca	32	22.4	449	16.1
Ostracoda	1	0.7	28	1.0
Echinodermata				
Holothuroidea	1	0.7	3	0.1
Ophiuroidea	1	0.7	4	0.1
Rhynchocoela	2	1.4	96	3.4
Other Taxa	3	2.1	69	2.5
Total	143		2,794	

Table 4. Summary of abundance of major benthic macroinfaunal taxonomic groups by station for the St. John's River stations, July 2000.

Station ID	Taxa	Total No. Taxa	% of Total	Total No. Individuals	% of Total
1	Annelida	5	21.7	366	44.7
	Mollusca	8	34.8	329	40.2
	Arthropoda	9	39.1	87	10.6
	Echinodermata	0	0.0	0	0.0
	Other Taxa	1	4.3	36	4.4
	Total	**23**		**818**	
2	Annelida	2	25.0	35	37.6
	Mollusca	5	62.5	52	55.9
	Arthropoda	0	0.0	0	0.0
	Echinodermata	0	0.0	0	0.0
	Other Taxa	1	12.5	6	6.5
	Total	**8**		**93**	
3	Annelida	12	42.9	210	75.8
	Mollusca	5	17.9	5	1.8
	Arthropoda	9	32.1	52	18.8
	Echinodermata	0	0.0	0	0.0
	Other Taxa	2	7.1	10	3.6
	Total	**28**		**277**	
4	Annelida	14	38.9	61	29.2
	Mollusca	12	33.3	108	51.7
	Arthropoda	9	25.0	37	17.7
	Echinodermata	0	0.0	0	0.0
	Other Taxa	1	2.8	3	1.4
	Total	**36**		**209**	
5	Annelida	34	45.3	356	44.4
	Mollusca	17	22.7	39	4.9
	Arthropoda	20	26.7	255	31.8
	Echinodermata	1	1.3	4	0.5
	Other Taxa	3	4.0	147	18.4
	Total	**75**		**801**	
6	Annelida	6	40.0	37	74.0
	Mollusca	3	20.0	3	6.0
	Arthropoda	4	26.7	7	14.0
	Echinodermata	0	0.0	0	0.0
	Other Taxa	2	13.3	3	6.0
	Total	**15**		**50**	
7	Annelida	25	46.3	105	19.2
	Mollusca	9	16.7	313	57.3
	Arthropoda	13	24.1	45	8.2
	Echinodermata	1	1.9	3	0.5
	Other Taxa	6	11.1	80	14.7
	Total	**54**		**546**	

Table 5. Percentage abundance of dominant benthic macroinfaunal taxa (>10% of the total) for the St. John's River stations, July 2000.

Taxa	1	2	3	4	5	6	7
Annelida							
Polychaeta							
Mediomastus ambiseta			12.6				
Nereis succinea				11.5			
Paraonis fulgens						58.0	
Sabellaria vulgaris					26.0		
Streblospio benedicti	37.2	29.0	53.1				
Arthropoda							
Malacostraca							
Paracaprella pusilla					15.6		
Cnidaria							
Anthozoa							
Actiniaria (LPIL)					13.1		
Mollusca							
Bivalvia							
Gemma gemma							53.5
Macoma mitchelli		29.0					
Mytilopsis leucophaeata	33.9						
Tellinidae (LPIL)		10.8					
Gastropoda							
Odostomia impressa				42.1			
Porifera							
Porifera (LPIL)							10.3

Table 6. Summary of the benthic macroinfaunal data for the St. John's River stations, July 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	17	221	5525	16.0	1.0	6816.7	1881.2	23	818	1.77	0.56
	B	15	359	8975								
	C	16	238	5950								
2	A	6	15	375	6.7	1.2	775.0	368.3	8	93	1.80	0.87
	B	8	44	1100								
	C	6	34	850								
3	A	13	56	1400	16.0	3.6	2308.3	1907.3	28	277	1.93	0.58
	B	15	41	1025								
	C	20	180	4500								
4	A	21	56	1400	17.0	8.7	1741.7	1762.5	36	209	2.44	0.68
	B	23	146	3650								
	C	7	7	175								
5	A	45	277	6925	42.0	2.6	6675.0	1047.6	75	801	2.83	0.66
	B	40	221	5525								
	C	41	303	7575								
6	A	7	25	625	7.0	3.0	416.7	260.2	15	50	1.75	0.65
	B	10	20	500								
	C	4	5	125								
7	A	37	163	4075	24.3	11.2	4550.0	1688.4	54	546	2.10	0.53
	B	16	126	3150								
	C	20	257	6425								

Table 7. Statistical analysis for density and taxa differences among stations for the St. John's River stations, July 2000.

DENSITY DATA

Shapiro-Wilk W Test for Normality

W= 0.93 Prob < W = 0.1192

ANOVA Table

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	6	11767.27	1961.21	**10.31**	**0.0002**
Error	14	2663.31	190.24		
Total	20	14430.58			

TAXA DATA

Shapiro-Wilk W Test for Normality

W= 0.93 Prob < W = 0.1212

ANOVA Table

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Model	6	30.54	5.01	**11.79**	**<0.0001**
Error	14	6.04	0.43		
Total	20	36.58			

Table 8. Density and taxa post-hoc results for the St. John's River stations, July 2000.

Density	1	5	7	3	4	2	6
1							
5							
7							
3							
4	*	*					
2	*	*	*				
6	*	*	*				

Taxa	5	7	4	1	3	6	2
5			*	*	*	*	*
7						*	*
4							
1							
3							
6							
2							

* indicates pairs of means that are significantly different.

Table 9. Two-way matrix of station and species groups for the St. John's River stations, July 2000.

			1			2		3	
	1	**3**	**2**	**4**	**5**	**7**	**6**	
Actiniaria (LPIL)	0	0	0	0	105	14	1	
Paracaprella pusilla	0	0	0	0	125	1	1	
Batea catharinensis	0	0	0	0	69	1	2	
Sabellaria vulgaris	0	0	0	1	208	0	0	**A**
Eusarsiella zostericola	0	6	0	0	20	2	0	
Dipolydora socialis	0	0	0	6	18	30		
Porifera (LPIL)	0	0	0	0	0	56	0	
Gemma gemma	0	0	0	0	0	292	0	
Ischadium recurvum	25	0	0	2	0	0	0	
Melitidae (LPIL)	56	1	0	1	1	1	0	
Nereis succinea	43	0	0	24	1	4	0	
Tubulanus (LPIL)	36	10	6	0	34	8	2	**B**
Mytilopsis leucophaeata	277	0	0	0	0	0	0	
Streblospio benedicti	304	147	27	6	2	11	2	
Mediomastus ambiseta	0	35	0	0	0	3	0	
Macoma mitchelli	0	1	27	0	0	1	0	**C**
Odostomia impressa	0	0	0	88	0	0	0	**D**
Paraonis fulgens	0	0	0	0	0	0	29	**E**

Figure 1. Station locations for the St. John's River stations, July 2000.

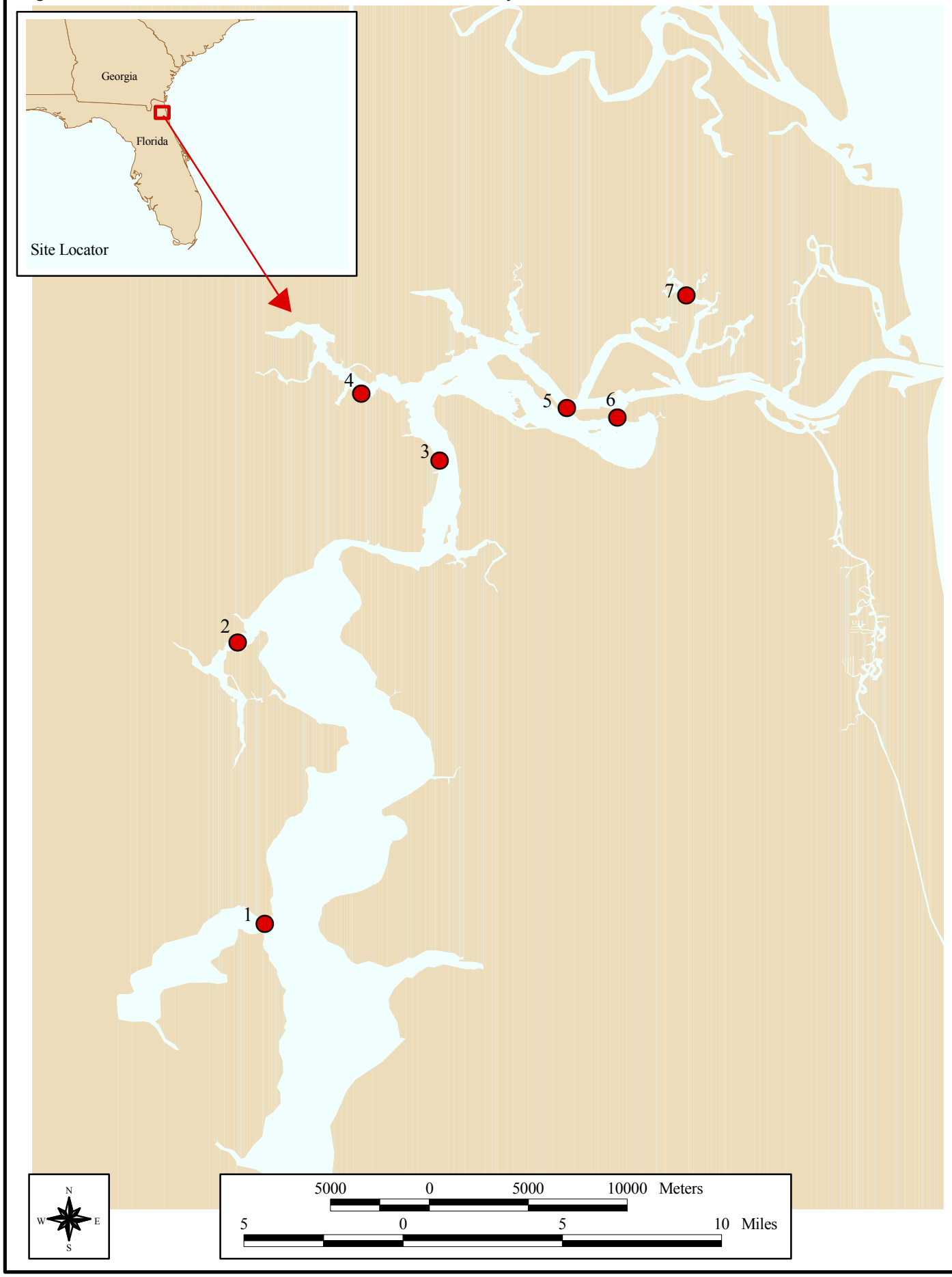


Figure 2. Depth and temperature data for the St. John's River stations, July 2000.

