Neuse River Post-Hurricane Floyd Benthic Community Assessment, 1999

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TABLE OF CONTENTS

LIST OF TABLES 3

LIST OF FIGURES 4

INTRODUCTION.....5

METHODS 5

Sample Collection And Handling 5

Macroinfaunal Sample Analysis.....5

DATA ANALYSIS 6

Assemblage Structure.....6

Cluster Analysis 7

HABITAT CHARACTERISTICS 7

BENTHIC COMMUNITY CHARACTERIZATION.....8

Faunal Composition, Abundance, and Community Structure.....8

Cluster Analysis 9

1998 vs 1999 Comparisons.....10

LITERATURE CITED 11

APPENDICES.....

LIST OF TABLES

Table 1. Station location and water quality data for the Neuse River/Pamlico Sound stations, 1999.

Table 2. Sediment data for the Neuse River/Pamlico Sound stations, 1999.

Table 3. Distribution and abundance of taxa for the Neuse River/Pamlico Sound stations, 1999.

Table 4. Summary of abundance of major taxonomic groups for the Neuse River/Pamlico Sound stations, 1999.

Table 5. Summary of abundance of major taxonomic groups by station for the Neuse River/Pamlico Sound stations, 1999.

Table 6. Percentage abundance of dominant taxa (> 10% of the total) for the Neuse River/Pamlico Sound stations, 1999.

Table 7. Summary of the benthic macroinfaunal data for the Neuse River/Pamlico Sound stations, 1999.

Table 8. Two-way table of abundance by station for taxa utilized in the cluster analysis.

LIST OF FIGURES

Figure 1. Locations of the Neuse River/Pamlico Sound, North Carolina stations, 1999.

Figure 2. Bottom salinities for the Neuse River/Pamlico Sound, North Carolina stations, 1999.

Figure 3. Sediment data for the Neuse River/Pamlico Sound stations, 1999.

Figure 4. Sediment composition for the Neuse River/Pamlico stations, 1999.

Figure 5. Taxa richness data for the Neuse River/Pamlico Sound stations, 1999.

Figure 6. Taxa richness for the Neuse River/Pamlico Sound stations, 1999.

Figure 7. Macoinvertebrate density data for the Neuse River/Pamlico Sound stations, 1999.

Figure 8. Density data for the Neuse River/Pamlico Sound stations, 1999.

Figure 9. Taxa diversity and evenness data for the Neuse River/Pamlico Sound stations, 1999.

Figure 10. Station cluster analysis for the Neuse River/Pamlico Sound stations, 1999.

Figure 11. Taxa cluster analysis for the Neuse River/Pamlico Sound stations, 1999.

Figure 12. Taxa richness data for the 1998 and 1999 Neuse River stations.

Figure 13. Macroinvertebrate density data for the 1998 and 1999 Neuse River stations.

INTRODUCTION

The Neuse River Estuary and Pamlico Sound in North Carolina were sampled during November 1999 to assess the potential effects of Hurrican Floyd on benthic macroinfauna. One aspect of this evaluation was benthic community characterization, which was accomplished via sample collection by National Oceanic and Atmospheric Administration (NOAA) personnel and laboratory and data analysis by Barry A. Vittor & Associates, Inc. (BVA).

The 1999 Neuse River Estuary/Pamlico Sound sampling stations are indicated in Figure 1; location data for the stations are given in Table 1.

METHODS

Sample Collection And Handling

A Young dredge (area = 0.04 m^2) was used to collect 3 replicate bottom samples at each of 24 stations in the Neuse River Estuary and Pamlico Sound, North Carolina. Each of these 24 stations had previously been studied as part of the EMAP Carolinian Province sampling program. Macroinfaunal samples were sieved through a 0.5-mm mesh screen and preserved with 10% formalin on ship. Macroinfaunal samples were transported to the BVA laboratory in Mobile, Alabama.

Macroinfaunal Sample Analysis

In the BVA laboratory, 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 Neuse River/Pamlico Sound 1999 samples are given in the Appendices. Quality control comments for common LPIL taxa are also given in the Appendices.

Assemblage Structure

Several numerical indices were chosen for analysis and interpretation of the macroinfaunal data. Infaunal abundance is reported as the total number of individuals per station and the total number of individuals per square meter (= density). Taxa richness is reported as the 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 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 $\log_{10}$. 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 diversity by multiplying the ln 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 the equitability in the fauna to the taxa diversity for a given area, Pielou's Index J' (Pielou, 1966) was calculated as J' = H'/lnS, where $ln S = H'_{max}$, or the maximum possible diversity, when all taxa are represented by the same number of individuals; thus, $J' = H' / H'_{max}$.

Cluster Analysis

Bray-Curtis cluster analyses were performed on the faunal data to examine between-station differences and to compare faunal composition of each station within the study area. Both normal and inverse cluster analyses were used in this study. Normal analysis treats samples as individual observations, each being composed of a number of attributes (*i.e.* the various taxa from a given sample). Normal analysis is instructive in helping to ascertain community structure and to infer specific ecological conditions between sampling stations from the relative distributions of species. Inverse clustering is based on taxa as individuals, each of which is characterized by its relative abundance in the various samples. This type of analysis is commonly used to identify species groupings with particular habitats or environmental conditions.

HABITAT CHARACTERISTICS

Water quality data for the 24 stations are given in Table 1 and Figure 2. Bottom salinities ranged from 0 (freshwater) in the upstream-most Neuse River stations to 15.1 ppt at Station 41 in Pamlico Sound (Figure 2). Sediment data for the 24 stations is given in Table 2 and Figures 3 and 4. Sediment type was variable, ranging from > 95% sand (Stations 27, 403, 404, 405, 406, 408, 409, 412, 413, 414, 418,419, and 420) to clay (>60% clay; Stations 407 and 416) (Table 2). Sediment percent total organic carbon (TOC) data is

given in Table 2 and Figure 3. Percent TOC ranged from 0.13% at several stations to 7.05% at Station 410. TOC was inversely correlated with the %sand in the sediment.

BENTHIC COMMUNITY CHARACTERIZATION

Faunal Composition, Abundance, and Community Structure

Table 3 provides a complete phylogenetic listing for the Neuse River/Pamlico Sound stations as well as data on taxa abundance and station occurrence. Microsoft ™ Excel spreadsheets will be provided separately to NOAA including a raw data table containing taxa abundance and density data and all report tables.

A total of 2,449 organisms, representing 97 taxa, was identified from the 24 stations (Table 4). Polychaetes were the most numerous organisms present and represented 46.3% of the total assemblage, followed in abundance by bivalves (14.9%), oligochaetes (14.0%), and insects (10.0%). Polychaetes represented 36.1% of the total number of taxa followed by insects and malacostracans (15.5% each), and bivalves (12.4%) (Table 4). The percent abundance of the major taxa at the 24 stations is given in Table 5.

The dominant taxon collected from the 24 Neuse River/Pamlico Sound samples was the polychaete, *Mediomastus ambiseta* , representing 32.83% of the total number of individuals identified (Table 3). The oligochaete Family, Tubificidae (11.72%), the freshwater bivalve, *Corbicula fluminea* (9.47%), and the gastropod *Acteocina canaliculata* (6.57%) were the only other taxa representing greater that 5% of the total number of organisms identified (Table 3). *Mediomastus* and tubificids were the most widely distributed taxa being found at 58% of the stations. The lack of broadly occuring taxa is the result of the freshwater to estuarine salinity regime encompassed by the 24 sampling stations. The distribution of taxa representing >10% of the total assemblage at each station is given in Table 6. Stations 401-406 with salinities of 0 ppt were dominated by freshwater

taxa including oligochaetes, chironomids and the bivalve, *Corbicula fluminea*. Stations 407 to 415 with salinites between 0.1 and < 1 ppt were dominated by a mix of freshwater and estuarine taxa. The remaining stations in the lower Neuse River estuary and Pamlico Sound were dominated by a more estuarine fauna (Table 6).

Station taxa richness (mean number of taxa per station) and mean density data are given in Table 7 and Figures 5, 6, 7 and 8. Taxa richness data was extremely variable along the freshwater to 15 ppt salinity gradient and ranged from 0.3 taxa at Station 16 to 14.7 taxa at Station 401. Densities typically averaged less than 2000 organisms m^{-2} except for densities greater than 2800 organisms m^{-2} at stations 401, 410, and 412. Mean densities ranged from 25 organisms m^{-2} at Station 416 to 4342 organisms m^{-2} at Station 401 (Table 5; Figure 3). Taxa diversity and evenness data are given in Table 7 and Figure 9. Taxa diversity (H') ranged from 0.0 at Station 416 to 2.29 at Station 40. Taxa evenness (J) ranged from 0.0 at Station 416 to 0.89 at Station 408.

Cluster Analysis

Cluster analysis was performed on the Neuse River/Pamlico Sound data and displayed as dendrograms (Figures 10 and 11). Count data for the 25 most abundant taxa (taxonomic redundancies were excluded or combined if possible) can be found in a matrix of station and taxa groups (Table 8).

Cluster analysis of the 24 stations can be interpreted at a five-group level (5% level of similarity). Group1 contained those stations in the lower Neuse River estuary and Pamlico Sound, Group 2 contained low salinity stations in the Neuse River, Groups 3 and 4 contained the freshwater stations in the distal portion of the Neuse River sampling area, and Group 5 contained estuarine Stations 418 and 420 which were dominated by the amphipod, *Parahaustorius* and had low densities of polychaetes(Table 8).

Cluster analysis of the 25 taxa at the 24 stations can interpreted at a three-group level (5% similarity; Table 8 and Figure 11). Group A included estuarine fauna, Group B

contained freshwater taxa, and Group C contained two estuarine taxa found in abundance at only three stations (Table 8).

1998 vs 1999 Comparisons

Taxa richness and density data for the Neuse River and Estuary for both 1998 and 1999 are given in Figures 12 and 13 (only stations 401-420 were sampled in both 1998 and 1999). Taxa richness was significantly higher in 1998 when compared to 1999 (Wilcoxon rank test, P=0.0098). Taxa richness in 1998 was higher at 16 of the 20 stations resampled in 1999 (Figure 12). Taxa densities were significantly higher in 1998 when compared to 1999 (Wilcoxon rank test, P=0.0075). Taxa densities in 1998 were higher at 15 of the 20 stations resampled in 1999 (Figure 13).

LITERATURE CITED

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

Table 1. Station location and water quality data for the Neuse River/Pamlico Sound stations, 1999.

Station	Latitude	Longitude	Depth (m)	Temp (°C)	Sal (ppt)	DO (mg/l)	pH
37	35.085346	76.189470	4.4	15.25	10.3	8.84	7.78
40	35.140150	76.470280	6.0	16.10	9.8	9.84	7.33
41	35.150940	76.220420	5.9	15.57	15.1	8.32	7.73
330	35.235940	76.148160	5.8	15.54	14.5	8.53	7.75
401	35.246060	77.229890	2.6	15.04	0.0	6.37	7.68
402	35.229190	77.165440	4.4	14.79	0.0	6.36	7.16
403	35.214260	77.132870	2.6	14.69	0.0	6.39	7.24
404	35.202850	77.116980	0.9	14.67	0.0	9.04	7.49
405	35.179380	77.091520	1.1	14.76	0.0	8.73	7.19
406	35.161470	77.077480	1.3	14.90	0.0	10.08	7.82
407	35.097410	77.029230	2.7	14.60	0.1	7.25	7.27
408	35.069900	76.987980	0.6	16.71	0.1	10.02	7.87
409	35.010290	76.941310	3.0	15.31	0.1	8.18	7.13
410	35.003500	76.966850	2.4	15.46	0.1	10.44	7.60
411	34.969270	76.896380	3.4	15.75	4.6	9.25	7.13
412	34.988900	76.851820	2.8	16.63	0.2	9.62	7.46
413	34.975230	76.775000	1.1	15.79	0.8	9.94	7.85
414	34.947620	76.819480	2.0	15.27	0.3	9.57	7.72
415	34.942780	76.771800	2.8	15.40	0.5	10.29	7.63
416	34.994900	76.695750	5.8	17.37	7.7	3.06	7.05
417	35.026070	76.601400	6.3	16.44	7.4	6.43	7.24
418	35.103030	76.560270	1.1	15.71	3.9	10.24	7.81
419	35.051850	76.499220	5.6	16.41	8.3	9.47	7.20
420	35.011070	76.571030	1.9	15.86	2.3	10.23	7.88

Table 2. Sediment data for the Neuse River/Pamlico Sound stations, 1999.

