Carolinian Province
Benthic Community Assessment

Submitted to

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INTRODUCTION

The Neuse River in North Carolina was sampled during the summer of 1998 as part of the EMAP Carolinian Province sampling program. 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 Carolinian Province region and 1998 EMAP sampling stations are indicated in Figure 1.

METHODS

Sample Collection And Handling

A Young dredge (area = 0.04 m^2) was used to collect replicate bottom samples at each of 20 stations in the Neuse, North Carolina. 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

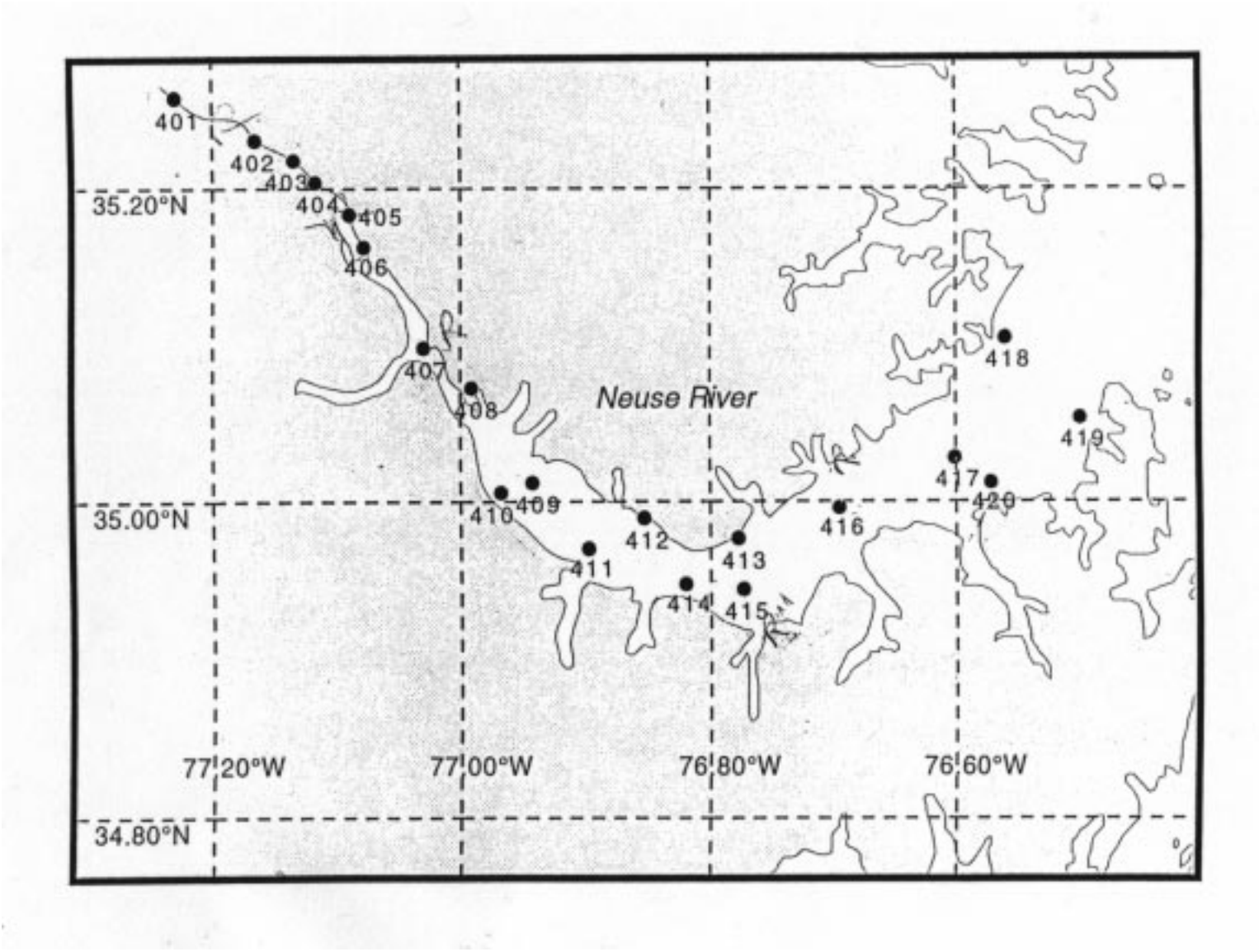

Figure 1. Area sampled for the EMAP Carolinian Province, North Caolina Stations, July 1998.

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 QA and QC reports for the Carolinian Province samples are given in the Appendix.

The analytical methodologies utilized for this study were similar to those used in similar benthic community characterization reports prepared for other state and federal agency surveys. Macroinfaunal characterization involves an evaluation of several biological community structure parameters (*e.g.*, species abundance, species composition and species diversity indices) during initial data reduction, followed by pattern and classification analysis for delineation of species assemblages. Since species are distributed along environmental gradients, there are generally no distinct boundaries between communities. However, the relationships between habitats and species assemblages often reflect the interactions of physical and biological factors and indicate major ecological trends.

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).

Species 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 taxa in the sample, and

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

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

Faunal Similarities

Numerical classification analysis (Boesch 1977) was performed on the faunal data to examine within- and between- stations differences at the Carolinian Province sites and to compare faunal composition at each station within the site. Both normal and inverse classification analyses were used in this study. Normal analysis (sometimes called Q-analysis) treats samples as individual observations, each being composed of a number of attributes (*i.e.* the various species 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 classification (termed

R-analysis) is based on species 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.