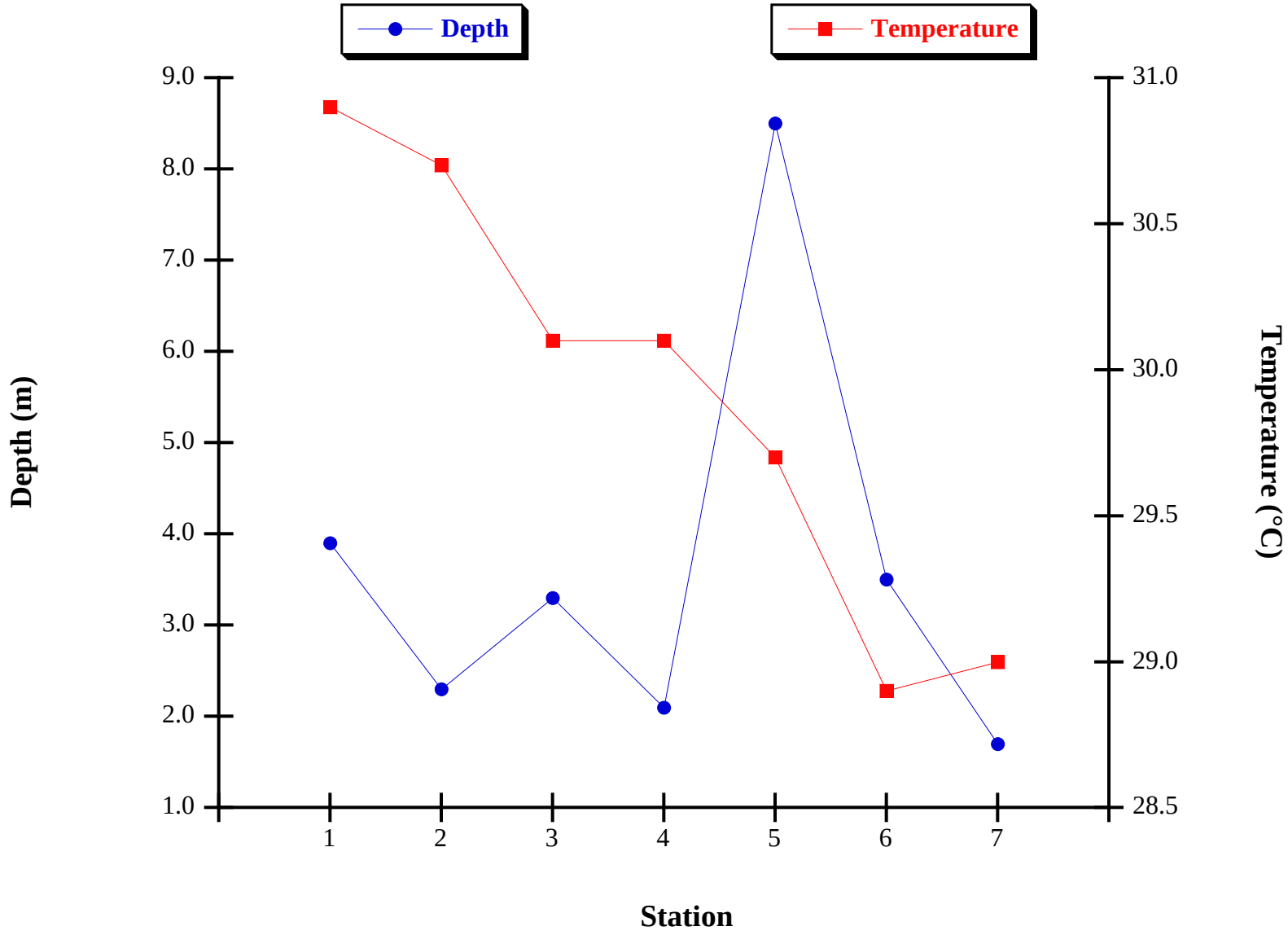


Figure 3. Salinty and dissolved oxygen data for the St. John's River stations, July 2000.

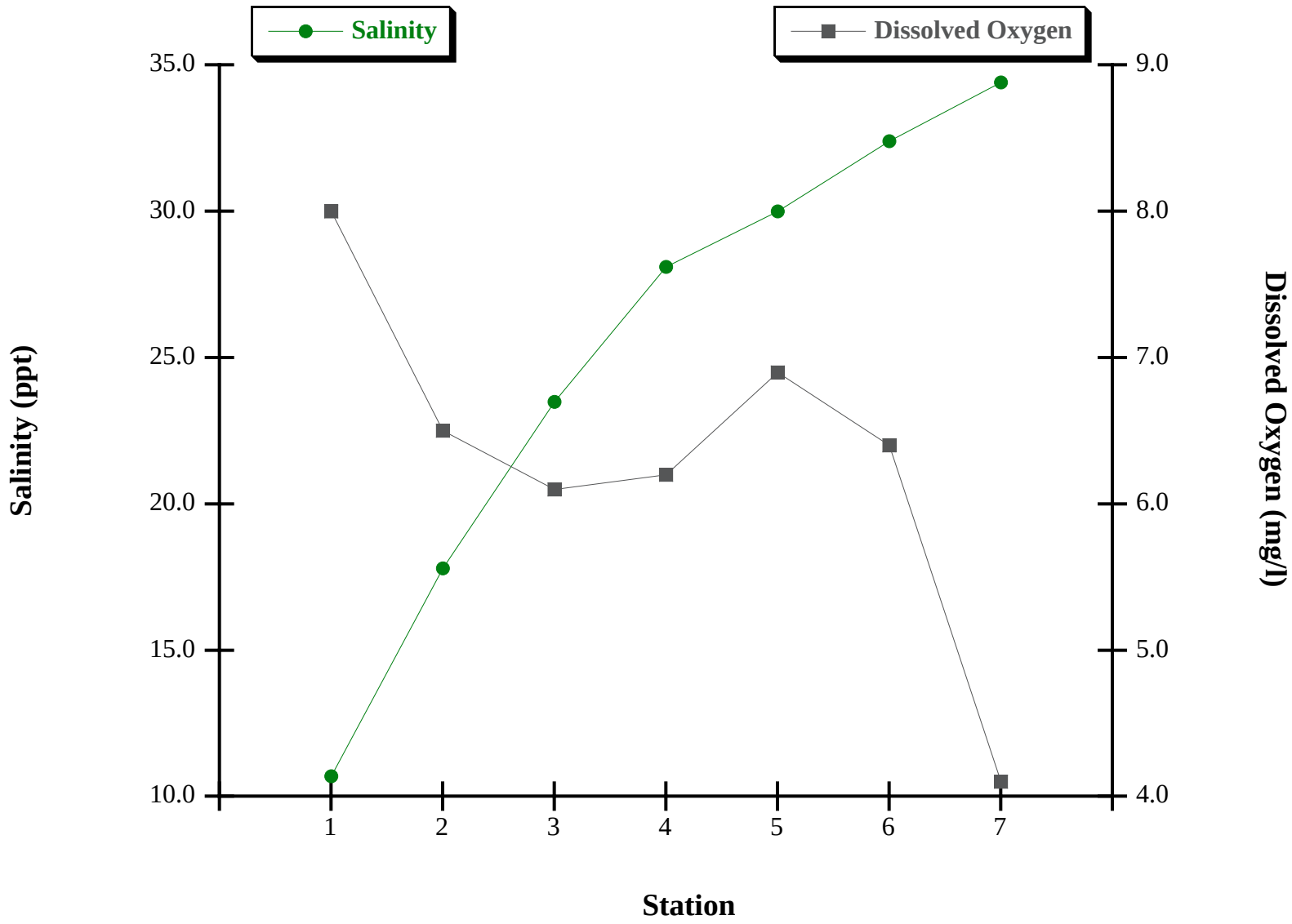


Figure 4. Sediment composition for the St. John's River stations, July 2000.

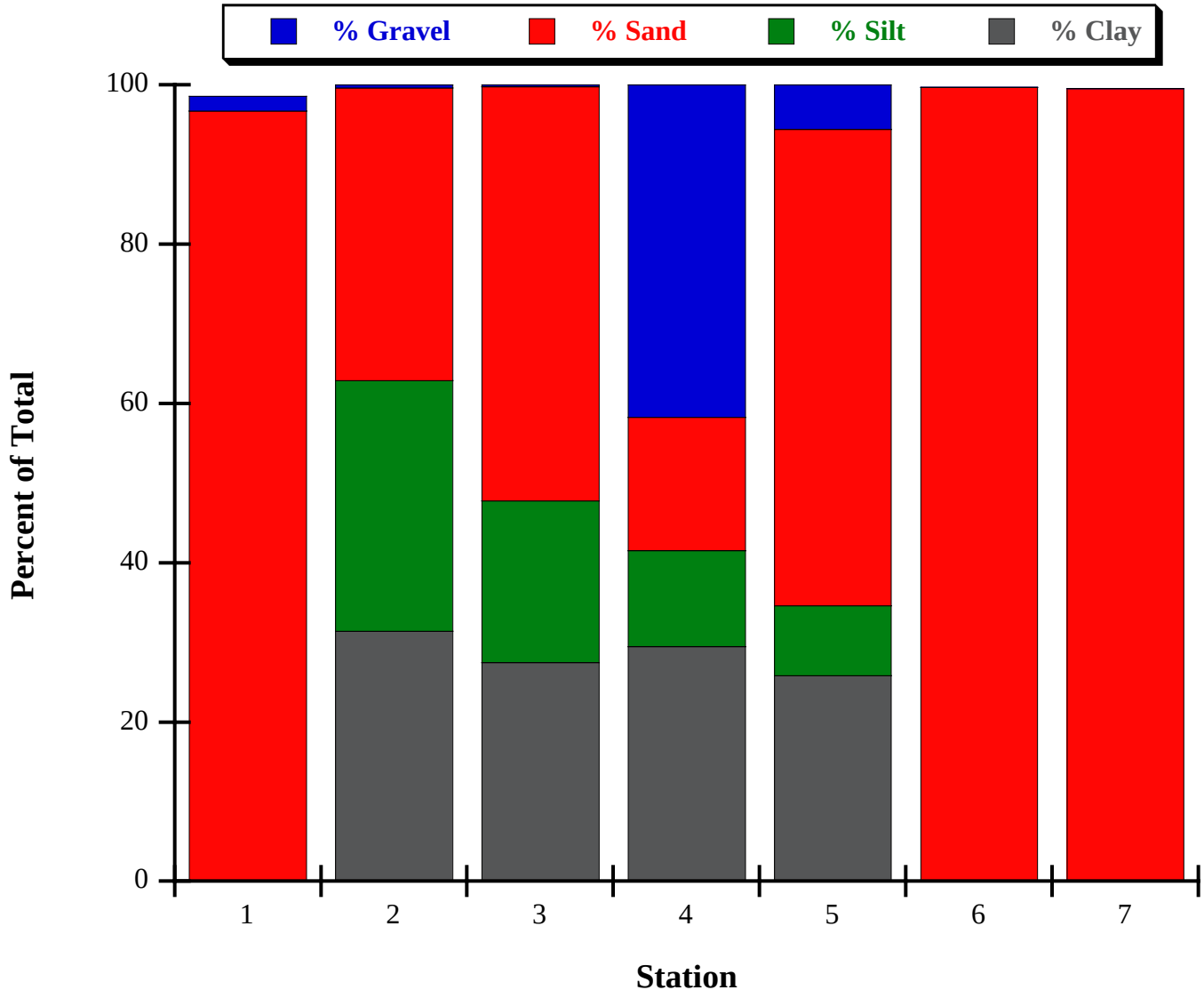


Figure 5. Spatial distribution of sediment composition for the St. John's River stations, July 2000.