Station	% TOC	% Gravel	% Sand	% Silt	% Clay	USACE Description	% Gravel+Sand	% Silt+Clay	Median Particle Size (phi)	Sorting Coefficient
37	0.63	0.00	99.56	*	*	Sand	99.56	0.44	1.774	0.637
40	3.43	0.00	6.80	50.48	42.73	Silty Clay	6.80	93.21	7.199	2.358
41	2.56	0.00	16.67	55.05	28.27	Clayey Silt	16.67	83.32	5.528	2.640
330	1.46	0.00	69.96	8.65	21.39	Clayey Sand	69.96	30.04	2.601	4.343
401	1.01	0.00	70.24	8.62	20.75	Clayey Sand	70.24	29.76	2.611	4.481
402	0.17	0.00	16.32	*	*	Sandy Silt	16.32	83.68	*	*
403	0.19	0.00	99.70	*	*	Sand	99.70	0.30	1.080	0.787
404	0.13	0.00	98.59	*	*	Sand	98.59	1.41	0.433	*
405	0.15	0.05	99.82	*	*	Sand	99.87	0.13	0.310	0.719
406	0.13	0.00	99.93	*	*	Sand	99.93	0.07	0.580	*
407	3.53	0.26	12.74	25.36	61.64	Clay	13.00	87.00	8.832	2.486
408	0.35	19.06	80.38	*	*	-	99.44	0.56	1.407	*
409	0.34	0.13	98.91	*	*	Sand	99.04	0.96	1.674	0.690
410	7.05	0.00	6.97	40.35	52.68	Clay	6.97	93.03	8.305	2.541
411	6.31	0.00	6.20	41.38	52.42	Clay	6.20	93.80	8.245	2.192
412	1.18	0.00	96.12	*	*	Sand	96.12	3.88	3.370	0.606
413	0.40	0.00	99.91	*	*	Sand	99.91	0.09	1.432	0.734
414	0.23	0.00	99.76	*	*	Sand	99.76	0.24	1.021	*
415	0.30	0.00	28.60	29.66	41.74	Silty Clay	28.60	71.40	7.003	3.734
416	5.66	0.06	10.44	25.44	64.06	Clay	10.50	89.50	9.158	2.825
417	3.02	0.00	15.22	57.80	26.98	Clayey Silt	15.22	84.78	4.878	2.605
418	0.37	0.00	99.97	*	*	Sand	99.97	0.03	2.130	0.634
419	0.87	0.00	96.47	*	*	Sand	96.47	3.53	2.277	0.806
420	0.29	0.00	96.08	*	*	Sand	96.08	3.92	2.053	0.644

*unable to calculate due to amount of sample retained in sieve

Table 3. Distribution and abundance of taxa for the Neuse River/Pamlico Sound stations, 1999.

Taxon Name	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	Station % Occurrence
Mediomastus ambiseta	Ann	Poly	804	32.83	32.83	14	58
Tubificidae (LPIL)	Ann	Olig	287	11.72	44.55	14	58
Corbicula fluminea	Mol	Biva	232	9.47	54.02	4	17
Acteocina canaliculata	Mol	Gast	161	6.57	60.60	5	21
Paraprionospio pinnata	Ann	Poly	59	2.41	63.01	6	25
Bivalvia (LPIL)	Mol	Biva	49	2.00	65.01	11	46
Amphicteis gunneri	Ann	Poly	46	1.88	66.88	1	4
Pseudochironomus (LPIL)	Art	Inse	46	1.88	68.76	1	4
Sigambra tentaculata	Ann	Poly	46	1.88	70.64	3	13
Rhynchocoela (LPIL)	Rhy	–	41	1.67	72.32	11	46
Streblospio benedicti	Ann	Poly	38	1.55	73.87	5	21
Nereididae (LPIL)	Ann	Poly	36	1.47	75.34	4	17
Robackia (LPIL)	Art	Inse	36	1.47	76.81	4	17
Cryptochironomus (LPIL)	Art	Inse	34	1.39	78.20	6	25
Ceratopogonidae (LPIL)	Art	Inse	31	1.27	79.46	2	8
Lucina multilineata	Mol	Biva	29	1.18	80.65	2	8
Polypedilum (LPIL)	Art	Inse	29	1.18	81.83	5	21
Gammarus tigrinus	Art	Mala	25	1.02	82.85	4	17
Parahaustorius attenuatus	Art	Mala	22	0.90	83.75	2	8
Spionidae (LPIL)	Ann	Poly	20	0.82	84.57	5	21
Tubulanus (LPIL)	Rhy	Anop	20	0.82	85.38	4	17
Paramphinome sp. B	Ann	Poly	18	0.73	86.12	2	8
Branchiura sowerbyi	Ann	Olig	17	0.69	86.81	1	4
Chironomidae (LPIL)	Art	Inse	17	0.69	87.51	2	8
Corbiculidae (LPIL)	Mol	Biva	17	0.69	88.20	2	8
Lineidae (LPIL)	Rhy	Anop	17	0.69	88.89	3	13
Limnodrilus hoffmeisteri	Ann	Olig	16	0.65	89.55	1	4
Chironomus (LPIL)	Art	Inse	15	0.61	90.16	4	17
Sipuncula (LPIL)	Sip	–	15	0.61	90.77	2	8
Heteromastus filiformis	Ann	Poly	14	0.57	91.34	3	13
Hydrobiidae (LPIL)	Mol	Gast	13	0.53	91.87	1	4
Naididae (LPIL)	Ann	Olig	13	0.53	92.41	5	21
Tellinidae (LPIL)	Mol	Biva	12	0.49	92.90	4	17
Procladius (LPIL)	Art	Inse	11	0.45	93.34	3	13
Coelotanypus (LPIL)	Art	Inse	9	0.37	93.71	3	13
Mytilus edulis	Mol	Biva	8	0.33	94.04	4	17
Phoronis (LPIL)	Pho	–	8	0.33	94.37	2	8
Dicrotendipes (LPIL)	Art	Inse	7	0.29	94.65	1	4
Quistadrilus multisetosus	Ann	Olig	7	0.29	94.94	1	4
Rangia cuneata	Mol	Biva	7	0.29	95.22	1	4
Glycera dibranchiata	Ann	Poly	6	0.24	95.47	3	13
Magelona sp. H	Ann	Poly	6	0.24	95.71	2	8
Nereis (LPIL)	Ann	Poly	6	0.24	95.96	1	4
Apocorophium lacustre	Art	Mala	5	0.20	96.16	3	13
Odostomia (LPIL)	Mol	Gast	5	0.20	96.37	2	8
Asabellides oculata	Ann	Poly	4	0.16	96.53	2	8
Caecidotea (LPIL)	Art	Mala	4	0.16	96.69	3	13

Table 3 continued:

Taxon Name	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	Station % Occurrence
Cyathura (LPIL)	Art	Mala	4	0.16	96.86	1	4
Mactridae (LPIL)	Mol	Biva	4	0.16	97.02	3	13
Mytilidae (LPIL)	Mol	Biva	4	0.16	97.18	4	17
Ablabesmyia (LPIL)	Art	Inse	3	0.12	97.31	2	8
Cyathura burbancki	Art	Mala	3	0.12	97.43	1	4
Gastropoda (LPIL)	Mol	Gast	3	0.12	97.55	3	13
Glycinde solitaria	Ann	Poly	3	0.12	97.67	2	8
Nereis succinea	Ann	Poly	3	0.12	97.80	2	8
Polydora cornuta	Ann	Poly	3	0.12	97.92	3	13
Rictaxis punctostriatus	Mol	Gast	3	0.12	98.04	2	8
Scoloplos (LPIL)	Ann	Poly	3	0.12	98.16	1	4
Tanytarsus (LPIL)	Art	Inse	3	0.12	98.29	3	13
Ameroculodes edwardsi	Art	Mala	2	0.08	98.37	1	4
Balanoglossus (LPIL)	Hem	Ente	2	0.08	98.45	1	4
Cumacea (LPIL)	Art	Mala	2	0.08	98.53	1	4
Phyllodocidae (LPIL)	Ann	Poly	2	0.08	98.61	1	4
Polygordius (LPIL)	Ann	Poly	2	0.08	98.69	2	8
Acanthohaustorius millsi	Art	Mala	1	0.04	98.73	1	4
Aglaophamus verrilli	Ann	Poly	1	0.04	98.78	1	4
Amphipoda (LPIL)	Art	Mala	1	0.04	98.82	1	4
Ancistrosyllis jonesi	Ann	Poly	1	0.04	98.86	1	4
Apoprionospio (LPIL)	Ann	Poly	1	0.04	98.90	1	4
Automate (LPIL)	Art	Mala	1	0.04	98.94	1	4
Boccardiella ligerica	Ann	Poly	1	0.04	98.98	1	4
Calyptraeidae (LPIL)	Mol	Gast	1	0.04	99.02	1	4
Corophiidae (LPIL)	Art	Mala	1	0.04	99.06	1	4
Cyathura polita	Art	Mala	1	0.04	99.10	1	4
Decapoda (LPIL)	Art	Mala	1	0.04	99.14	1	4
Dero (LPIL)	Ann	Olig	1	0.04	99.18	1	4
Dero flabelliger	Ann	Olig	1	0.04	99.22	1	4
Hypaniola (LPIL)	Ann	Poly	1	0.04	99.27	1	4
Leitoscoloplos (LPIL)	Ann	Poly	1	0.04	99.31	1	4
Loimia medusa	Ann	Poly	1	0.04	99.35	1	4
Lumbrineridae (LPIL)	Ann	Poly	1	0.04	99.39	1	4
Maldanidae (LPIL)	Ann	Poly	1	0.04	99.43	1	4
Manayunkia speciosa	Ann	Poly	1	0.04	99.47	1	4
Monticellina dorsobranchialis	Ann	Poly	1	0.04	99.51	1	4
Nereis lamellosa	Ann	Poly	1	0.04	99.55	1	4
Ogyrides (LPIL)	Art	Mala	1	0.04	99.59	1	4
Parachironomus (LPIL)	Art	Inse	1	0.04	99.63	1	4
Paratendipes (LPIL)	Art	Inse	1	0.04	99.67	1	4
Phaenopsectra (LPIL)	Art	Inse	1	0.04	99.71	1	4
Podarkeopsis levifuscina	Ann	Poly	1	0.04	99.76	1	4
Polymesoda (LPIL)	Mol	Biva	1	0.04	99.80	1	4
Scoloplos rubra	Ann	Poly	1	0.04	99.84	1	4
Sphaeriidae (LPIL)	Mol	Biva	1	0.04	99.88	1	4

Table 3 continued:

Taxon Name	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	Station % Occurrence
Spiochaetopterus oculatus	Ann	Poly	1	0.04	99.92	1	4
Tellina agilis	Mol	Biva	1	0.04	99.96	1	4
Vitrinellidae (LPIL)	Mol	Gast	1	0.04	100.00	1	4

Taxa Key

Ann = Annelida
- Olig = Oligochaeta
- Poly = Polychaeta

Art = Arthropoda
- Inse = Insecta
- Mala = Malacostraca

Hem = Hemichordata
- Ente = Enteropneusta

Mol = Mollusca
- Biva = Bivalvia
- Gast = Gastropoda

Pho = Phoronida

Rhy = Rhynchocoela
- Anop = Anopla

Sip = Sipuncula

Table 4. Summary of overall abundance of major benthic macroinfauna taxonomic groups for the Neuse River/Pamlico Sound stations, 1999.