Classification analysis of both station collections (normal analysis) and species (inverse analysis) was performed using the Czekanowski quantitative index of faunal similarity (Field and MacFarlane 1968). This index is computationally equivalent to the Bray-Curtis similarity measure (Bray and Curtis 1957). The value of the similarity index is 1.0 when two samples are identical and 0 when no species are in common. Hierarchical clustering of similarity values is achieved using the group-average sorting strategy (Lance and Williams 1967) and displayed in the form of dendrograms.

Both similarity classification and cluster analysis were performed using the microcomputer package, "Community Analysis System 5.0" (Bloom 1994), as modified for use in BVA's benthic data management program. Taxa used in these analyses were selected according to their percent abundance and percent frequency. Total densities for each of the selected taxa at a given station were log-transformed [x=ln(x+1)] for the analysis.

BENTHIC COMMUNITY CHARACTERIZATION

Faunal Composition, Abundance, And Community Structure

Table 1 provides a complete phylogenetic listing for all stations as well as data on taxa abundance and station occurrence. Microsoft ™Excel 5.0 (Macintosh version) spreadsheets are being provided separately to NOAA which include: raw data on taxa abundance and density by replicate, a complete taxonomic listing with station abundance and occurrence, a major taxa table with overall taxa abundance, and an assemblage parameter table including data on mean number of taxa, mean density, taxa diversity and taxa evenness by station.

Table 1. Abundance and distribution of taxa for the EMAP Carolinian Province, North Carolina Stations, July 1998.

Taxon Name	Phylum	Class	No. of Individuals	% Total	Cummulative %	Station Occurrence	Station % Occurrence
Marenzellaria viridis	A	Poly	543	10.74	10.74	7	35
Chironomus (LPIL)	Ar	Inse	539	10.66	21.40	9	45
Corbicula fluminea	M	Biva	509	10.07	31.47	9	45
Polypedilum halterale group	Ar	Inse	409	8.09	39.56	5	25
Tellina agilis	M	Biva	340	6.72	46.28	6	30
Chironomidae (LPIL)	Ar	Inse	270	5.34	51.62	12	60
Parahaustorius longimerus	Ar	Mala	255	5.04	56.67	3	15
Bivalvia (LPIL)	M	Biva	215	4.25	60.92	8	40
Tubificidae (LPIL)	A	Olig	209	4.13	65.05	14	70
Robackia claviger	Ar	Inse	201	3.98	69.03	1	5
Mytilopsis leucophaeata	M	Biva	156	3.09	72.11	3	15
Cyathura polita	Ar	Mala	141	2.79	74.90	4	20
Heteromastus filiformis	A	Poly	125	2.47	77.37	6	30
Mediomastus (LPIL)	A	Poly	123	2.43	79.81	6	30
Mulinia lateralis	M	Biva	122	2.41	82.22	9	45
Polydora cornuta	A	Poly	94	1.86	84.08	9	45
Tellinidae (LPIL)	M	Biva	87	1.72	85.80	3	15
Laeonereis culveri	A	Poly	86	1.70	87.50	4	20
Tubificoides heterochaetus	A	Olig	78	1.54	89.04	5	25
Gammarus tigrinus	Ar	Mala	74	1.46	90.51	6	30
Procladius (LPIL)	Ar	Inse	45	0.89	91.40	5	25
Gammaridae (LPIL)	Ar	Mala	40	0.79	92.19	5	25
Rhynchocoela (LPIL)	R		34	0.67	92.86	9	45
Coelotanypus (LPIL)	Ar	Inse	25	0.49	93.35	4	20
Cryptochironomus (LPIL)	Ar	Inse	25	0.49	93.85	6	30
Limnodrilus hoffmeisteri	A	Olig	25	0.49	94.34	4	20

Table 1. Continued:

Taxon Name	Phylum	Class	No. of Individuals	% Total	Cummulative %	Station Occurrence	Station % Occurrence
Haplocytheridea setipunctata	Ar	Ostr	22	0.44	94.78	1	5
Haustoriidae (LPIL)	Ar	Mala	21	0.42	95.19	2	10
Macoma balthica	M	Biva	18	0.36	95.55	5	25
Oecetis inconspicua	Ar	Inse	18	0.36	95.90	4	20
Dicrotendipes (LPIL)	Ar	Inse	16	0.32	96.22	5	25
Ampharetidae (LPIL)	A	Poly	14	0.28	96.50	2	10
Cryptotendipes (LPIL)	Ar	Inse	14	0.28	96.77	2	10
Almyracuma proximoculi	Ar	Mala	13	0.26	97.03	1	5
Nereis succinea	A	Poly	13	0.26	97.29	4	20
Caecidotea (LPIL)	Ar	Mala	11	0.22	97.50	1	5
Phylocentropus (LPIL)	Ar	Inse	11	0.22	97.72	1	5
Acanthohaustorius millsi	Ar	Mala	9	0.18	97.90	1	5
Spionidae (LPIL)	A	Poly	9	0.18	98.08	3	15
Ceratopogonidae (LPIL)	Ar	Inse	8	0.16	98.24	4	20
Polypedilum (LPIL)	Ar	Inse	8	0.16	98.39	2	10
Tellina (LPIL)	M	Biva	7	0.14	98.53	2	10
Monoculodes edwardsi	Ar	Mala	6	0.12	98.65	3	15
Capitellidae (LPIL)	A	Poly	5	0.10	98.75	2	10
Heptageniidae (LPIL)	Ar	Inse	5	0.10	98.85	1	5
Isochaetides freyi	A	Olig	5	0.10	98.95	1	5
Ceratonereis irritabilis	A	Poly	4	0.08	99.03	2	10
Lumbriculidae (LPIL)	A	Olig	4	0.08	99.11	3	15
Tanytarsus (LPIL)	Ar	Inse	4	0.08	99.19	2	10
Axarus (LPIL)	Ar	Inse	3	0.06	99.25	2	10
Gammarus (LPIL)	Ar	Mala	3	0.06	99.30	2	10
Lineidae (LPIL)	R	Anop	3	0.06	99.36	2	10
Monoculodes (LPIL)	Ar	Mala	3	0.06	99.42	1	5