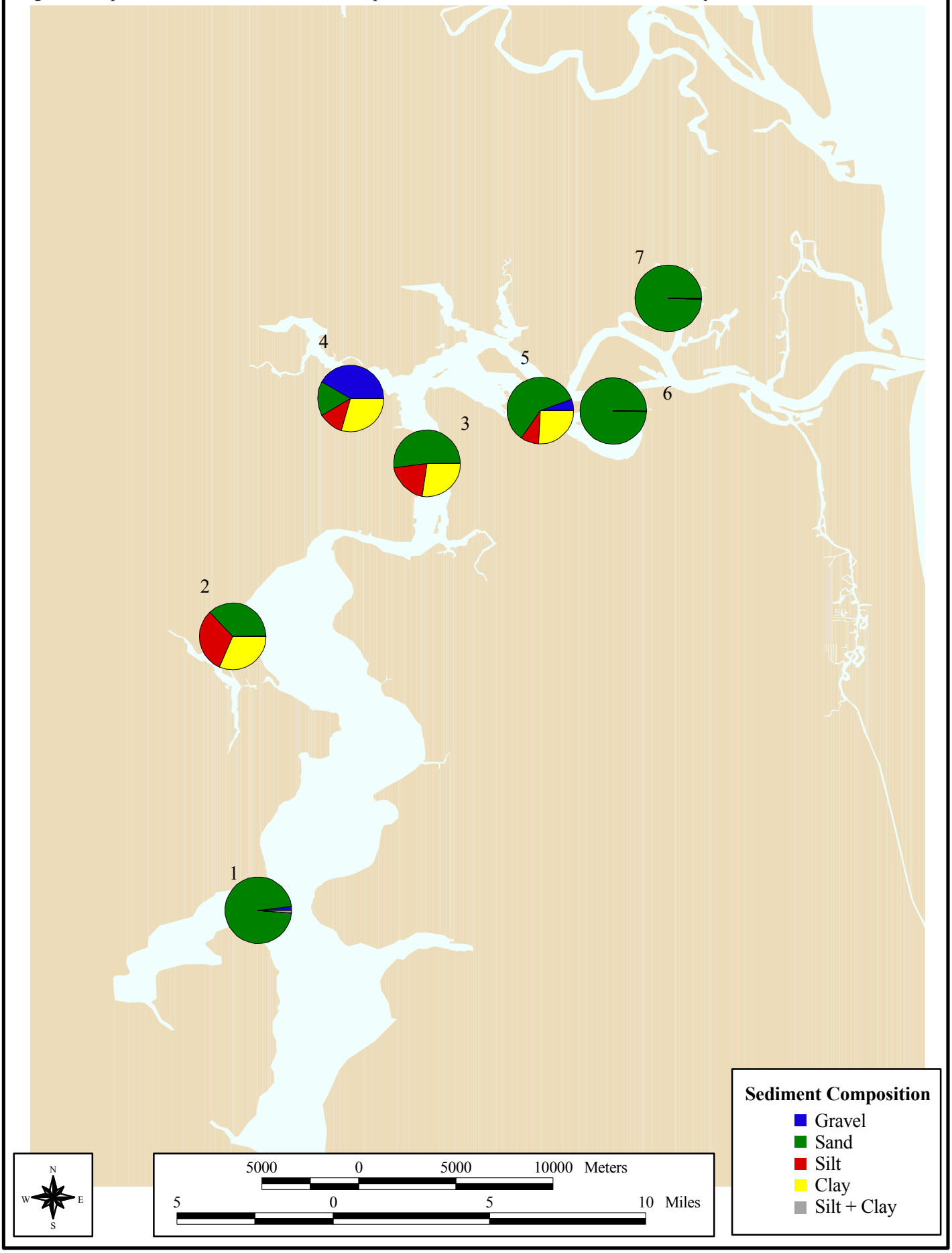


Figure 6. Mean particle size data for the St. John's River stations, July 2000.

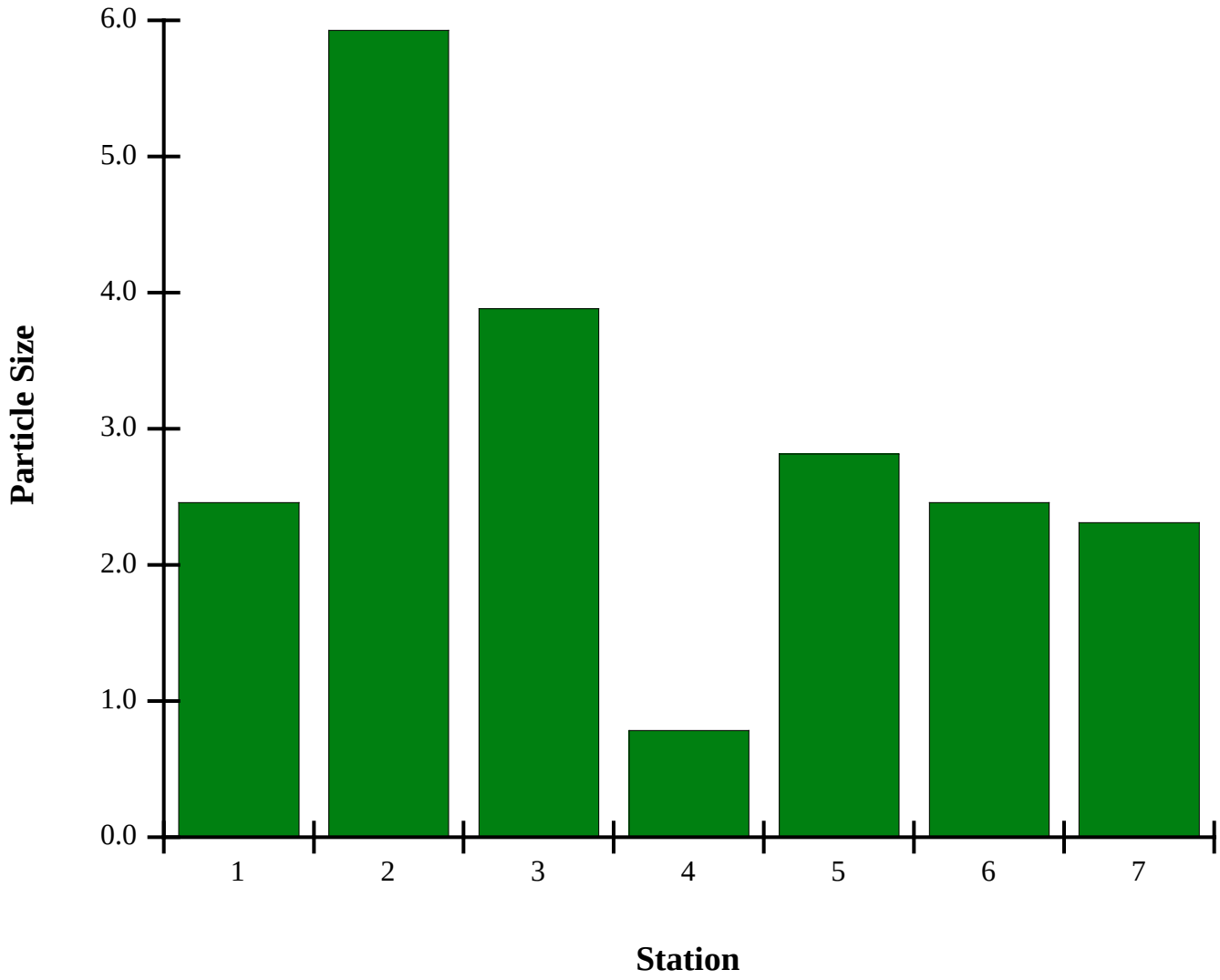


Figure 7. Sorting coefficient data for the St. John's River stations, July 2000.

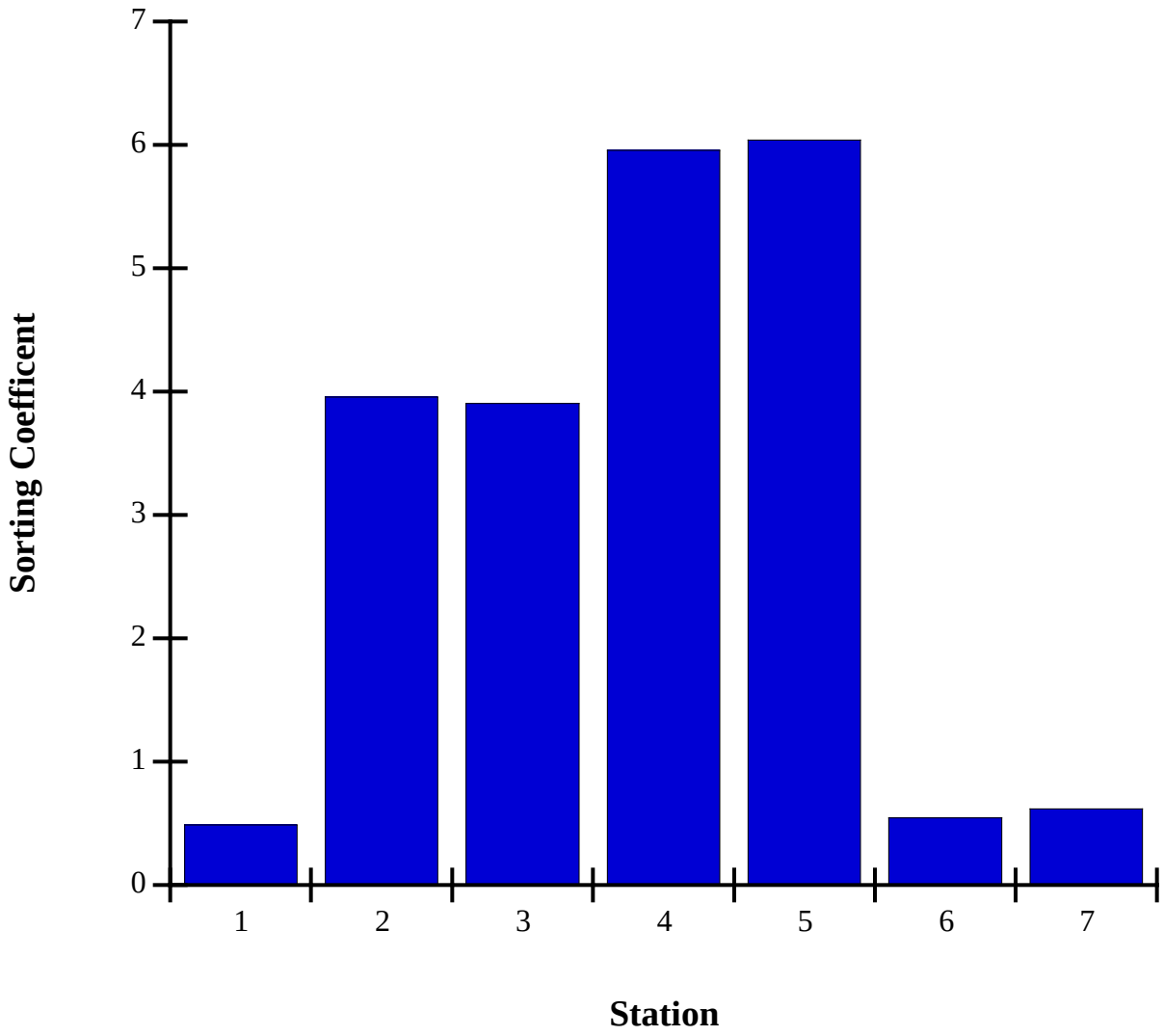


Figure 8. Percent total organic carbon (TOC) for the St. John's River stations, July 2000.