Taxa	Total No. Taxa	% Total	Total No. Individuals	% Total
Annelida				
Oligochaeta	7	7.2	342	14.0
Polychaeta	35	36.1	1,134	46.3
Mollusca				
Bivalvia	12	12.4	365	14.9
Gastropoda	7	7.2	187	7.6
Arthropoda				
Insecta	15	15.5	244	10.0
Malacostraca	15	15.5	74	3.0
Other Taxa	6	6.2	103	4.2
Total	**97**		**2,449**	

Table 5. Summary of abundance of major benthic macroinfauna taxonomic groups by station for the Neuse River/Pamlico Sound stations, 1999.

Station	Taxa	No. of Taxa	% of Total	No. of Individuals (per 0.04 m²)	% of Total
37	Annelida	10	50.0	41	28.7
	Mollusca	7	35.0	89	62.2
	Arthropoda	0	0.0	0	0.0
	Other Taxa	3	15.0	13	9.1
	Total	**20**		**143**	
40	Annelida	10	55.6	66	70.2
	Mollusca	3	16.7	19	20.2
	Arthropoda	1	5.6	1	1.1
	Other Taxa	4	22.2	8	8.5
	Total	**18**		**94**	
41	Annelida	6	46.2	51	58.6
	Mollusca	3	23.1	17	19.5
	Arthropoda	1	7.7	1	1.1
	Other Taxa	3	23.1	18	20.7
	Total	**13**		**87**	
330	Annelida	10	50.0	41	24.4
	Mollusca	4	20.0	88	52.4
	Arthropoda	1	5.0	2	1.2
	Other Taxa	5	25.0	37	22.0
	Total	**20**		**168**	
401	Annelida	6	24.0	155	29.8
	Mollusca	5	20.0	207	39.7
	Arthropoda	14	56.0	159	30.5
	Other Taxa	0	0.0	0	0.0
	Total	**25**		**521**	
402	Annelida	1	33.3	1	6.7
	Mollusca	1	33.3	13	86.7
	Arthropoda	1	33.3	1	6.7
	Other Taxa	0	0.0	0	0.0
	Total	**3**		**15**	
403	Annelida	3	60.0	5	35.7
	Mollusca	1	20.0	4	28.6
	Arthropoda	1	20.0	5	35.7
	Other Taxa	0	0.0	0	0.0
	Total	**5**		**14**	

Table 5 continued:

Station	Taxa	No. of Taxa	% of Total	No. of Individuals (per 0.04 m²)	% of Total
404	Annelida	2	22.2	4	8.5
	Mollusca	4	44.4	17	36.2
	Arthropoda	2	22.2	25	53.2
	Other Taxa	1	11.1	1	2.1
	Total	**9**		**47**	
405	Annelida	2	33.3	7	46.7
	Mollusca	2	33.3	3	20.0
	Arthropoda	2	33.3	5	33.3
	Other Taxa	0	0.0	0	0.0
	Total	**6**		**15**	
406	Arthropoda	2	66.7	4	22.2
	Mollusca	1	33.3	14	77.8
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	Total	**3**		**18**	
407	Annelida	6	37.5	30	56.6
	Mollusca	1	6.3	1	1.9
	Arthropoda	9	56.3	22	41.5
	Other Taxa	0	0.0	0	0.0
	Total	**16**		**53**	
408	Annelida	9	52.9	98	64.1
	Mollusca	4	23.5	27	17.6
	Arthropoda	4	23.5	28	18.3
	Other Taxa	0	0.0	0	0.0
	Total	**17**		**153**	
409	Annelida	5	35.7	103	89.6
	Arthropoda	8	57.1	11	9.6
	Mollusca	1	7.1	1	0.9
	Other Taxa	0	0.0	0	0.0
	Total	**14**		**115**	
410	Annelida	3	50.0	366	97.6
	Mollusca	0	0.0	0	0.0
	Arthropoda	3	50.0	9	2.4
	Other Taxa	0	0.0	0	0.0
	Total	**6**		**375**	

Table 5 continued:

Station	Taxa	No. of Taxa	% of Total	No. of Individuals (per 0.04 m²)	% of Total
411	Annelida	3	50.0	80	86.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	2	33.3	6	6.5
	Other Taxa	1	16.7	7	7.5
	Total	**6**		**93**	
412	Annelida	5	55.6	325	94.5
	Mollusca	0	0.0	0	0.0
	Arthropoda	3	33.3	10	2.9
	Other Taxa	1	11.1	9	2.6
	Total	**9**		**344**	
413	Annelida	6	60.0	28	84.8
	Mollusca	3	30.0	4	12.1
	Arthropoda	1	10.0	1	3.0
	Other Taxa	0	0.0	0	0.0
	Total	**10**		**33**	
414	Annelida	3	50.0	7	70.0
	Mollusca	1	16.7	1	10.0
	Arthropoda	2	33.3	2	20.0
	Other Taxa	0	0.0	0	0.0
	Total	**6**		**10**	
415	Annelida	3	60.0	24	92.3
	Mollusca	2	40.0	2	7.7
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	Total	**5**		**26**	
416	Annelida	0	0.0	0	0.0
	Mollusca	0	0.0	0	0.0
	Arthropoda	0	0.0	0	0.0
	Other Taxa	2	100.0	5	100.0
	Total	**2**		**5**	
417	Annelida	3	60.0	21	87.5
	Mollusca	2	40.0	3	12.5
	Arthropoda	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	Total	**5**		**24**	

Table 5 continued:

Station	Taxa	No. of Taxa	% of Total	No. of Individuals (per 0.04 m²)	% of Total
418	Annelida	4	44.4	5	20.0
	Mollusca	2	22.2	10	40.0
	Arthropoda	3	33.3	10	40.0
	Other Taxa	0	0.0	0	0.0
	Total	**9**		**25**	
419	Annelida	5	50.0	17	42.5
	Mollusca	3	30.0	19	47.5
	Arthropoda	0	0.0	0	0.0
	Other Taxa	2	20.0	4	10.0
	Total	**10**		**40**	
420	Annelida	1	12.5	1	3.2
	Mollusca	4	50.0	13	41.9
	Arthropoda	2	25.0	16	51.6
	Other Taxa	1	12.5	1	3.2
	Total	**8**		**31**	

Table 6. Percentage abundance of dominant taxa (> 10% of total) for the Neuse River/Pamlico Sound stations, 1999.

Taxa	37	40	41	330	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
Annelida																								
Oligochaeta																								
Naididae (LPIL)									40.0															
Tubificidae (LPIL)					21.7		21.4				47.2		11.3	24.3	16.1			10.0						
Polychaeta																								
Amphicteis gunneri												30.1												
Heteromastus filiformis																	18.2		21.4					
Mediomastus ambiseta			17.2										75.7	73.3	69.9	91.0	54.5	50.0	60.7					
Nereididae (LPIL)												19.6												
Paraprionospio pinnata		23.4																			33.3		10.0	
Polydora cornuta																		10.0						
Sigambra tentaculata		19.1	23.0																					
Spionidae (LPIL)																							15.0	
Streblospio benedicti		11.7																			50.0			
Arthropoda																								
Insecta																								
Ceratopogonidae (LPIL)																		10.0						
Cryptochironomus (LPIL)																		10.0						
Robackia (LPIL)							35.7	51.1	26.7	16.7														
Malacostraca																								
Gammarus tigrinus											17.0													
Parahaustorius attenuatus																						32.0		45.2
Mollusca																								
Bivalvia																								
Bivalvia (LPIL)																						36.0	30.0	
Corbicula fluminea					39.2	86.7	28.6	25.5	13.3	77.8														
Lucina multilineata	16.8																							
Mytilidae (LPIL)																		10.0						
Tellinidae (LPIL)																								22.6
Gastropoda																								
Acteocina canaliculata	35.7	14.9	16.1	45.2																			15.0	
Rhynchocoela																								
Rhynchocoela (LPIL)																				100.0				
Anopla																								
Tubulanus (LPIL)			10.3																					

Table 7. Summary of benthic macroinfaunal data for the Neuse River/Pamlico Sound stations, 1999.

Station	Rep	Taxa	Indvs	Density	Mean No. Taxa	Taxa (SD)	Mean Density	Density (SD)	Total No. Taxa	Total No. Individuals	Diversity (H')	Evenness (J')
37	1	14	43	1075	12.3	2.1	1191.7	112.7	20	143	2.20	0.73
	2	10	48	1200								
	3	13	52	1300								
40	1	9	20	500	9.7	0.6	783.3	256.6	18	94	2.29	0.79
	2	10	34	850								
	3	10	40	1000								
41	1	8	36	900	8.3	0.6	725.0	163.9	13	87	2.17	0.84
	2	8	28	700								
	3	9	23	575								
330	1	13	61	1525	11.3	2.1	1400.0	354.4	20	168	2.15	0.72
	2	9	40	1000								
	3	12	67	1675								
401	1	19	245	6125	14.7	5.1	4341.7	1925.5	24	521	2.02	0.64
	2	16	184	4600								
	3	10	92	2300								
402	1	3	10	250	1.7	1.2	125.0	109.0	3	15	0.49	0.44
	2	1	3	75								
	3	1	2	50								
403	1	2	4	100	2.7	0.6	116.7	14.4	5	14	1.43	0.89
	2	3	5	125								
	3	3	5	125								
404	1	4	11	275	5.0	1.0	391.7	125.8	9	47	1.45	0.66
	2	6	21	525								
	3	5	15	375								
405	1	2	3	75	2.7	1.2	125.0	43.3	6	15	1.53	0.85
	2	4	6	150								
	3	2	6	150								
406	1	2	8	200	2.0	1.0	150.0	66.1	3	18	0.65	0.60
	2	1	3	75								
	3	3	7	175								
407	1	10	17	425	7.3	2.3	441.7	225.5	16	53	1.95	0.70
	2	6	27	675								
	3	6	9	225								
408	1	9	58	1450	11.0	2.6	1275.0	188.7	17	153	2.24	0.79
	2	14	52	1300								
	3	10	43	1075								
409	1	5	14	350	6.0	1.0	958.3	544.5	13	115	1.02	0.40
	2	6	45	1125								
	3	7	56	1400								
410	1	4	77	1925	4.0	0.0	3125.0	1113.6	5	375	0.68	0.42
	2	4	165	4125								
	3	4	133	3325								
411	1	4	57	1425	4.0	0.0	775.0	589.5	5	93	0.96	0.59
	2	4	25	625								
	3	4	11	275								
412	1	6	148	3700	5.0	1.0	2866.7	1846.8	8	344	0.44	0.21
	2	4	30	750								
	3	5	166	4150								

Table 7 continued:

Station	Rep	Taxa	Indvs	Density	Mean No. Taxa	Taxa (SD)	Mean Density	Density (SD)	Total No. Taxa	Total No. Individuals	H' Diversity	J' Evenness
413	1	4	8	200	4.7	1.2	275.0	175.0	9	33	1.51	0.69
	2	4	19	475								
	3	6	6	150								
414	1	2	5	125	2.3	1.5	83.3	52.0	6	10	1.50	0.84
	2	4	4	100								
	3	1	1	25								
415	1	5	6	150	3.3	1.5	233.3	104.1	6	28	1.18	0.66
	2	3	8	200								
	3	2	14	350								
416	1	0	0	0	0.3	0.6	25.0	43.3	1	3	0.00	
	2	1	3	75								
	3	0	0	0								
417	1	2	10	250	3.0	1.0	200.0	66.1	5	24	1.18	0.74
	2	3	9	225								
	3	4	5	125								
418	1	5	12	300	4.3	1.2	208.3	80.4	9	25	1.71	0.78
	2	3	6	150								
	3	5	7	175								
419	1	4	8	200	5.7	2.9	333.3	189.3	10	40	2.03	0.88
	2	4	10	250								
	3	9	22	550								
420	1	4	10	250	4.0	0.0	258.3	62.9	8	31	1.61	0.77
	2	4	13	325								
	3	4	8	200								

Table 8. Two-way table of abundance by station for taxa utilized in the cluster analysis.