Table 1. Continued:

Taxon Name	Phylum	Class	No. of Individuals	% Total	Cummulative %	Station Occurrence	Station % Occurrence
Corophium lacustre	Ar	Mala	2	0.04	99.46	1	5
Gemma gemma	M	Biva	2	0.04	99.50	1	5
Hirudinea (LPIL)	A	Hiru	2	0.04	99.54	1	5
Lopescladius (LPIL)	Ar	Inse	2	0.04	99.58	1	5
Naididae (LPIL)	A	Olig	2	0.04	99.62	2	10
Nereididae (LPIL)	A	Poly	2	0.04	99.66	1	5
Paraonidae (LPIL)	A	Poly	2	0.04	99.70	1	5
Streblospio benedicti	A	Poly	2	0.04	99.74	2	10
Acteocina canaliculata	M	Gast	1	0.02	99.76	1	5
Cladotanytarsus (LPIL)	Ar	Inse	1	0.02	99.78	1	5
Desserobdella phalera	A	Hiru	1	0.02	99.80	1	5
Edotia triloba	Ar	Mala	1	0.02	99.82	1	5
Gastropoda (LPIL)	M	Gast	1	0.02	99.84	1	5
Lirceus lineatus	Ar	Mala	1	0.02	99.86	1	5
Oedicerotidae (LPIL)	Ar	Mala	1	0.02	99.88	1	5
Phyllodocidae (LPIL)	A	Poly	1	0.02	99.90	1	5
Pyramidellidae (LPIL)	M	Gast	1	0.02	99.91	1	5
Rangia cuneata	M	Biva	1	0.02	99.93	1	5
Sididae (LPIL)	Ar	Bran	1	0.02	99.95	1	5
Spisula solidissima	M	Biva	1	0.02	99.97	1	5
Trichoptera (LPIL)	Ar	Inse	1	0.02	99.99	1	5

Taxa Key

A = Annelida
- Hiru = Hirudinea
- Olig = Oligochaeta
- Poly = Polychaeta

Ar = Arthropoda
- Bran = Branchiopoda
- Inse = Insecta
- Mala = Malacostraca
- Ostr = Ostracoda

M = Mollusca
- Biva = Bivalvia
- Gast = Gastropoda

R = Rhynchocoela
- Anop = Anopla

A total of 5,056 organisms, representing 74 taxa, were identified from the 20 stations (Table 2). Insects were the most numerous organisms present representing 31.7% of the total assemblage, followed in abundance by bivalves (28.8%), polychaetes (20.2%), malacostracans (11.5%) and other annelids (6.4%). Insects represented 25.7% of the total number of taxa followed by malacostracans (20.3%), polychaetes (18.9%), bivalves (14.9%) and other annelids (10.8%) (Table 2).

The abundance of major taxa by station are given in Table 3. The number of taxa per station ranged from 1 at Station 417 to 24 at Station 413. Similarly, the number of organisms per station ranged from 1 at Station 417 to 683 at Station 413. The percentage abundance of the major taxa at the 20 stations is given in Figure 2.

The two dominant taxa collected from the samples were the polychaete, *Marenzellaria viridis* , and the chrionomid, *Chironomus* (LPIL), each representing 10.7% of the total number of individuals identified. The bivalve, *Corbicula fluminea* (10.1%), the chironomid, *Polypedilum halteral* group (8.1%), the bivalve, *Tellina agilis* (6.7%), the insect family, Chironomidae (5.3%), and the amphipod, *Protohaustorius longicarpus* (5.0%) were the only other taxa representing greater that 5% of the total number of organisms identified (Table 1). Tubificidae was the most widely distributed taxon being found at 70% of the stations followed by the Chironomidae (60%). *Chironomus* (LPIL), *Mulinia lateralis*, *Corbicula fluminea*, *Polydora cornuta*, and Rhynchocoela (LPIL) were found at 45% of the stations. All remaining taxa were found at ≤ 40% of the stations. The distribution of dominant taxa representing >10% of the total assemblage at each station is given in Table 4. Stations 401-406 were dominated by freshwater taxa. Station 401 was the only station containing the dipteran *Robackia claviger*, which represented 84.5% of the organisms found at the station. Stations 402-406 where dominated by the freshwater bivalve, *Corbicula fluminea*, along with individuals from the families Tubificidae and Chironomidae.

Table 2. Summary of abundance of major taxonomic groups for the EMAP Carolinian Province, North Carolina Stations, July 1998.