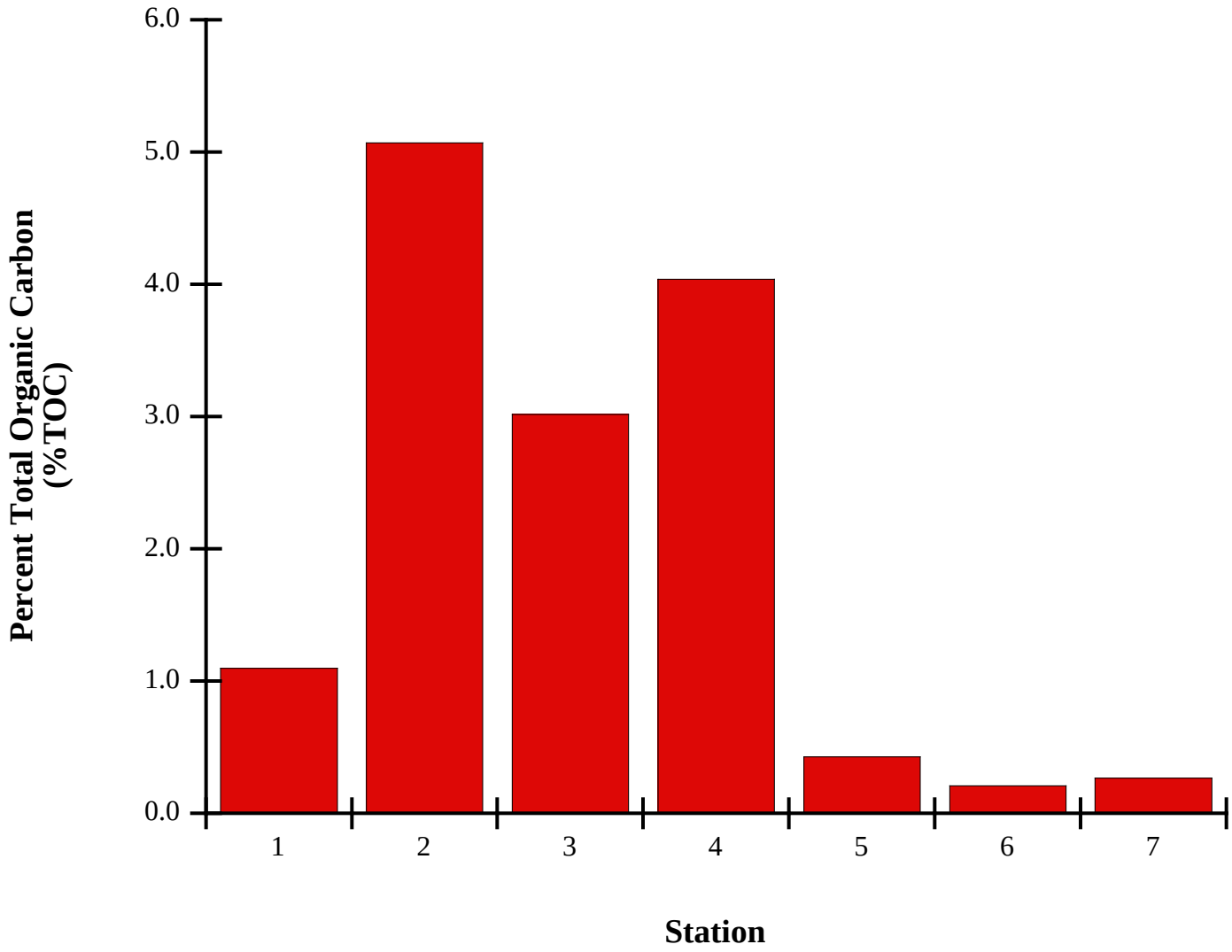


Figure 9. Percent abundance of major taxonomic groups for the St. John's River stations, July 2000.

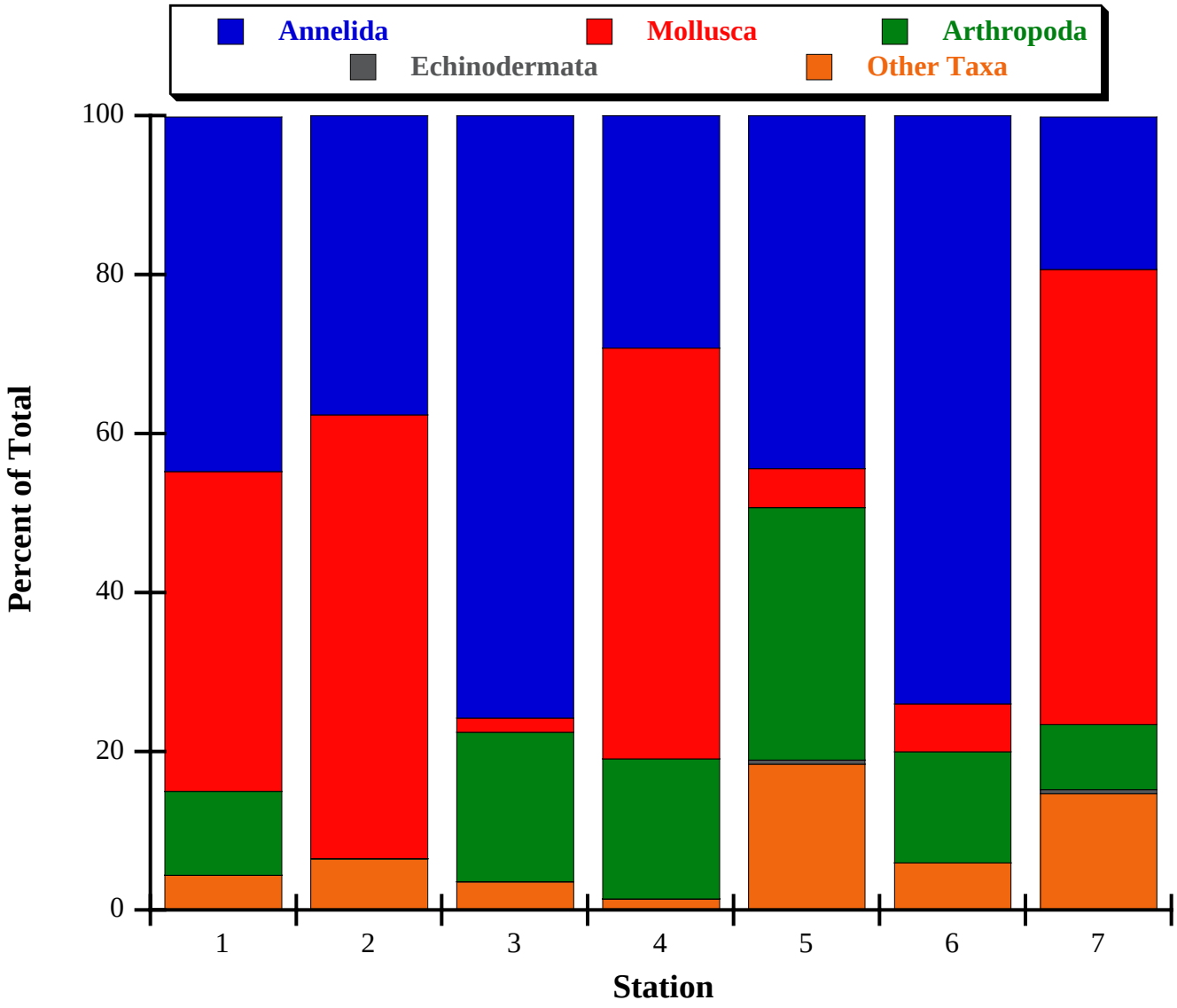


Figure 10. Spatial distribution of major taxonomic groups for the St. John's River stations, July 2000.