Taxa	37	40	41	330	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
Acteocina canaliculata	51	14	14	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
Amphicteis gunneri	0	0	0	0	0	0	0	0	0	0	0	46	0	0	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae (LPIL)	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Chironomus (LPIL)	0	0	0	0	4	0	0	0	0	0	2	0	0	0	2	7	0	0	0	0	0	0	0	0
Coelotanypus (LPIL)	0	0	0	0	7	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Corbicula fluminea	0	0	0	0	204	0	0	12	2	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cryptochironomus (LPIL)	0	0	0	0	14	0	0	0	0	0	2	11	4	2	0	0	0	1	0	0	0	0	0	0
Gammarus tigrinus	0	0	0	0	5	0	0	0	0	1	9	10	0	0	0	0	0	0	0	0	0	0	0	0
Heteromastus filiformis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	0	0	2	0	0
Hydrobiidae (LPIL)	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0
Limnodrilus hoffmeisteri	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lucina multilineata	24	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mediomastus ambiseta	2	1	15	3	0	0	1	0	0	0	0	1	87	275	65	313	18	5	17	0	1	0	0	0
Parahaustorius attenuatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	14
Paramphinome sp. B	0	0	4	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paraprionospio pinnata	12	22	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	4	0
Polypedilum (LPIL)	0	0	0	0	25	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Procladius (LPIL)	0	0	0	0	0	0	0	0	0	0	0	0	0	6	4	1	0	0	0	0	0	0	0	0
Pseudochironomus (LPIL)	0	0	0	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhynchocoela (LPIL)	2	6	18	26	0	0	0	1	0	0	0	0	0	0	7	9	0	0	2	3	0	0	3	1
Robackia (LPIL)	0	0	0	0	0	0	5	24	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sigambra tentaculata	0	18	20	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sipuncula (LPIL)	11	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streblospio benedicti	12	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	1	2	0
Tubificidae (LPIL)	0	7	4	1	113	1	3	0	0	0	25	1	13	91	15	10	0	1	0	0	0	0	2	0

Figure 1. Locations of the Neuse River/Pamlico Sound stations, 1999.

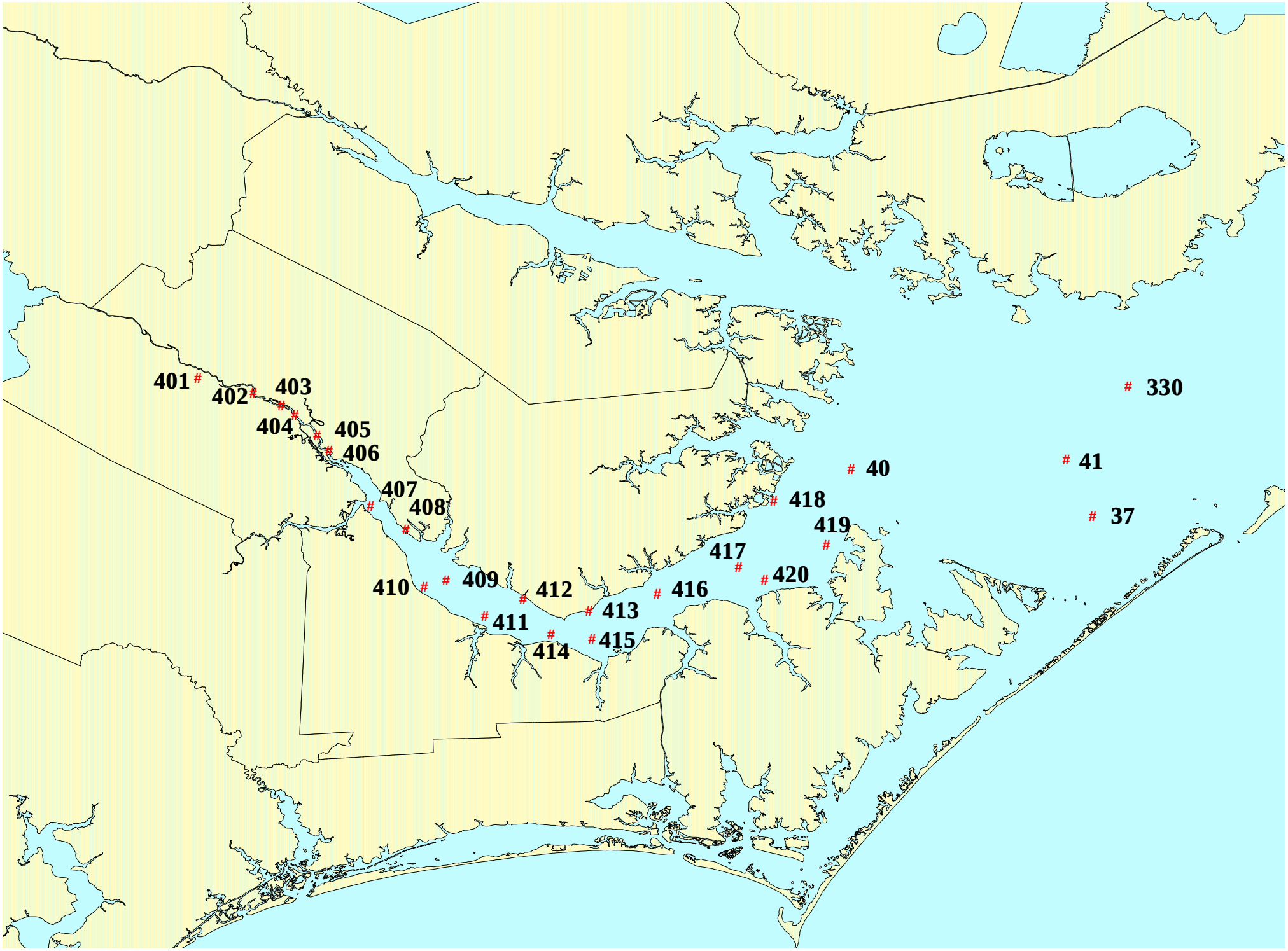


Figure 2. Bottom salinities for the Neuse River/Pamlico Sound stations, 1999.

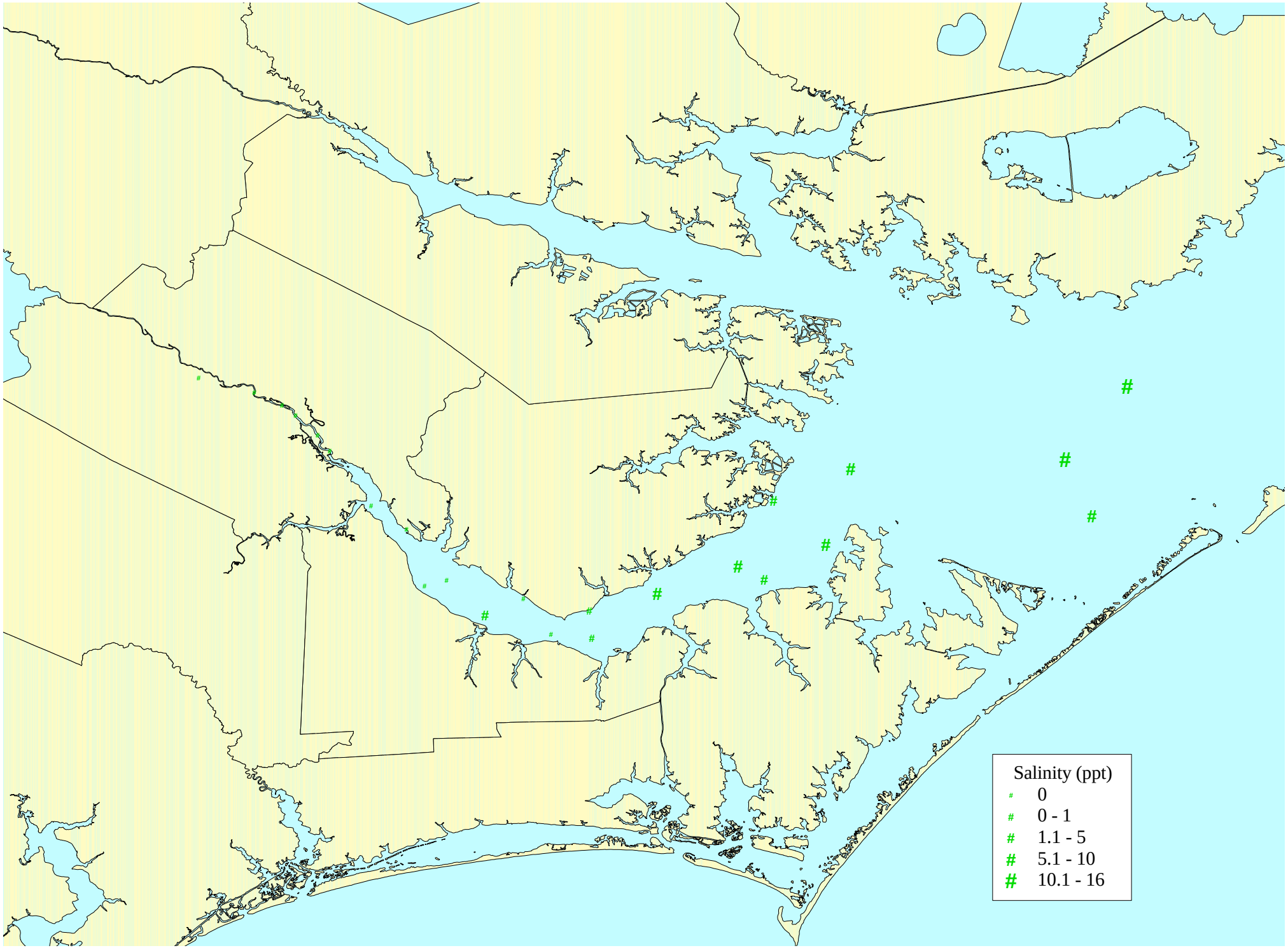
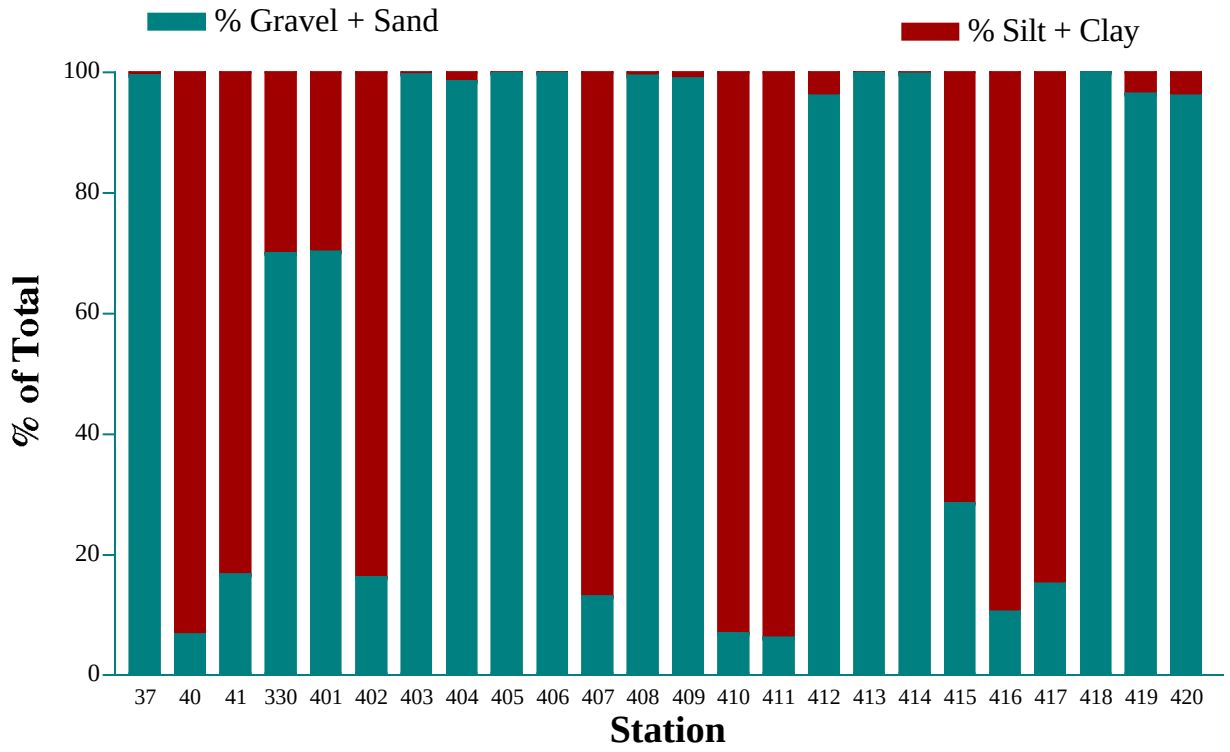


Figure 3. Sediment data for the Neuse River/Pamlico Sound stations, 1999.