TAXA	Total No. Taxa	% Total	Total No. Individuals	% Total
Annelida				
Polychaeta	14	18.9	1023	20.2
Other Annelida	8	10.8	326	6.4
Arthropoda				
Insecta	19	25.7	1605	31.7
Malacostraca	15	20.3	581	11.5
Other Arthropoda	2	2.7	23	0.5
Mollusca				
Bivalvia	11	14.9	1458	28.8
Gastropoda	3	4.1	3	0.1
Other Taxa	2	2.7	37	0.7
TOTAL	74		5056	

Table 3. Summary of abundance of major taxonomic groups by station for the EMAP Carolinian Province, North Carolina, July 1998.

Station	Taxa	No. of Taxa	% of Total	No. of Individuals	% of Total
401	Annelida	0	0.0	0	0.0
	Mollusca	2	40.0	34	14.3
	Arthropoda (Crustacea)	1	20.0	1	0.4
	Arthropoda (Insecta)	2	40.0	203	85.3
	Other Taxa	0	0.0	0	0.0
	TOTAL	5		238	
402	Annelida	5	26.3	56	21.6
	Mollusca	1	5.3	127	49.0
	Arthropoda (Crustacea)	3	15.8	15	5.8
	Arthropoda (Insecta)	10	52.6	61	23.6
	Other Taxa	0	0.0	0	0.0
	TOTAL	19		259	
403	Annelida	2	20.0	2	1.7
	Mollusca	2	20.0	102	87.2
	Arthropoda (Crustacea)	2	20.0	5	4.3
	Arthropoda (Insecta)	4	40.0	8	6.8
	Other Taxa	0	0.0	0	0.0
	TOTAL	10		117	
404	Annelida	3	15.8	26	11.3
	Mollusca	1	5.3	103	44.6
	Arthropoda (Crustacea)	4	21.1	14	6.1
	Arthropoda (Insecta)	11	57.9	88	38.1
	Other Taxa	0	0.0	0	0.0
	TOTAL	19		231	
405	Annelida	2	13.3	35	6.1
	Mollusca	1	6.7	158	27.6
	Arthropoda (Crustacea)	3	20.0	91	15.9
	Arthropoda (Insecta)	9	60.0	288	50.3
	Other Taxa	0	0.0	0	0.0
	TOTAL	15		572	
406	Annelida	3	25.0	26	23.9
	Mollusca	2	16.7	22	20.2
	Arthropoda (Crustacea)	2	16.7	3	2.8
	Arthropoda (Insecta)	5	41.7	58	53.2
	Other Taxa	0	0.0	0	0.0
	TOTAL	12		109	

Table 3. Continued:

Station	Taxa	No. of Taxa	% of Total	No. of Individuals	% of Total
407	Annelida	5	45.5	19	17.9
	Mollusca	1	9.1	1	0.9
	Arthropoda (Crustacea)	0	0.0	0	0.0
	Arthropoda (Insecta)	5	45.5	86	81.1
	Other Taxa	0	0.0	0	0.0
	TOTAL	11		106	
408	Annelida	7	30.4	215	31.3
	Mollusca	5	21.7	161	23.4
	Arthropoda (Crustacea)	3	13.0	60	8.7
	Arthropoda (Insecta)	8	34.8	252	36.6
	Other Taxa	0	0.0	0	0.0
	TOTAL	23		688	
409	Annelida	4	44.4	59	52.2
	Mollusca	1	11.1	1	0.9
	Arthropoda (Crustacea)	1	11.1	1	0.9
	Arthropoda (Insecta)	2	22.2	50	44.2
	Other Taxa	1	11.1	2	1.8
	TOTAL	9		113	
410	Annelida	5	55.6	57	19.5
	Mollusca	2	22.2	2	0.7
	Arthropoda (Crustacea)	0	0.0	0	0.0
	Arthropoda (Insecta)	2	22.2	234	79.9
	Other Taxa	0	0.0	0	0.0
	TOTAL	9		293	
411	Annelida	2	40.0	8	8.0
	Mollusca	1	20.0	2	2.0
	Arthropoda (Crustacea)	0	0.0	0	0.0
	Arthropoda (Insecta)	2	40.0	90	90.0
	Other Taxa	0	0.0	0	0.0
	TOTAL	5		100	
412	Annelida	7	43.8	149	37.3
	Mollusca	5	31.3	58	14.5
	Arthropoda (Crustacea)	1	6.3	22	5.5
	Arthropoda (Insecta)	2	12.5	160	40.1
	Other Taxa	1	6.3	10	2.5
	TOTAL	16		399	

Table 3. Continued:

Station	Taxa	No. of Taxa	% of Total	No. of Individuals	% of Total
413	Annelida	7	29.2	349	51.1
	Mollusca	8	33.3	216	31.6
	Arthropoda (Crustacea)	4	16.7	95	13.9
	Arthropoda (Insecta)	3	12.5	19	2.8
	Other Taxa	2	8.3	4	0.6
	TOTAL	24		683	
414	Annelida	9	60.0	188	57.5
	Mollusca	4	26.7	132	40.4
	Arthropoda (Crustacea)	1	6.7	4	1.2
	Arthropoda (Insecta)	0	0.0	0	0.0
	Other Taxa	1	6.7	3	0.9
	TOTAL	15		327	
415	Annelida	7	50.0	57	26.4
	Mollusca	4	28.6	148	68.5
	Arthropoda (Crustacea)	0	0.0	0	0.0
	Arthropoda (Insecta)	2	14.3	7	3.2
	Other Taxa	1	7.1	4	1.9
	TOTAL	14		216	
416	Annelida	1	25.0	1	10.0
	Mollusca	1	25.0	6	60.0
	Arthropoda (Crustacea)	0	0.0	0	0.0
	Arthropoda (Insecta)	1	25.0	1	10.0
	Other Taxa	1	25.0	2	20.0
	TOTAL	4		10	
417	Annelida	0	0.0	0	0.0
	Mollusca	0	0.0	0	0.0
	Arthropoda (Crustacea)	1	100.0	1	100.0
	Arthropoda (Insecta)	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	TOTAL	1		1	
418	Annelida	9	56.3	83	56.1
	Mollusca	3	18.8	45	30.4
	Arthropoda (Crustacea)	3	18.8	12	8.1
	Arthropoda (Insecta)	0	0.0	0	0.0
	Other Taxa	1	6.3	8	5.4
	TOTAL	16		148	