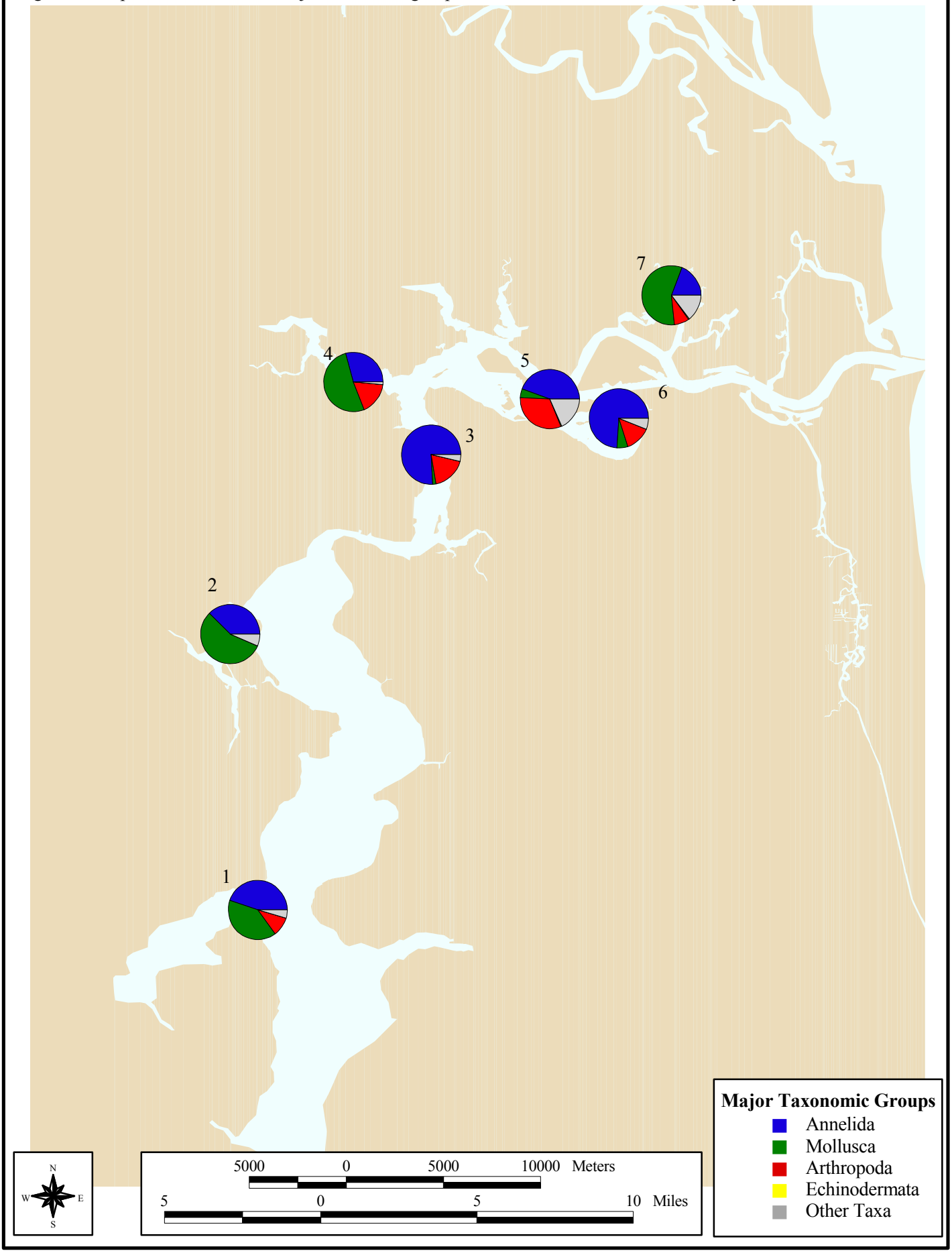


Figure 11. Mean macroinvertebrate density for the St. John's River stations, July 2000.

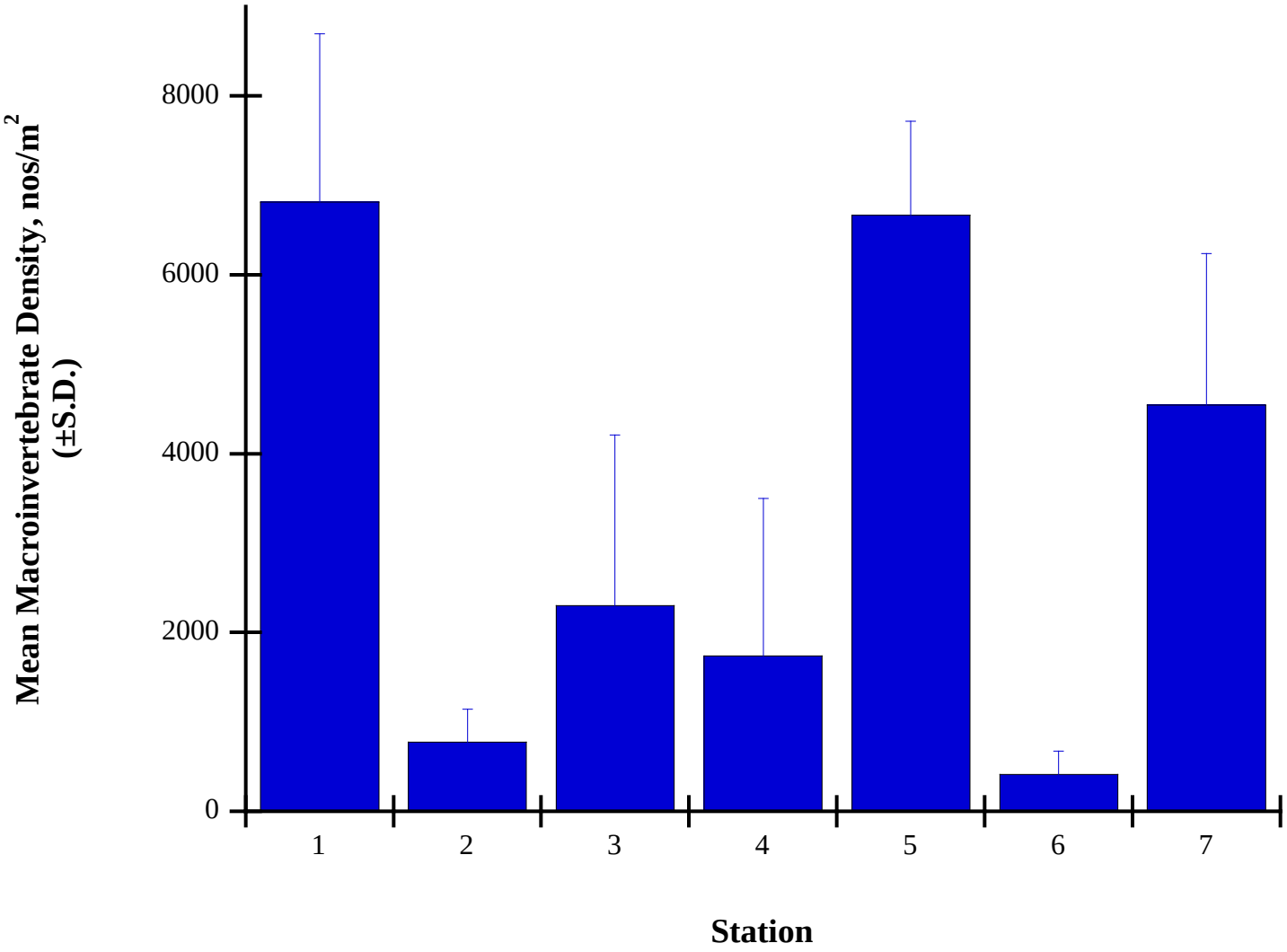


Figure 12. Spatial distribution of mean macroinvertebrate density for the St. John's River stations, July 2000.

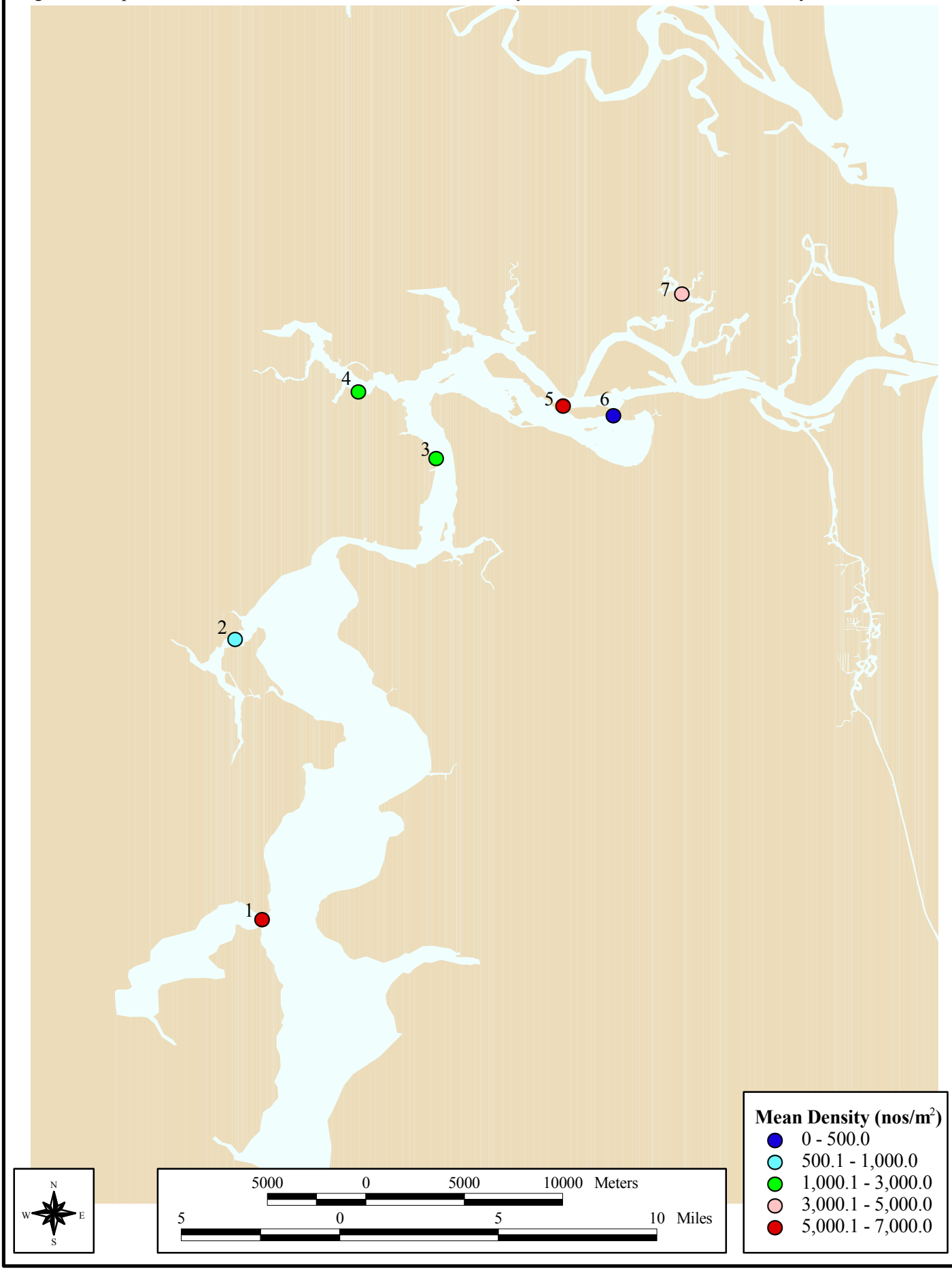


Figure 13. Mean number of taxa per replicate for the St. John's River stations, July 2000.