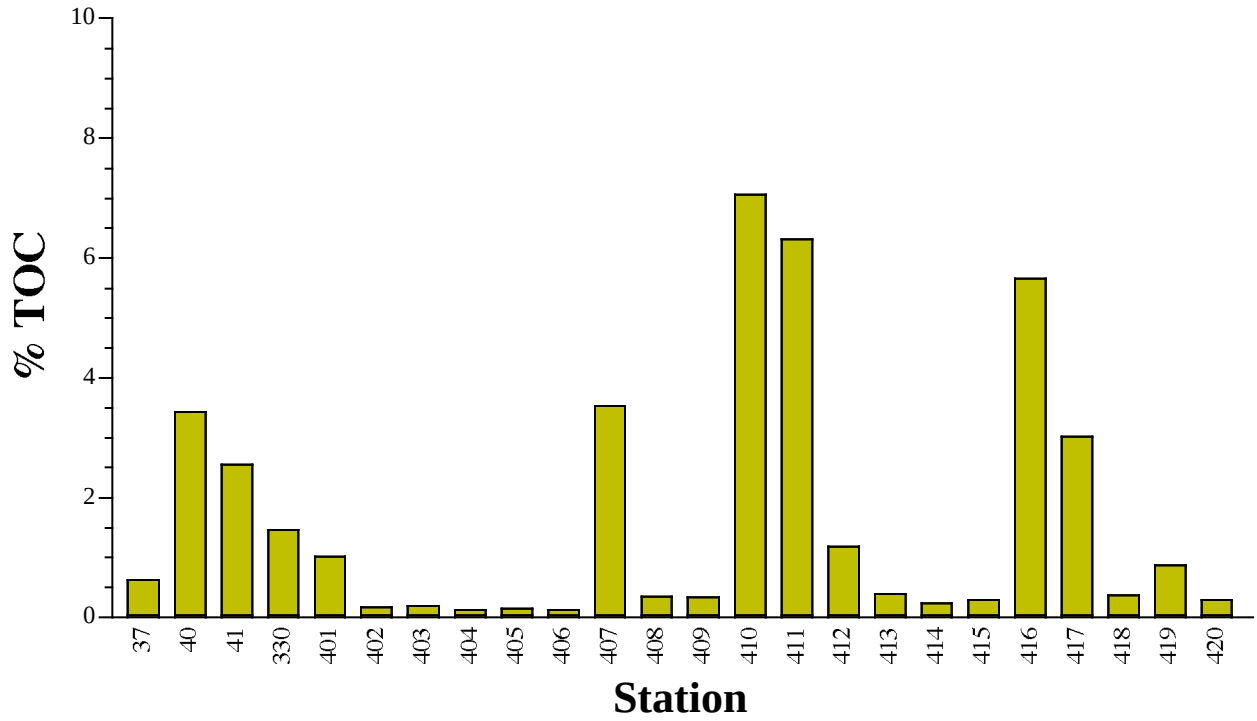


Figure 4. Sediment composition for the Neuse River/Pamlico Sound stations, 1999.

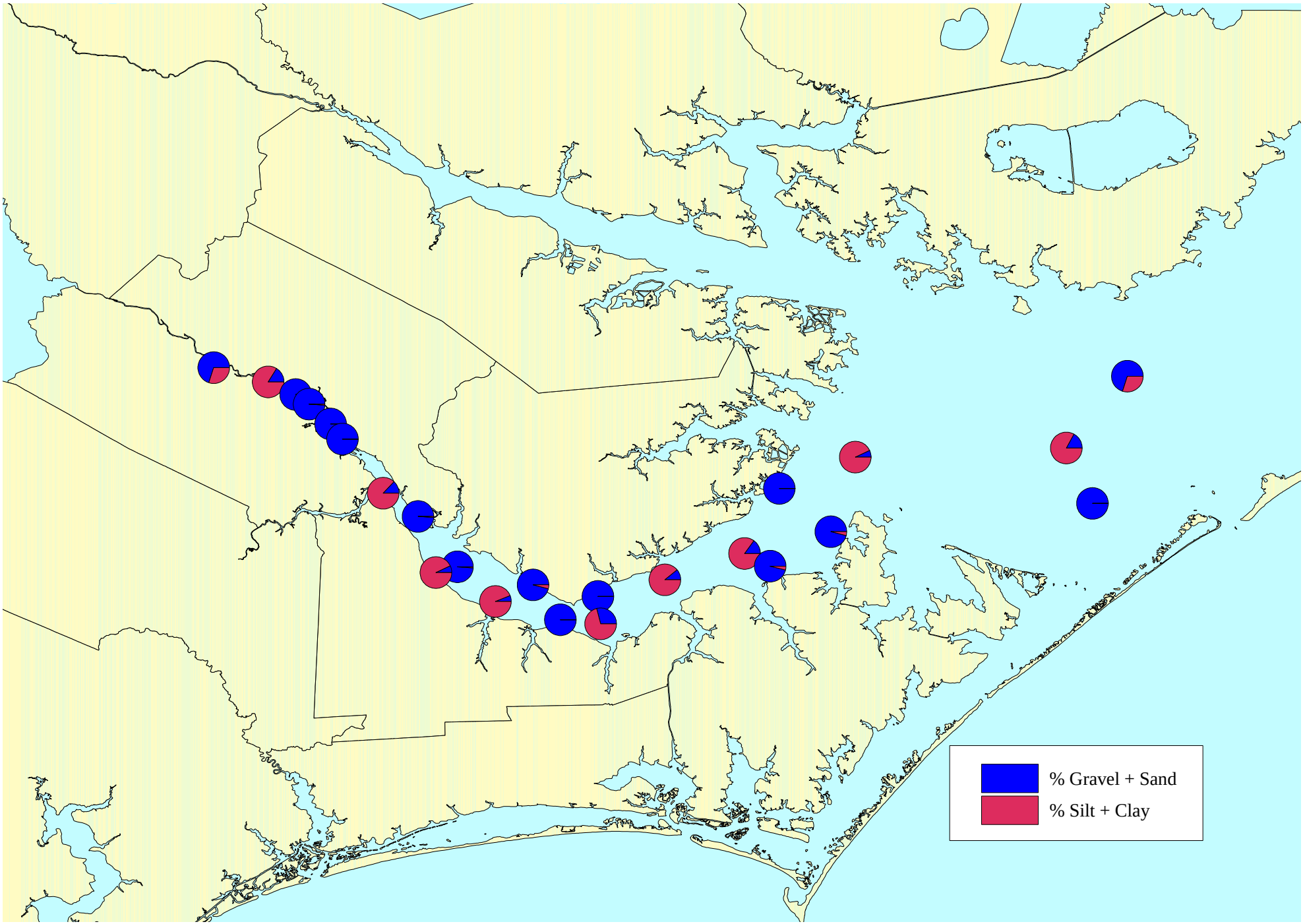


Figure 5. Taxa richness data for the Neuse River/Pamlico Sound stations, 1999.

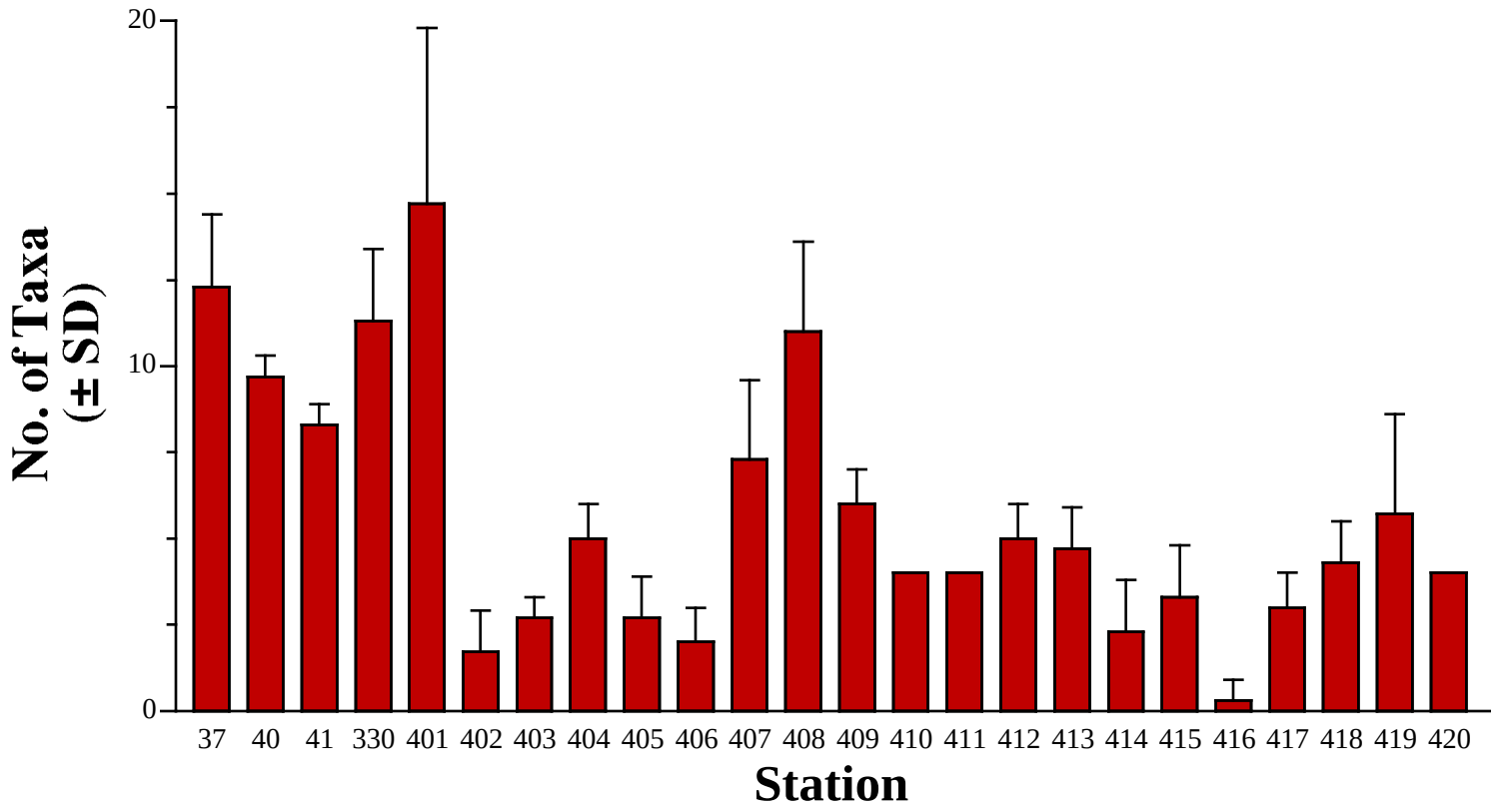


Figure 6. Taxa richness for the Neuse River/Pamlico Sound stations, 1999.