Table 3. Continued:

Station	Taxa	No. of Taxa	% of Total	No. of Individuals	% of Total
419	Annelida	0	0.0	0	0.0
	Mollusca	2	66.7	8	80.0
	Arthropoda (Crustacea)	0	0.0	0	0.0
	Arthropoda (Insecta)	0	0.0	0	0.0
	Other Taxa	1	33.3	2	20.0
	TOTAL	3		10	
420	Annelida	3	18.8	19	4.4
	Mollusca	5	31.3	135	31.0
	Arthropoda (Crustacea)	6	37.5	280	64.2
	Arthropoda (Insecta)	0	0.0	0	0.0
	Other Taxa	2	12.5	2	0.5
	TOTAL	16		436	

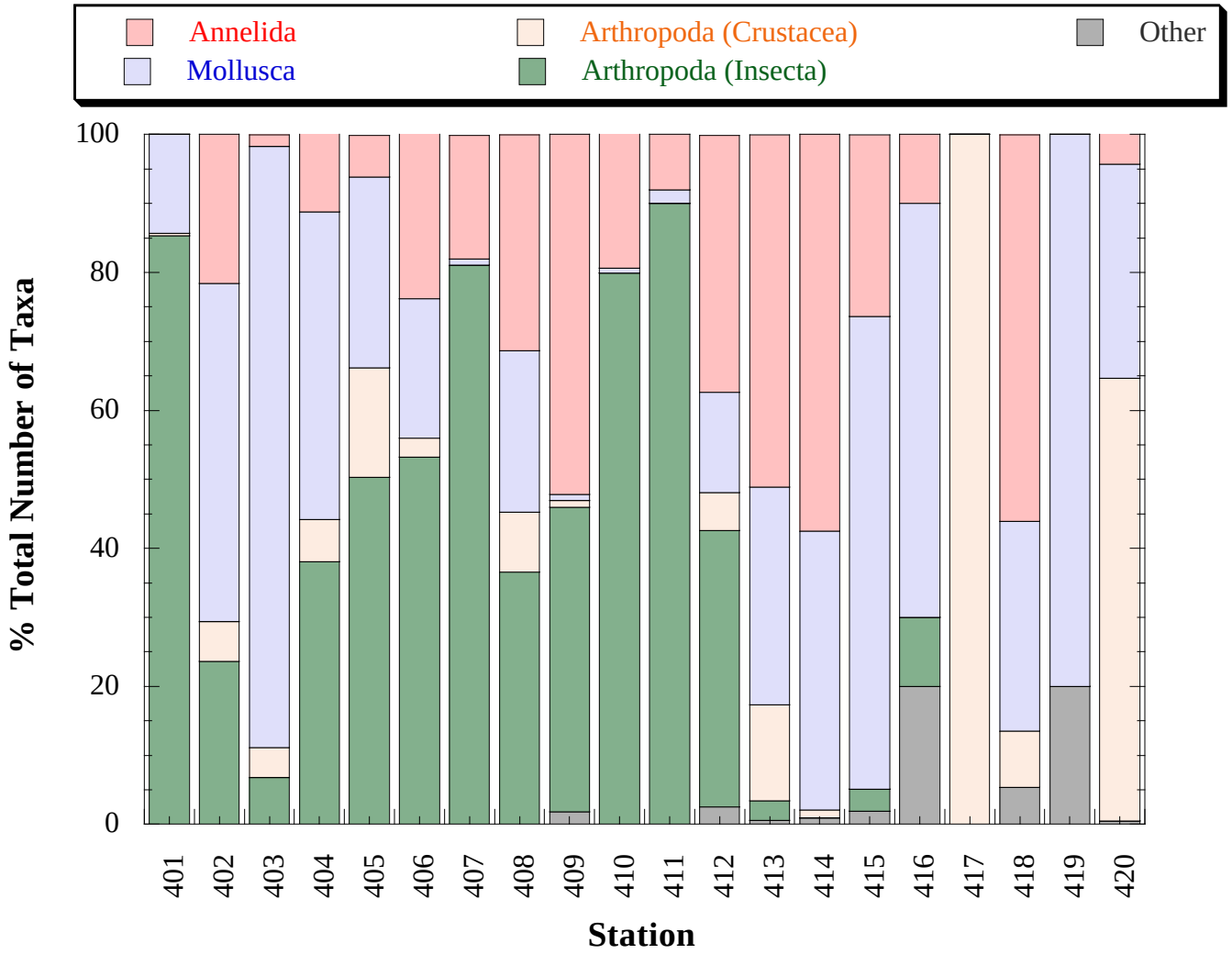

Figure 2. Percent abundance of major taxa for the EMAP Carolinian Province, North Carolina Stations, July1998.