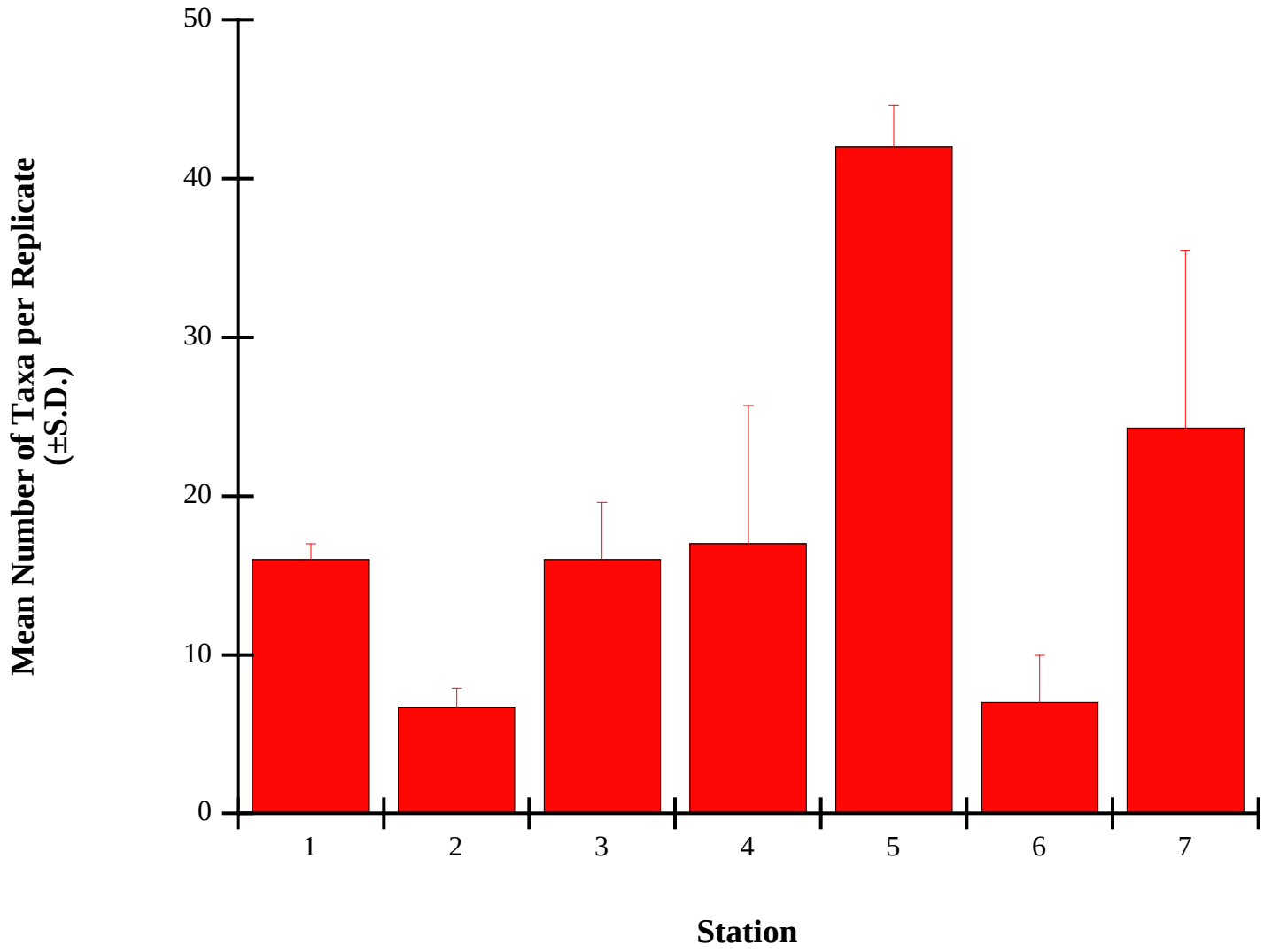


Figure 14. Spatial distribution of mean number of taxa per replicate for the St. John's River stations, July 2000.

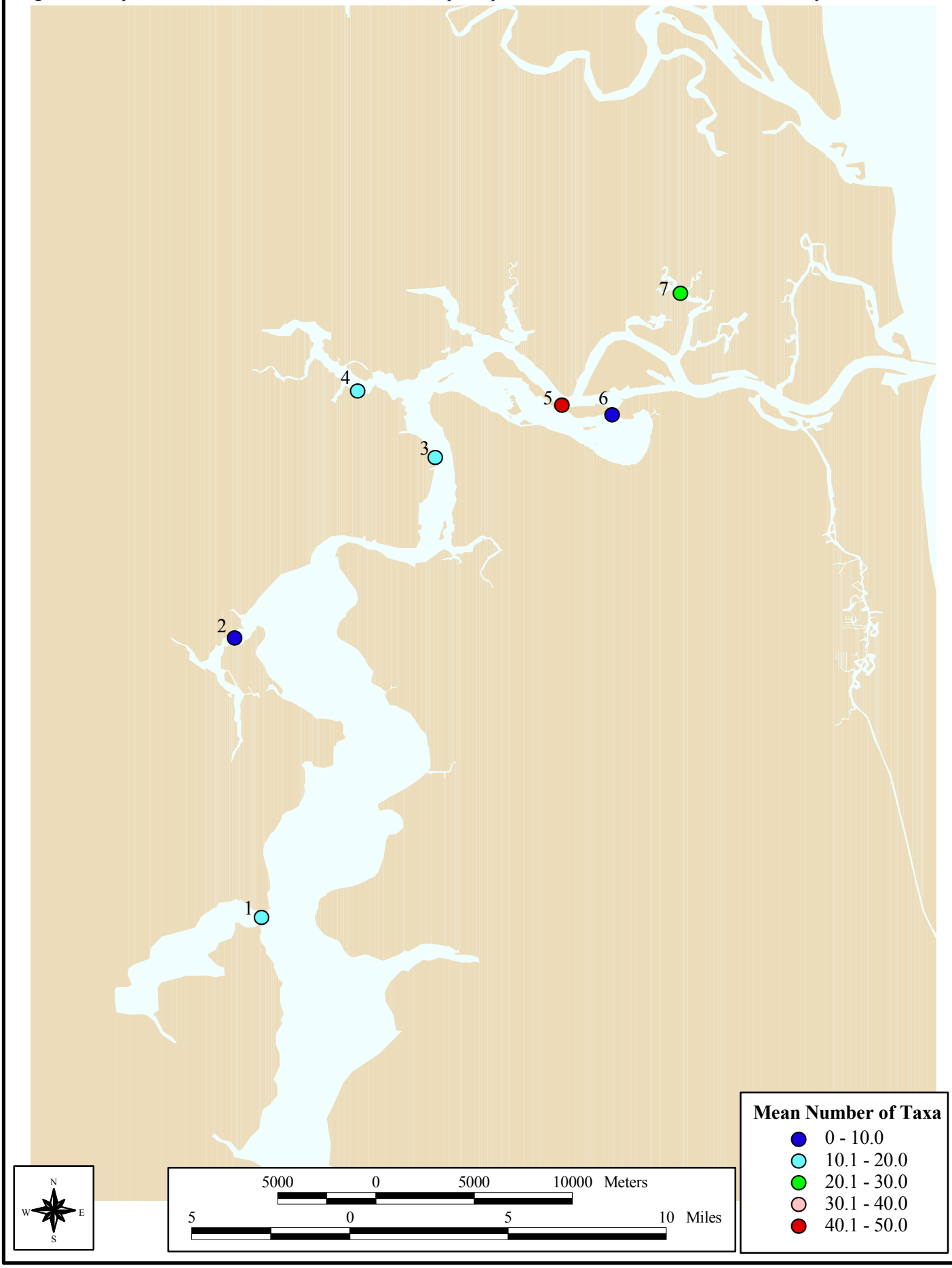


Figure 15. Taxa diversity (H') for the St. John's River stations, July 2000.

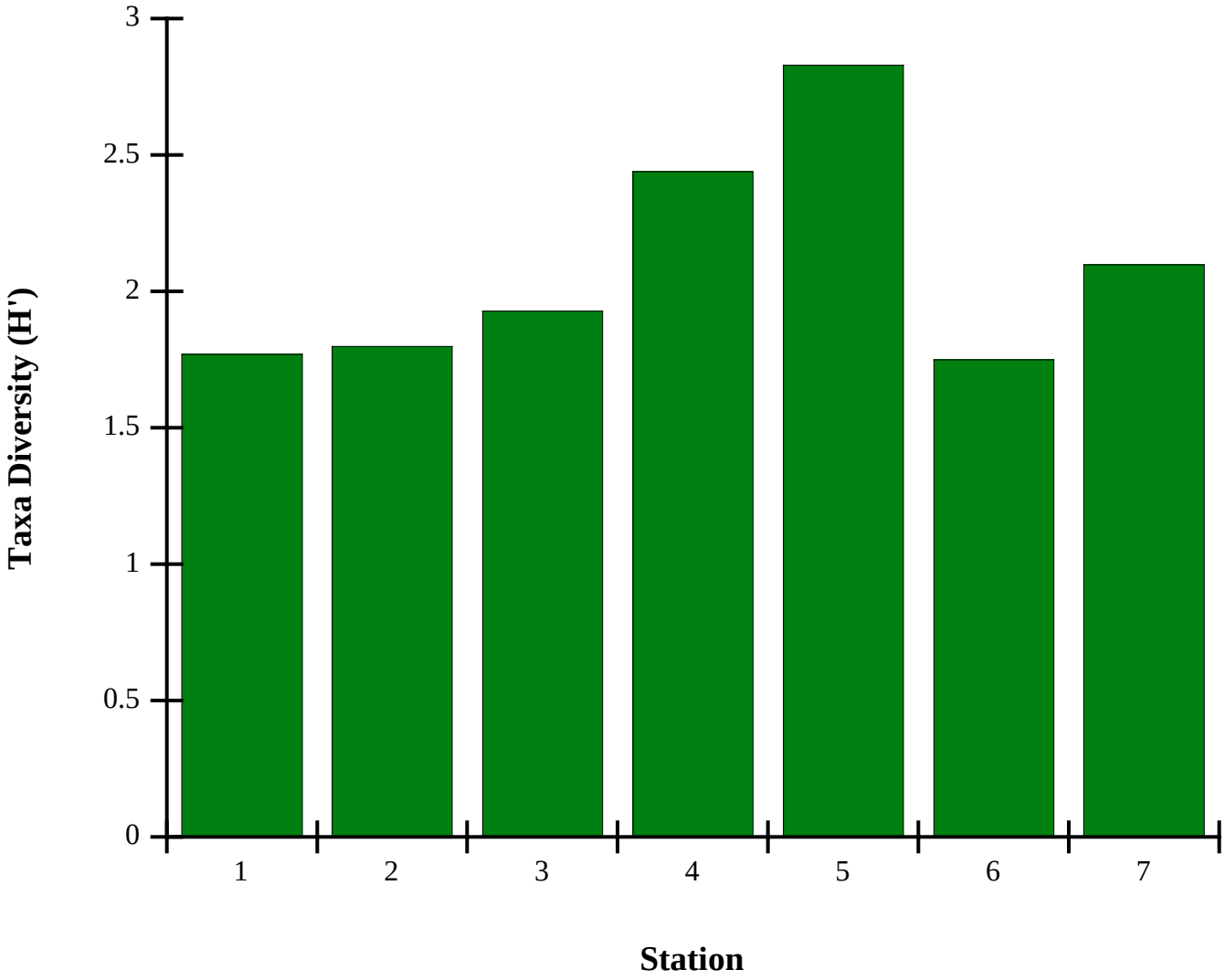


Figure 16. Spatial distribution of taxa diversity (H') for the St. John's River stations, July 2000.