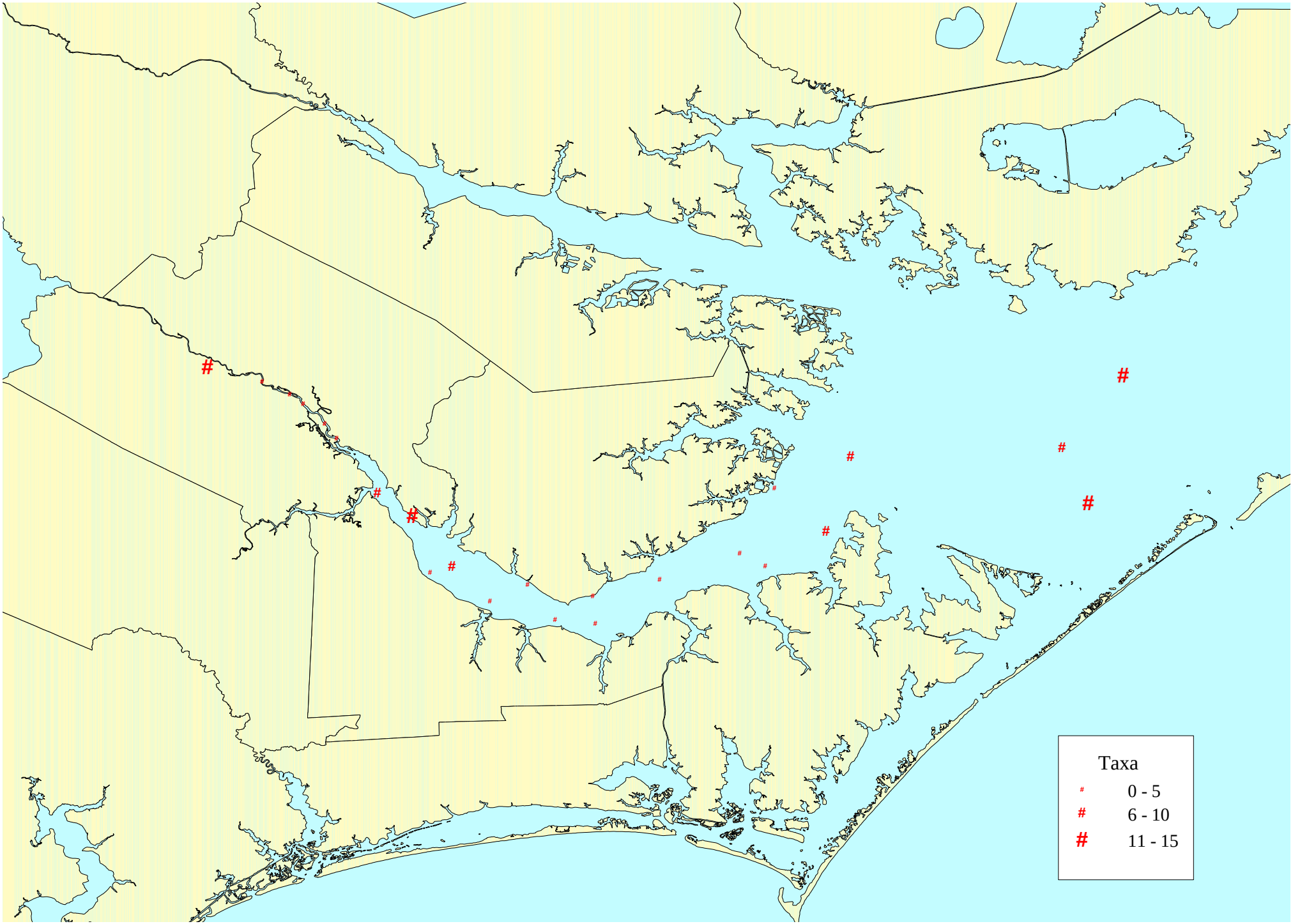


Figure 7. Taxa density data for the Neuse River/Pamlico Sound stations, 1999.

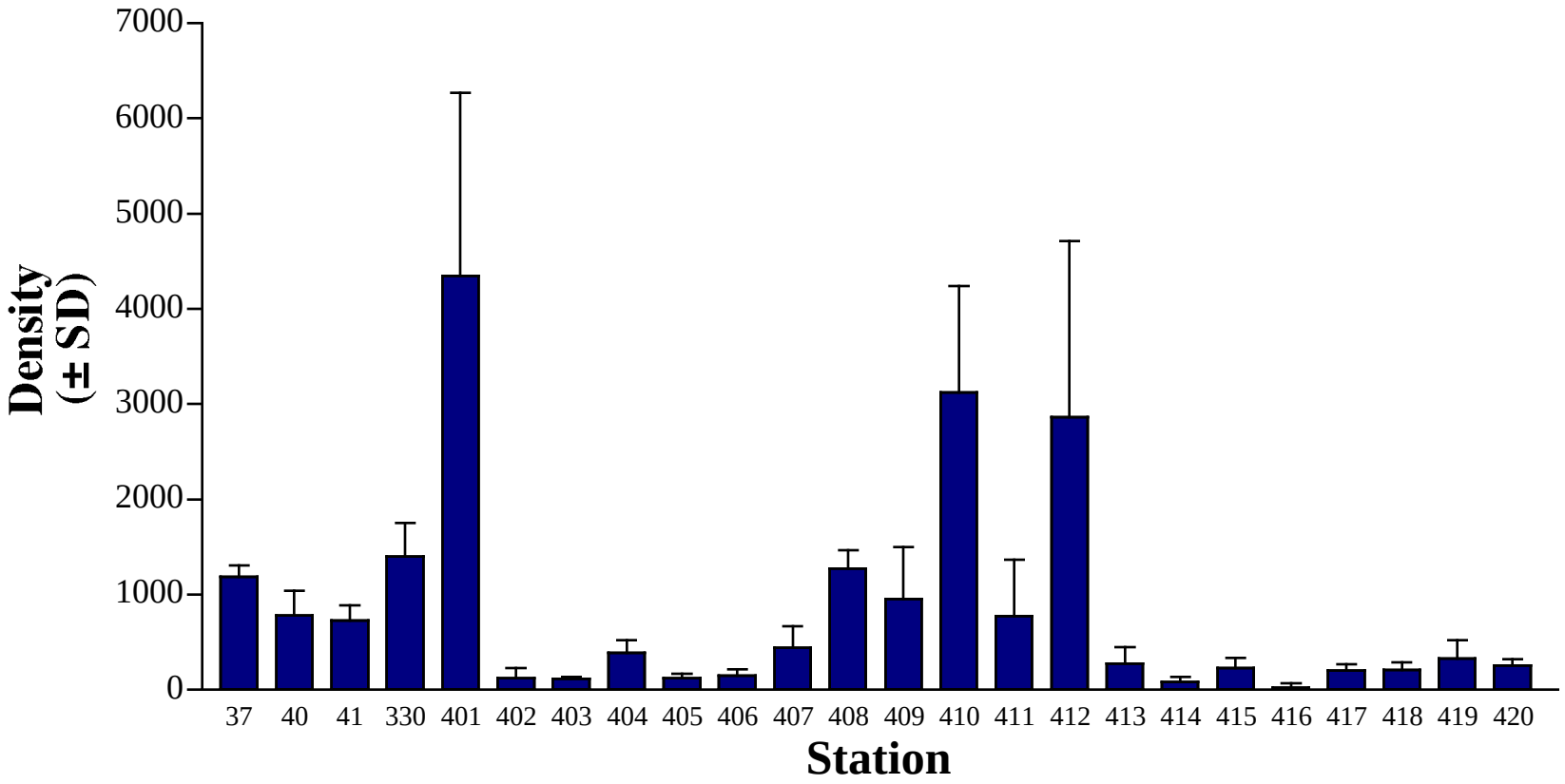


Figure 8. Taxa density for the Neuse River/Pamlico Sound stations, 1999.

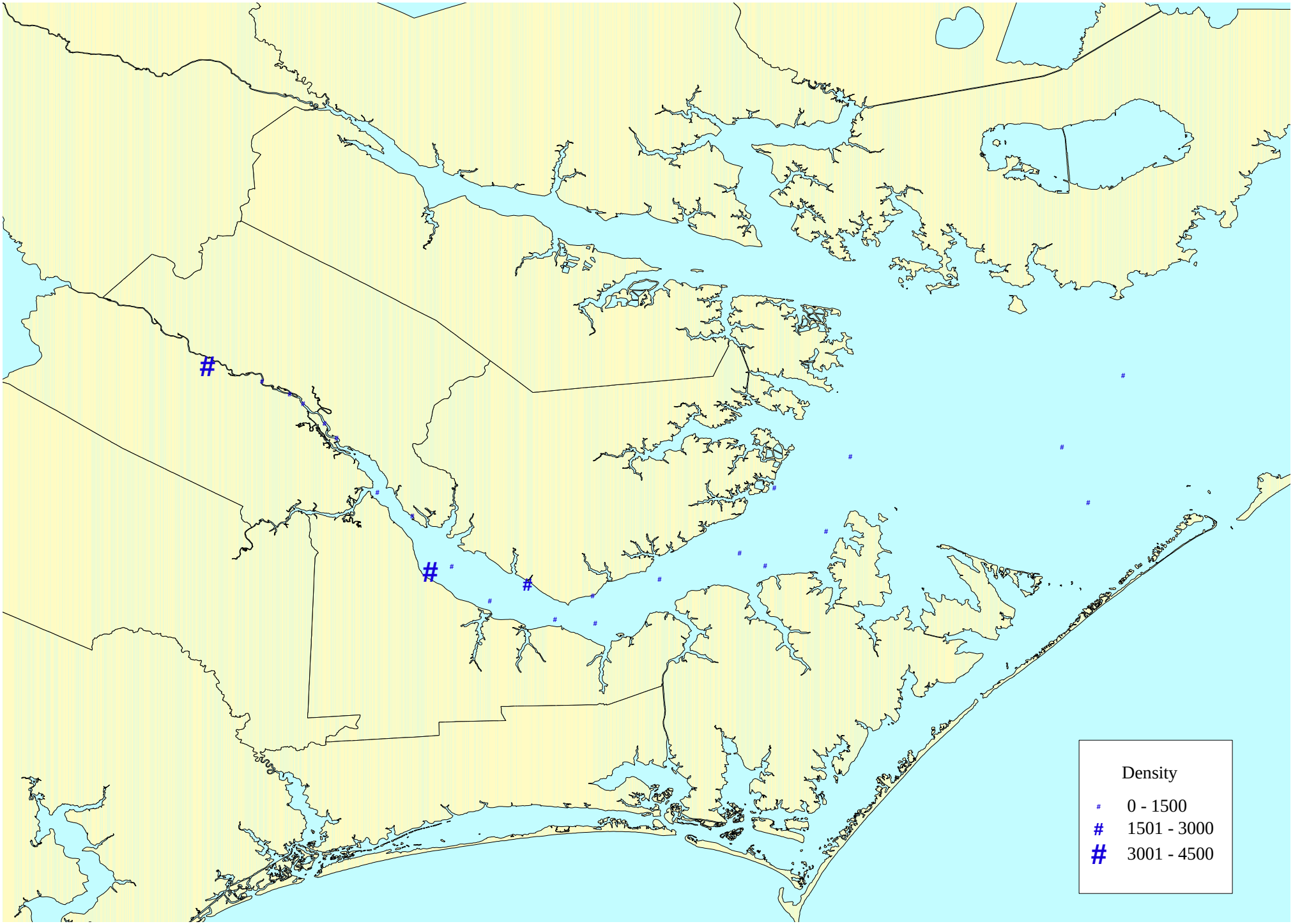
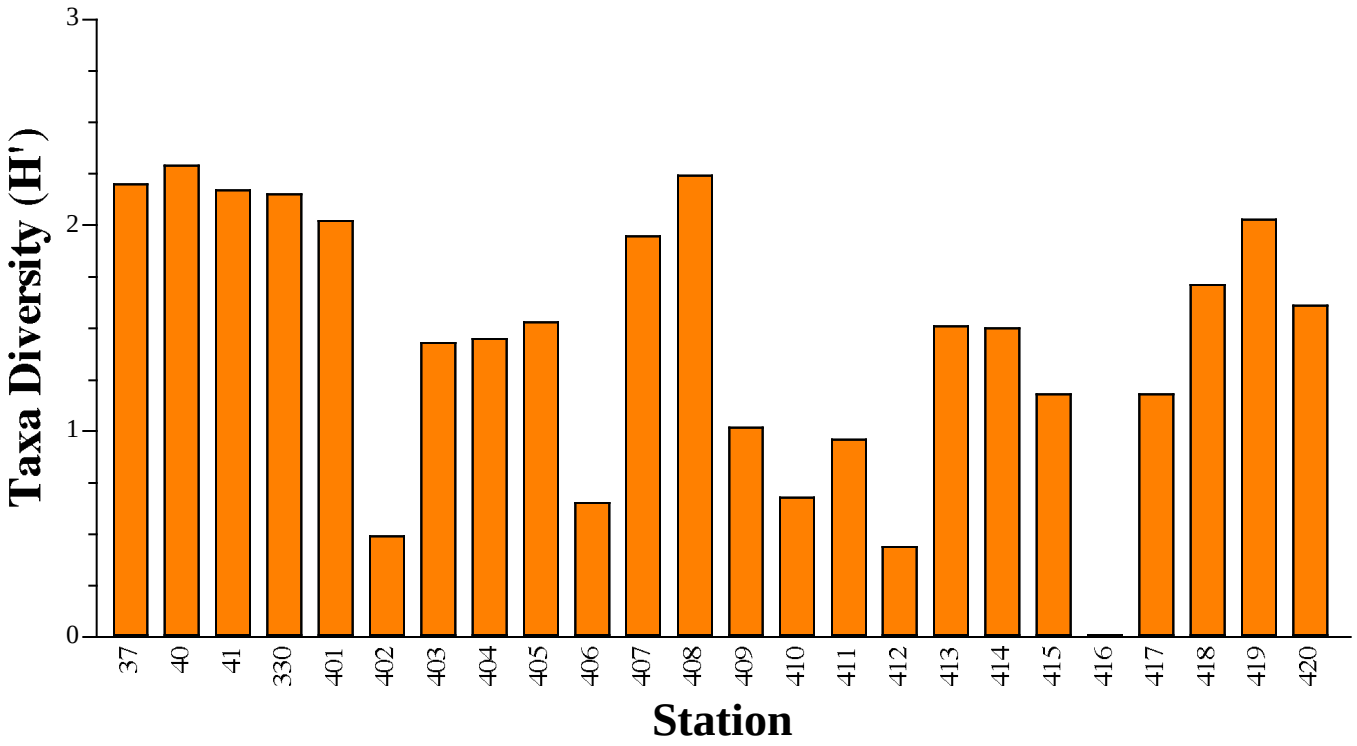