Table 4. Percentage abundance of dominant taxa (> 10% of the total) for the EMAP Carolinian Province, North Carolina Stations, July 1998.

TAXA	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
RHYNCHOCOELA																				
Rhynchocoela (LPIL)																20.0			20.0	
ANNELIDA																				
Polychaeta																				
Capitellidae (LPIL)																10.0				
Heteromastus filiformis															17.6					
Mediomastus (LPIL)									30.1			14.3								
Laeonereis culveri													11.0							
Polydora cornuta														12.8						
Marenzellaria viridis								22.1					31.2	28.4				45.3		
Oligochaeta																				
Tubificidae (LPIL)		18.5		10.0								11.0								
Tubificoides heterochaetus									16.8	15.0										
Limnodrilus hoffmeisteri						13.8														
MOLLUSCA																				
Bivalvia																				
Bivalvia (LPIL)			25.6										21.4							
Tellinidae (LPIL)																			70.0	10.3
Tellina agilis												11.5		14.1	46.8			28.4		19.5
Mulinia lateralis														16.8	18.1	60.0				
Corbicula fluminea	10.5	49.0	61.5	44.6	27.6	19.2														
Mytilopsis leucophaeata								22.4												
Gastropoda																				
Acteocina canaliculata																			10.0	
ARTHROPODA																				
Malacostraca																				
Cyathura polita													12.4							
Gammarus tigrinus					10.0															
Parahaustorius longimerus																	100.0			57.6
Insecta																				
Chironomidae (LPIL)				11.3	11.9	15.6	17.0				11.0									
Chironomus (LPIL)							49.1		38.9	74.7	79.0	31.1				10.0				
Polypedilum halterale Group				16.5	32.2	27.5		21.8												
Procladius (LPIL)							10.4													
Robackia claviger	84.5																			

Station mean density and mean number of taxa data are given in Table 5 and Figures 3 and 4. Mean densities ranged from 14 organisms/m^{-2} at Station 417 to 5733 organisms/m^{-2} at Station 408 (Table 5; Figure 3). The mean number of taxa per replicate ranged from 0.3 at Station 417 to 17.3 at Stations 408 and 413 (Table 5; Figure 4). Taxa diversity and evenness are given in Table 5 and Figures 5 and 6. Taxa diversity (H') ranged from 0.0 at Station 417 to 2.17 at Station 408. Taxa evenness (J) ranged from 0.0 at Station 417 to 0.80 at Station 406.

Numerical Classification Analysis

Normal (stations) and inverse (species) classification analyses were performed on the Carolinian Province data set and displayed as dendrograms (Figures 7 and 8). Selection of the species included in the analyses was based on a minimum representation of 0.49% of total individuals. Count data for the 20 taxa selected were included in a matrix of station and species groups (Table 6). These taxa accounted for 94.3% of the macroinfaunal assemblage collected.

Numerical classification of the 20 stations can be interpreted at a five-group level (5-22% level of similarity) representing the upper (group C: Stations 401-406), mid- (group D: Stations 407-411) and lower (group E: Stations 412-415, 418, 420) regions of the Neuse River (Figures 7 and 10). Of the remaining two groups, Group A contained one station (417) with one organism and Group B contained two stations with 10 organisms each.

A survey map by station group is given in Figure 9. Station depth and salinity are represented in Figure 10. Comparing Figures 7, 9, and 10, the station groupings (with the exception of groups A and B) correlate strongly with salinity. Stations 401-406 exhibited salinities ≤ 0.1 ppt, which can be considered freshwater (Group C). Salinities for Stations 407-411 were ≤ 5.3 ppt (Group D), and Stations 412-415, 418, and 420 exhibited salinities ≥ 5.2 (Group E).

Classification of the 20 taxa at the 20 stations can interpreted at a three-group level (4-14% similarity; Table 6 and Figure 8). Group 1 includes one taxon, *Robackia claviger*,

Table 5. Summary of the benthic macroinfaunal data for the EMAP Carolinian Province, North Carolina Stations, July 1998.

Summary by Replicate					Summary by Station								
Station	Rep	Taxa	Indvs	Density	Mean No.Taxa	Taxa (SD)	Mean Density	Density (SD)	Taxa	Indvs	H'	J'	D
401	A	3	119	2975	3.00	1.00	1983.3	863.3	5	238	0.57	0.35	0.73
401	B	4	63	1575									
401	C	2	56	1400									
402	A	15	73	1825	13.00	2.65	2158.3	643.4	19	259	1.82	0.62	3.24
402	B	14	70	1750									
402	C	10	116	2900									
403	A	3	26	650	5.33	2.08	975.0	420.6	10	117	1.17	0.51	1.89
403	B	7	33	825									
403	C	6	58	1450									
404	A	12	77	1925	10.33	1.53	1925.0	75.0	19	231	1.87	0.64	3.31
404	B	9	80	2000									
404	C	10	74	1850									
405	A	13	195	4875	12.00	1.00	4766.7	1415.6	15	572	1.87	0.69	2.21
405	B	12	245	6125									
405	C	11	132	3300									
406	A	9	45	1125	8.33	1.15	908.3	274.2	12	109	1.99	0.80	2.34
406	B	9	24	600									
406	C	7	40	1000									
407	A	7	35	875	7.67	0.58	883.3	162.7	11	106	1.64	0.68	2.14
407	B	8	29	725									
407	C	8	42	1050									
408	A	16	182	4550	17.33	1.53	5733.3	1227.1	23	688	2.17	0.69	3.37
408	B	17	280	7000									
408	C	19	226	5650									