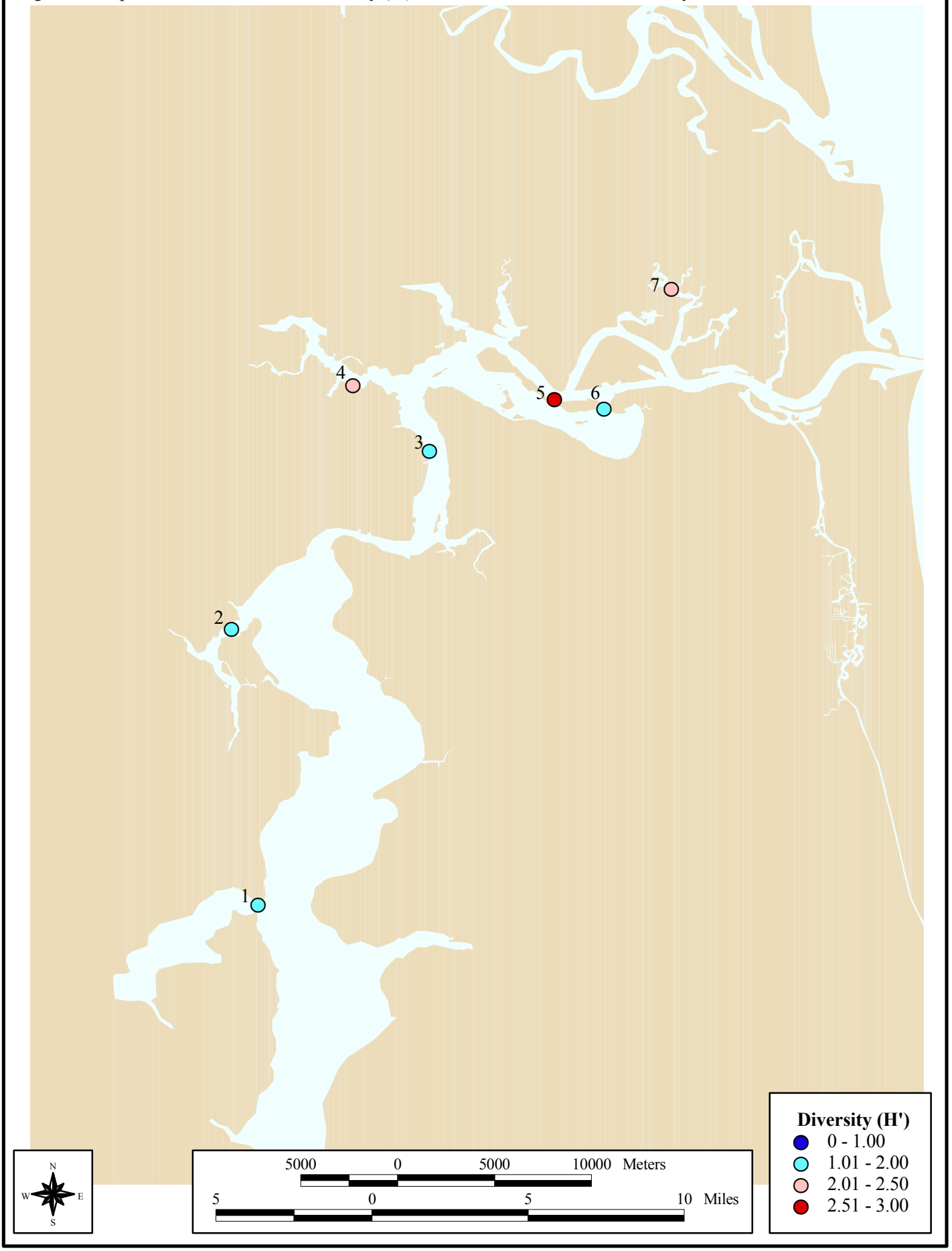


Figure 17. Taxa evenness (J') for the St. John's River stations, July 2000.

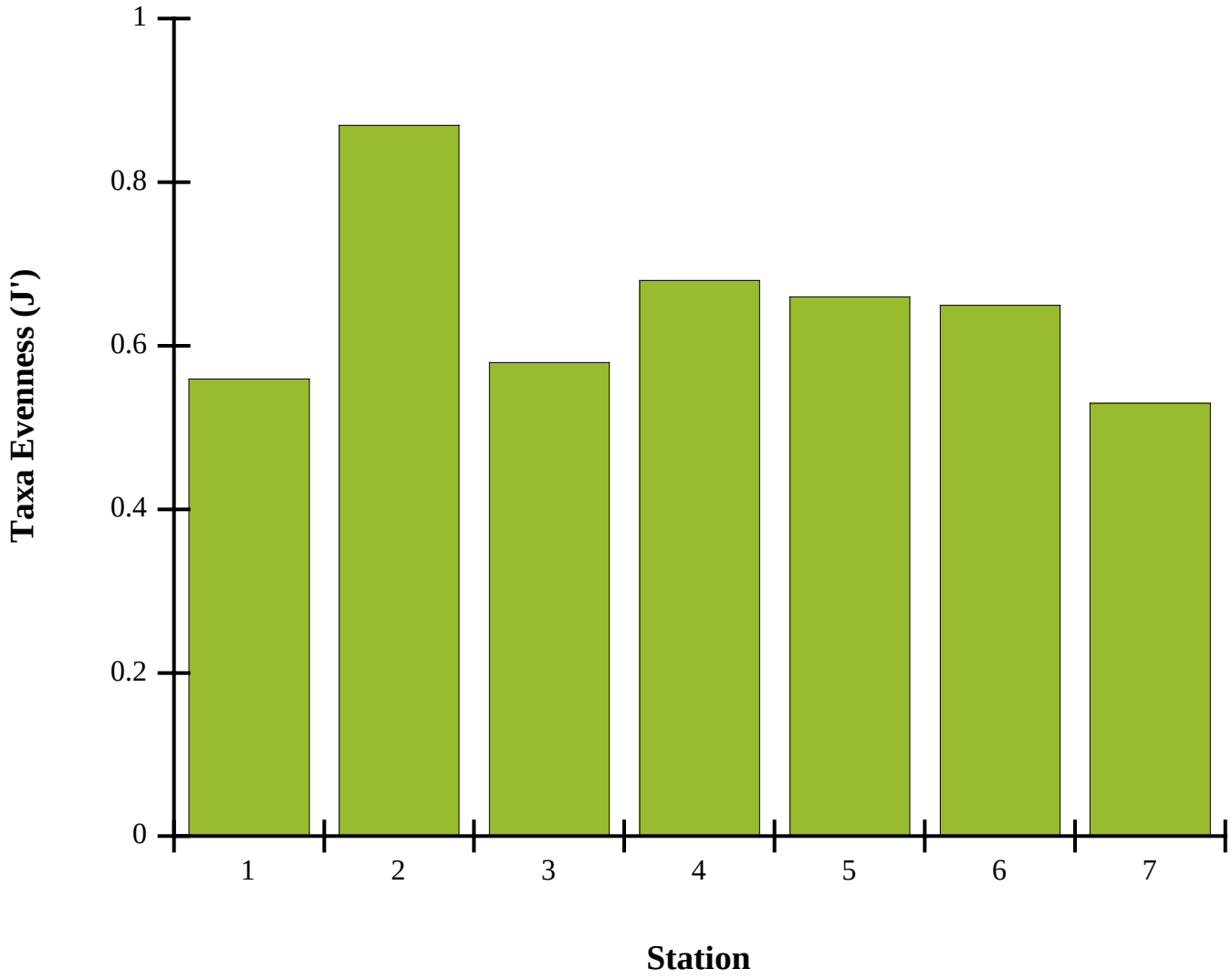


Figure 18. Spatial distribution of taxa evenness (J') for the St. John's River stations, July 2000.

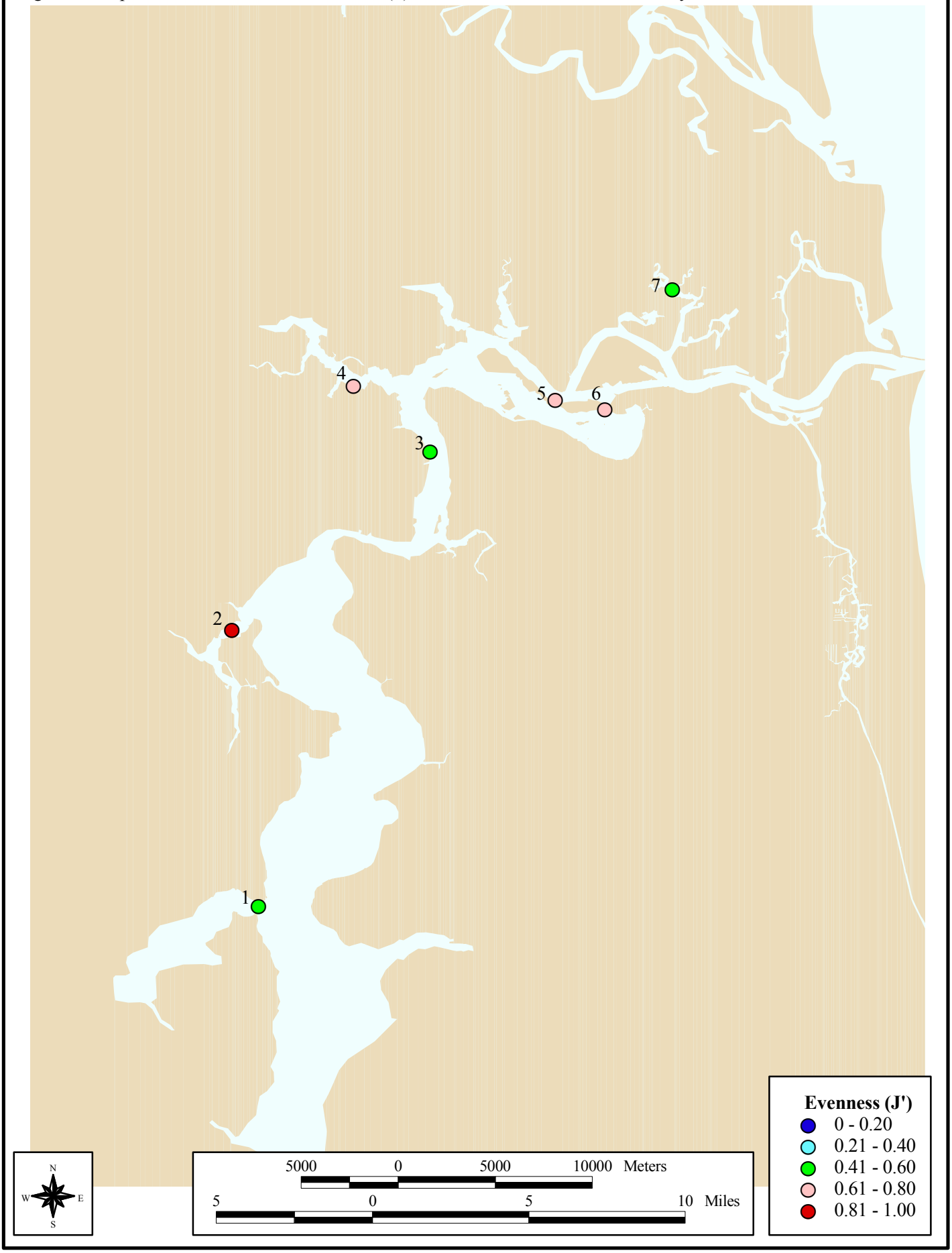


Figure 19. Station dendrogram from the cluster analysis for St. John's river stations, July 2000.