Figure 9. Taxa diversity and evenness data for the Neuse River/Pamlico Sound stations, 1999.



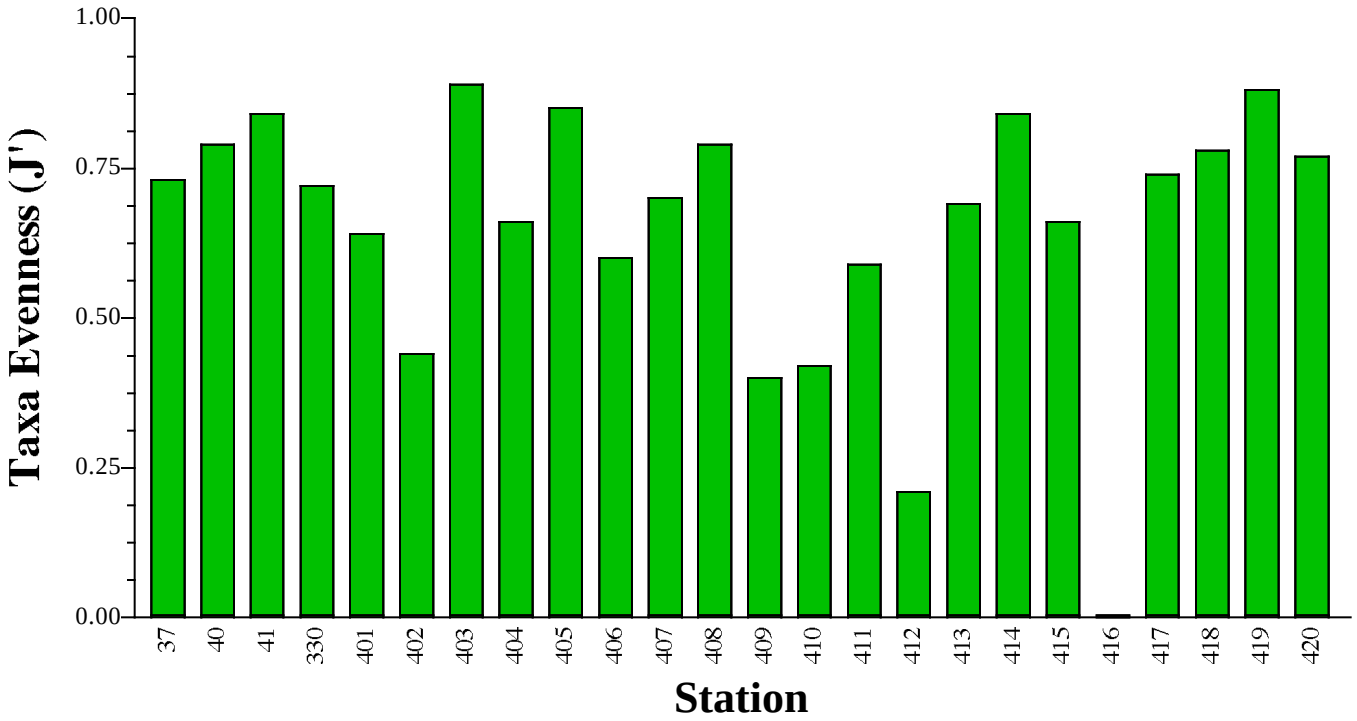


Figure 10. Station dendrogram from the cluster analysis of the 1999 Neuse River/Pamlico Sound data.

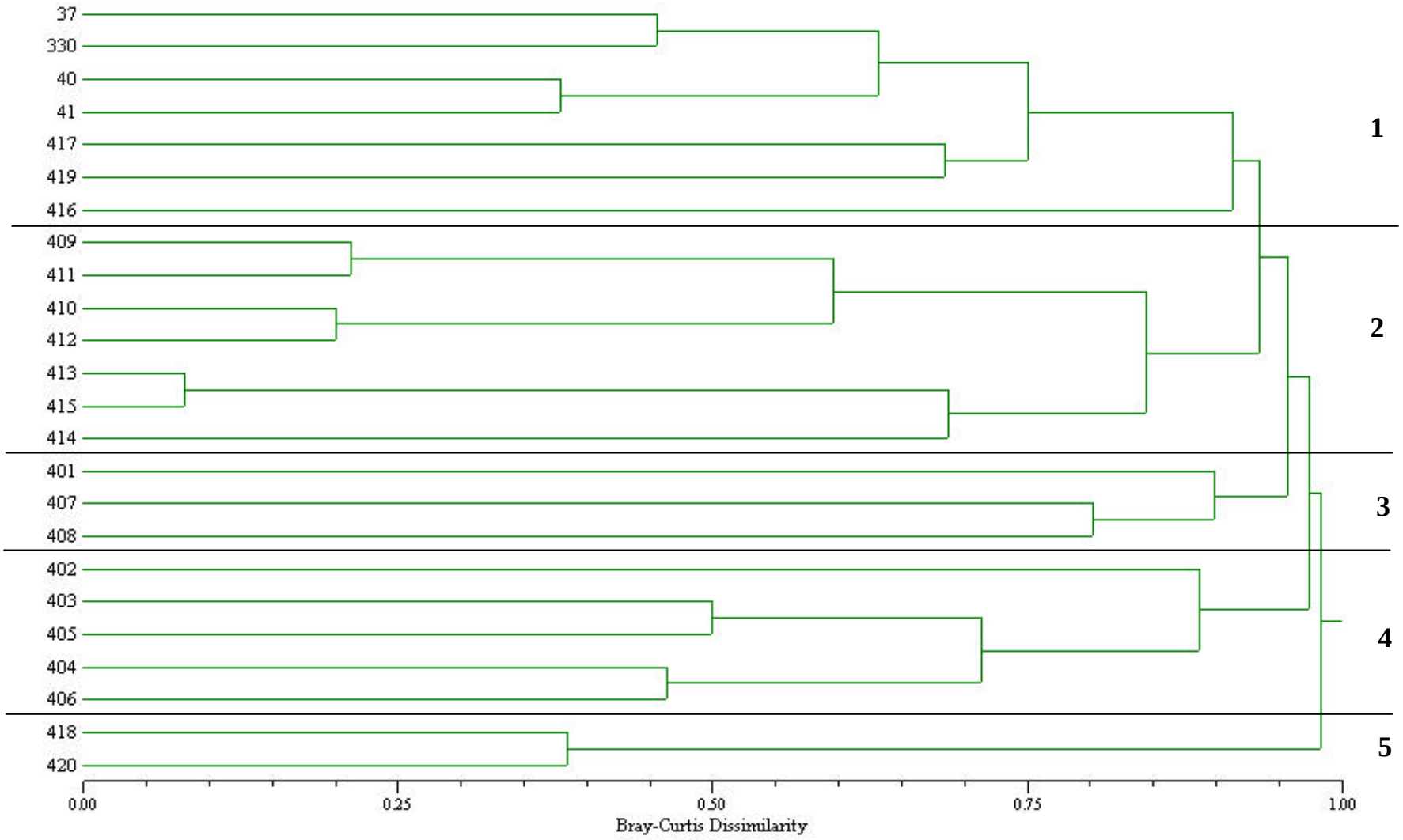


Figure 11. Taxa dendrogram from the cluster analysis of the 1999 Neuse River/Pamlico Sound data.