Table 5. Continued:

Summary by Replicate					Summary by Station								
Station	Rep	Taxa	Indvs	Density	Mean No.Taxa	Taxa (SD)	Mean Density	Density (SD)	Taxa	Indvs	H'	J'	D
409	A	6	34	850	6.67	2.08	941.7	87.8	9	113	1.54	0.70	1.69
409	B	5	38	950									
409	C	9	41	1025									
410	A	7	121	3025	5.33	1.53	2441.7	710.8	9	293	0.87	0.40	1.41
410	B	5	106	2650									
410	C	4	66	1650									
411	A	5	35	875	4.00	1.00	833.3	339.4	5	100	0.74	0.46	0.87
411	B	4	46	1150									
411	C	3	19	475									
412	A	14	203	5075	12.67	2.31	3325.0	1750.0	16	399	2.12	0.76	2.50
412	B	14	133	3325									
412	C	10	63	1575									
413	A	17	233	5825	17.33	1.53	5691.7	464.6	24	683	2.12	0.67	3.52
413	B	16	243	6075									
413	C	19	207	5175									
414	A	11	79	1975	11.33	1.53	2725.0	1299.0	15	327	2.10	0.78	2.42
414	B	10	79	1975									
414	C	13	169	4225									
415	A	10	78	1950	9.00	1.73	1800.0	492.4	14	216	1.63	0.62	2.42
415	B	7	50	1250									
415	C	10	88	2200									
416	A	1	1	25	1.33	0.58	83.3	101.0	4	10	1.09	0.79	1.30
416	B	1	1	25									
416	C	2	8	200									

Table 5. Continued:

Summary by Replicate					Summary by Station								
Station	Rep	Taxa	Indvs	Density	Mean No.Taxa	Taxa (SD)	Mean Density	Density (SD)	Taxa	Indvs	H'	J'	D
417	A	0	0	0	0.33	0.58	8.3	14.4	1	1	0.00	0.00	
417	B	0	0	0									
417	C	1	1	25									
418	A	10	42	1050	9.00	1.00	1233.3	166.5	16	148	1.68	0.61	3.00
418	B	9	51	1275									
418	C	8	55	1375									
419	A	2	8	200	1.33	0.58	83.3	101.0	3	10	0.80	0.73	0.87
419	B	1	1	25									
419	C	1	1	25									
420	A	12	137	3425	9.67	3.21	3633.3	1448.8	16	436	1.37	0.49	2.47
420	B	11	207	5175									
420	C	6	92	2300									