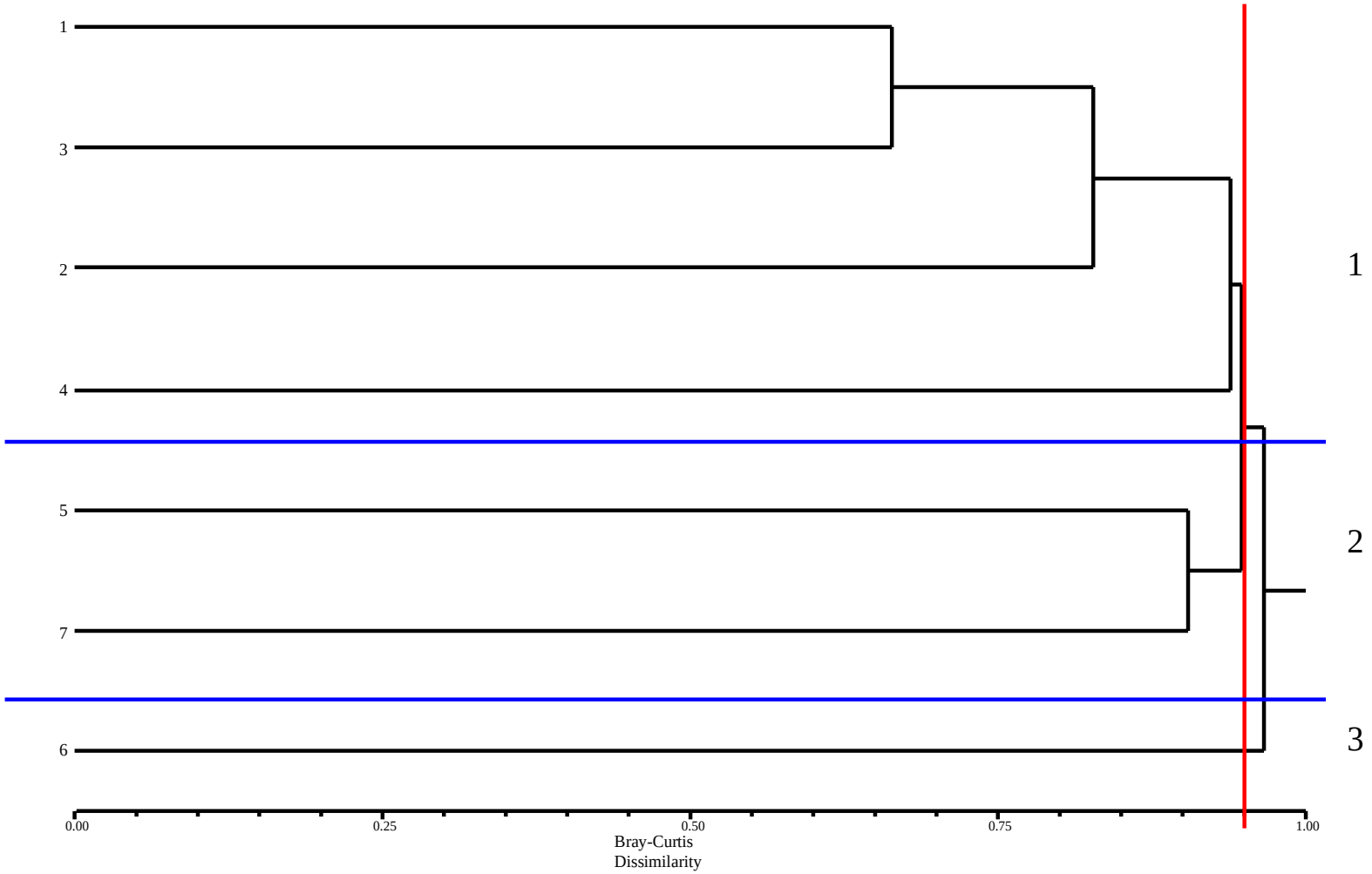
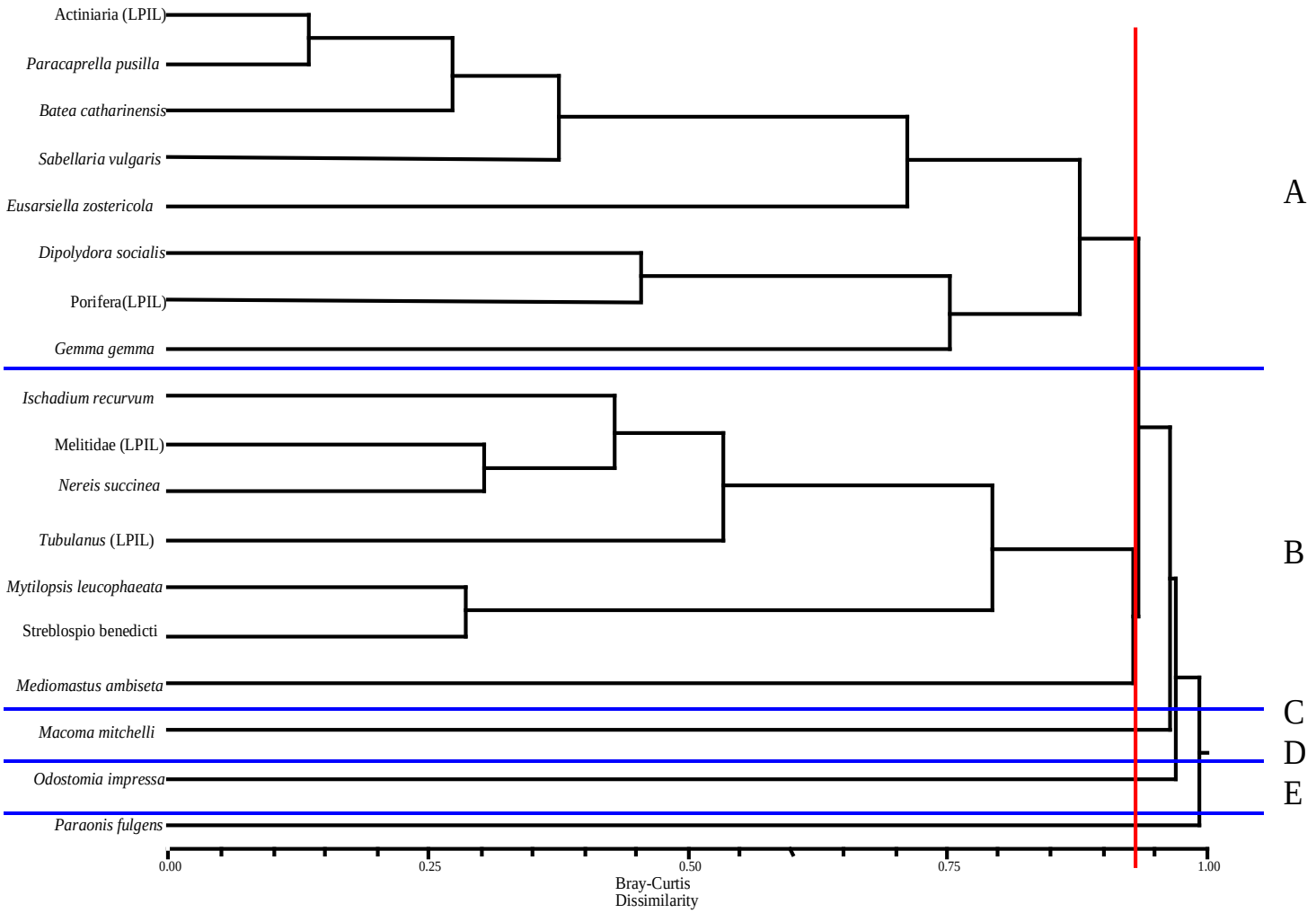


Figure 20. Taxa dendrogram from the cluster analysis for St. John's river stations, July 2000.



APPENDIX A1. QUALITY ASSURANCE STATEMENT

Client/Project NOAA

Work Assignment Title St. John's River HAB Study-Cruise 1

Work Assignment Number Task Number DO-5

Description of Data Set or Deliverable: 21 Benthic macroinvertebrate samples collected June 9-11, 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: None

_____

Signature of QA Officer or Reviewer Date

_____

Signature of Project Manager Date

APPENDIX A2. QUALITY CONTROL REWORKS

Client/Project NOAA-St. John's River HAB Study-Cruise 1

Task Number DO 5

Sorting Results:	**Sample #**	**% Accuracy**
	SJ-103-3	100%
	SJ-106-2	100%
	SJ-103-1	100%

Taxonomy Results:	**Sample #**	**Taxa**	**% Accuracy**
	SJ-106-1	Crust./Moll.	100%
	SJ-102-2	Crust./Moll.	96%
	SJ-102-2	Poly./Misc.	100%
	SJ-105-3	Poly./Misc.	99%

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 St. John's River stations, July 2000.

Taxa	Phylum	Class	Definition
Streblospio benedicti	Ann	Poly	
Gemma gemma	Mol	Biva	
Mytilopsis leucophaeata	Mol	Biva	
Sabellaria vulgaris	Ann	Poly	
Paracaprella pusilla	Art	Mala	
Actiniaria (LPIL)	Cni	Anth	order is lowest identification level.
Odostomia impressa	Mol	Gast	
Batea catharinensis	Art	Mala	
Nereis succinea	Ann	Poly	
Melitidae (LPIL)	Art	Mala	specimen lacks third uropod.
Porifera (LPIL)	Por	–	phylum is lowest identification level
Dipolydora socialis	Ann	Poly	
Rhynchocoela (LPIL)	Rhy	–	no identifiable characters.
Mediomastus (LPIL)	Ann	Poly	anterior portions only, pygidium needed for species ID.
Tubulanus (LPIL)	Rhy	Anop	genus is lowest identification level.
Mediomastus ambiseta	Ann	Poly	
Ampelisca (LPIL)	Art	Mala	juvenile specimen or missing characters
Macoma mitchelli	Mol	Biva	
Paraonis fulgens	Ann	Poly	
Eusarsiella zostericola	Art	Ostr	
Ischadium recurvum	Mol	Biva	
Rangia cuneata	Mol	Biva	
Cyclaspis varians	Art	Mala	
Diopatra cuprea	Ann	Poly	
Melita (LPIL)	Art	Mala	adult male needed for species identification
Xanthidae (LPIL)	Art	Mala	missing appendages.
Tellinidae (LPIL)	Mol	Biva	crushed, and/or juvenile specimens
Grandidierella bonnieroides	Art	Mala	
Leucon americanus	Art	Mala	
Pista quadrilobata	Ann	Poly	
Ascidiacea (LPIL)	Cho	Asci	
Hypereteone (LPIL)	Ann	Poly	
Lucina multilineata	Mol	Biva	
Marenzellaria viridis	Ann	Poly	