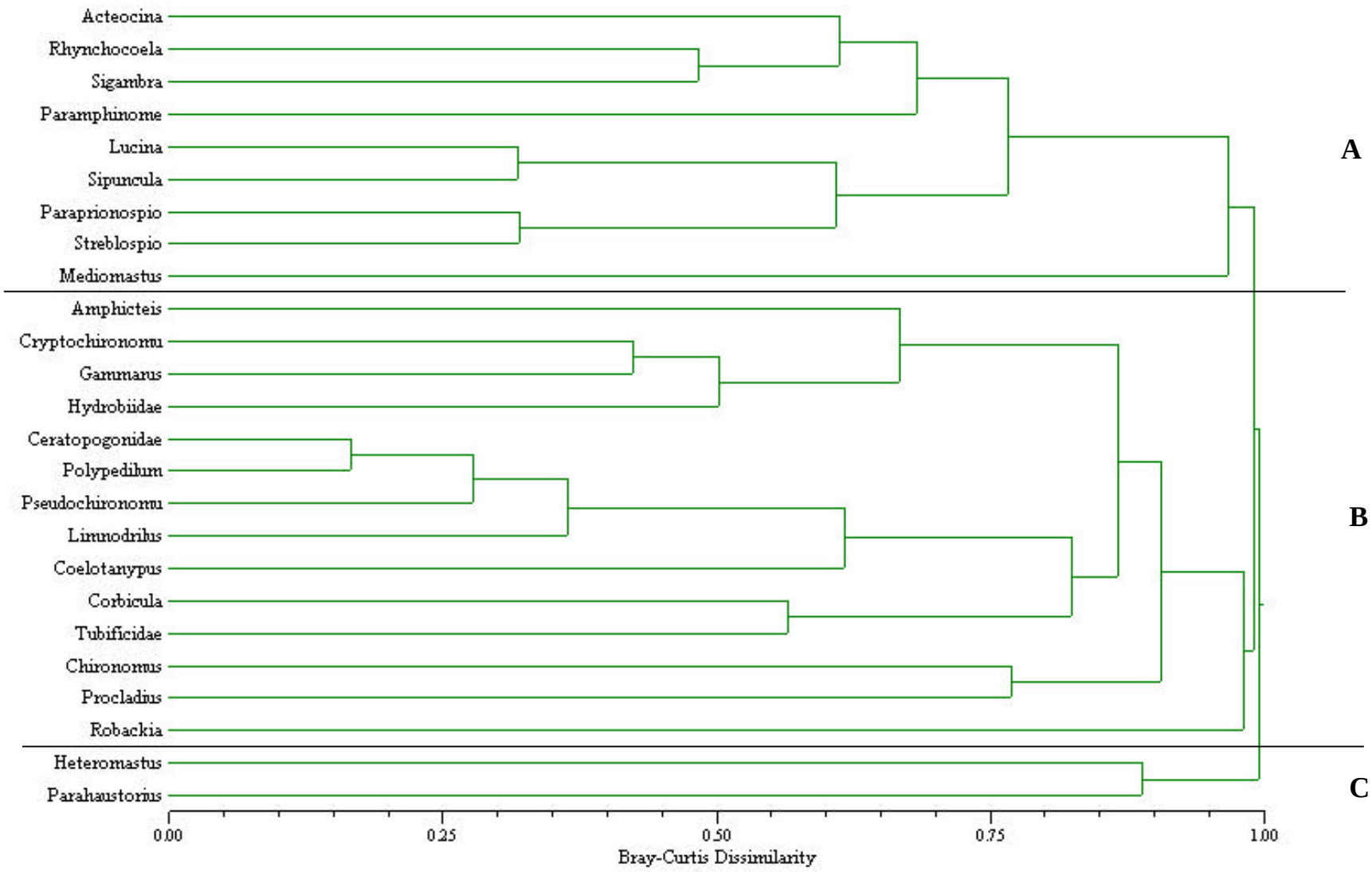


Figure 12. Taxa richness data for the 1998 and 1999 Neuse River stations.

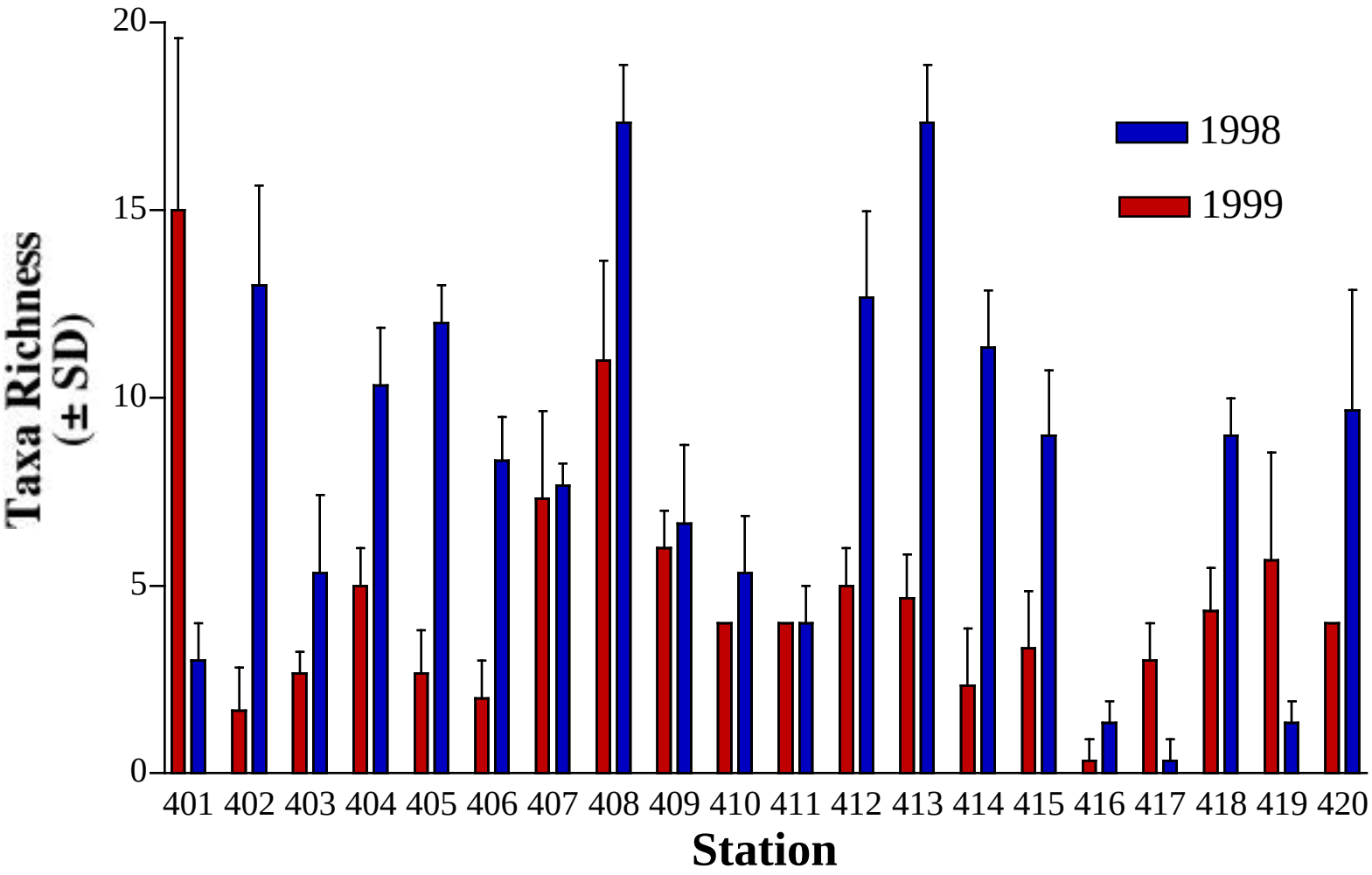
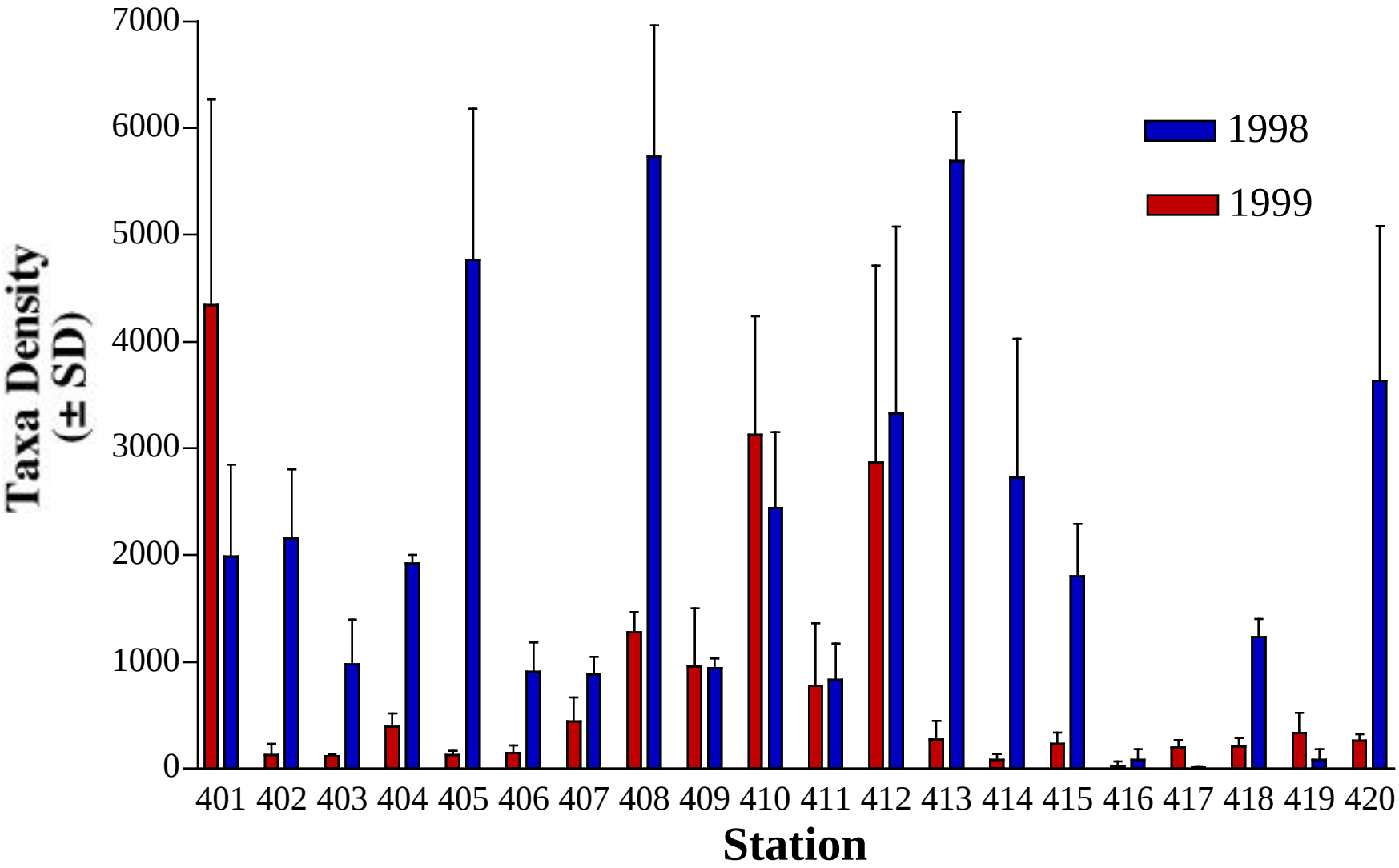


Figure 13. Macroinvertebrate density data for the 1998 and 1999 Neuse River stations.



APPENDICES

QUALITY ASSURANCE STATEMENT

Client/Project: NOAA

Work Assignment Title: Neuse River 1999

Work Assignment Number: Task Number: DO 1 Opt 1

Description of Data Set or Deliverable: 72 Benthic macroinvertebrate samples collected in 1999; Young Dredge grabs.

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

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

_____

Signature of QA Officer or Reviewer Date

_____

Signature of Project Manager Date

QUALITY CONTROL REWORKS

Client/Project: NOAA Neuse River 1999
Task Number: DO1, Opt 1

Sorting Results:	**Sample #**	**% Accuracy**
	415-3	100%
	417-3	100%
	420-2	100%
	418-1	100%
	037-2	100%
	402-1	100%
	402-3	100%
	037-3	100%
	420-1	100%

Taxonomy Results:	**Sample #**	**Taxa**	**% Accuracy**
	406-3	Crust./Moll.	100%
	418-2	Crust./Moll.	100%
	407-1	Crust./Moll.	100%
	041-2	Crust./Moll.	100%
	413-3	Crust./Moll.	100%
	419-3	Crust./Moll.	100%
	402-1	Crust./Moll.	100%
	408-2	Poly./Misc.	97%
	409-3	Poly./Misc.	100%
	412-1	Poly./Misc.	98%
	417-1	Poly./Misc.	100%
	330-1	Poly./Misc.	100%
	040-3	Poly./Misc.	100%
	401-2	Chiron/Oligo	100%
	410-2	Chiron/Oligo	100%
	407-1	Chiron/Oligo	100%
	419-3	Chiron/Oligo	100%

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

Signature of QA Officer or Reviewer Date