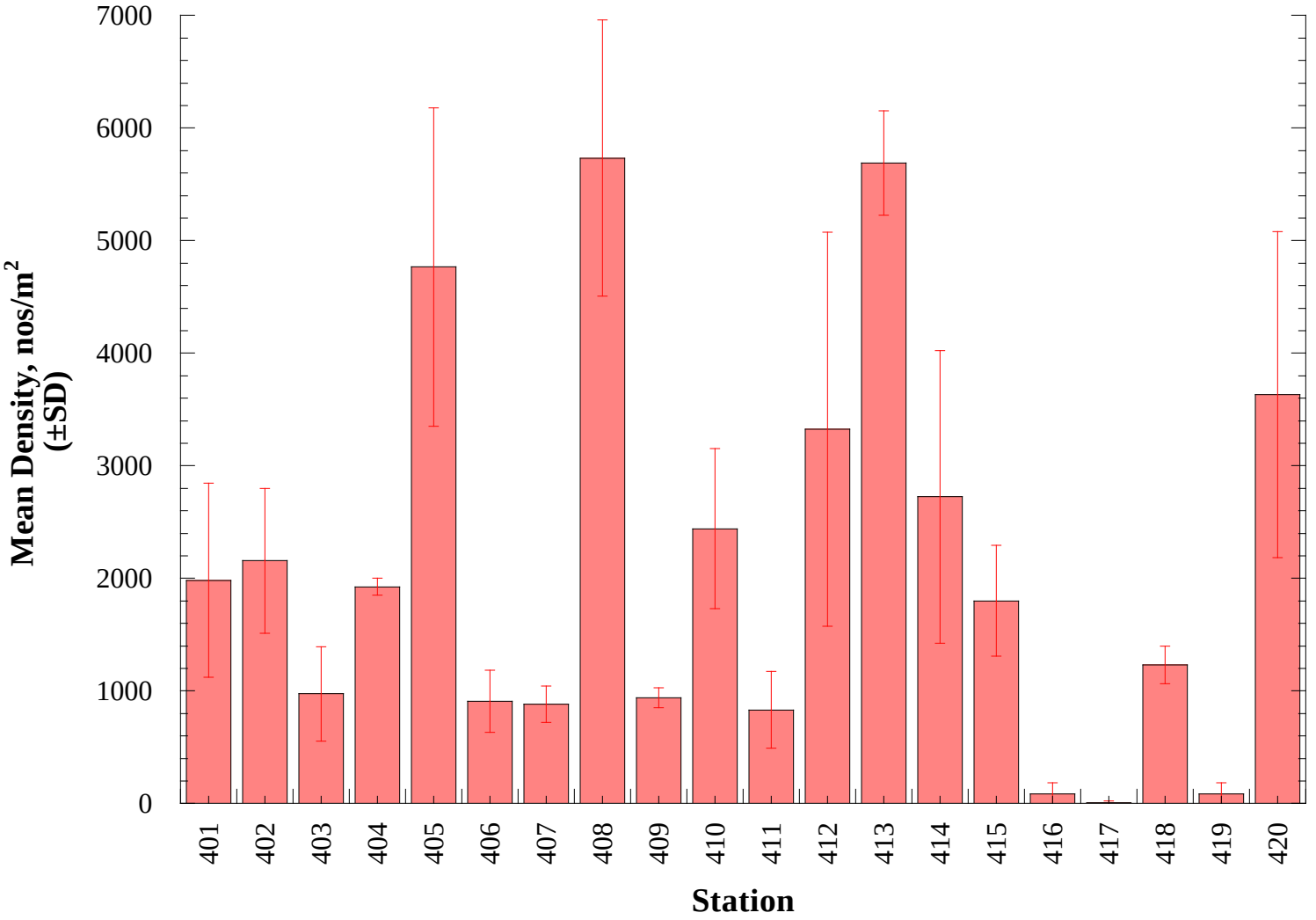

Figure 3. Mean macroinfaunal density for the EMAP Carolinian Province, North Carolina Stations, July 1998.

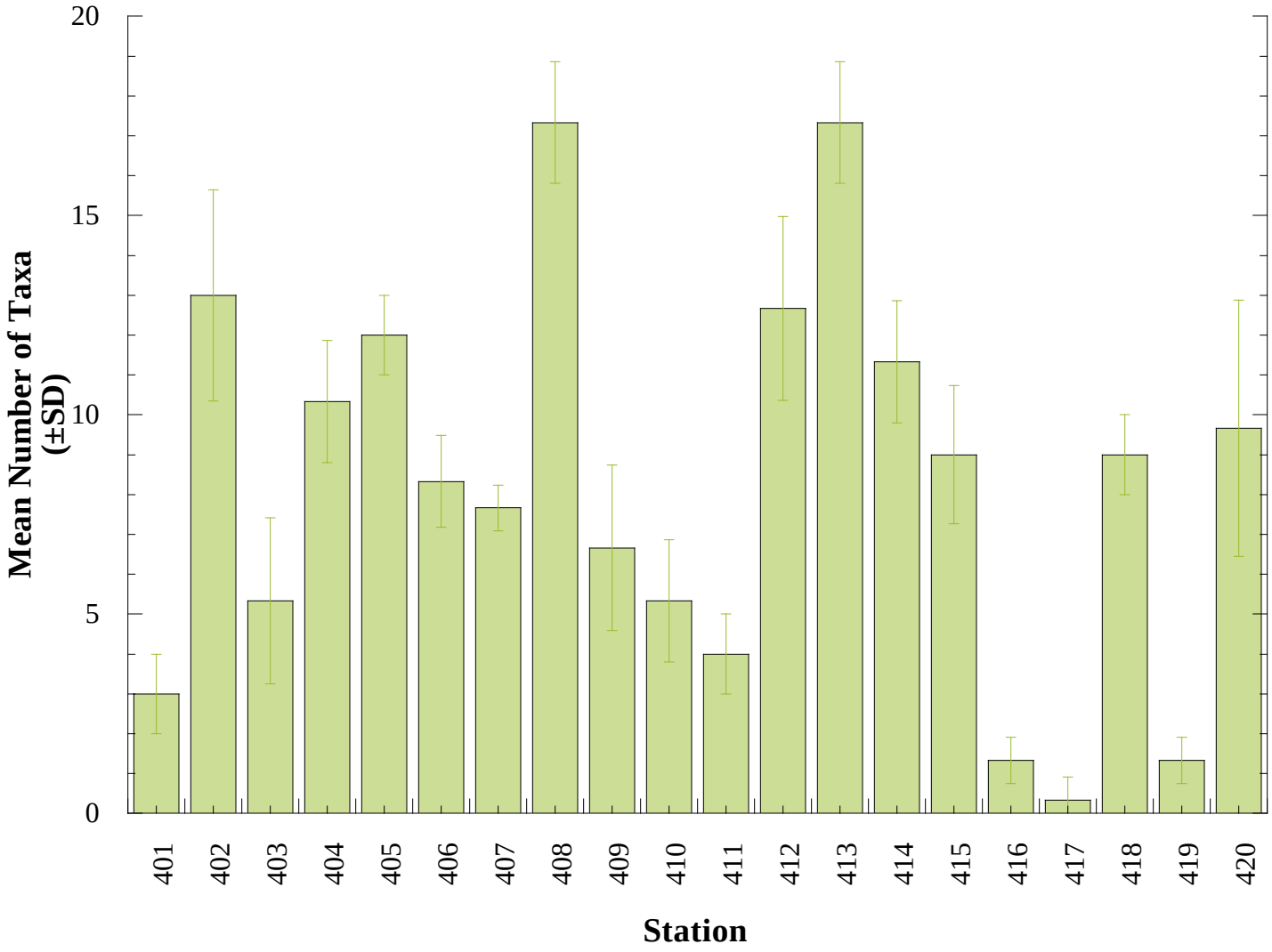

Figure 4. Mean number of macroinfaunal taxa for the EMAP Carolinian Province, North Carolina Stations, July 1998.

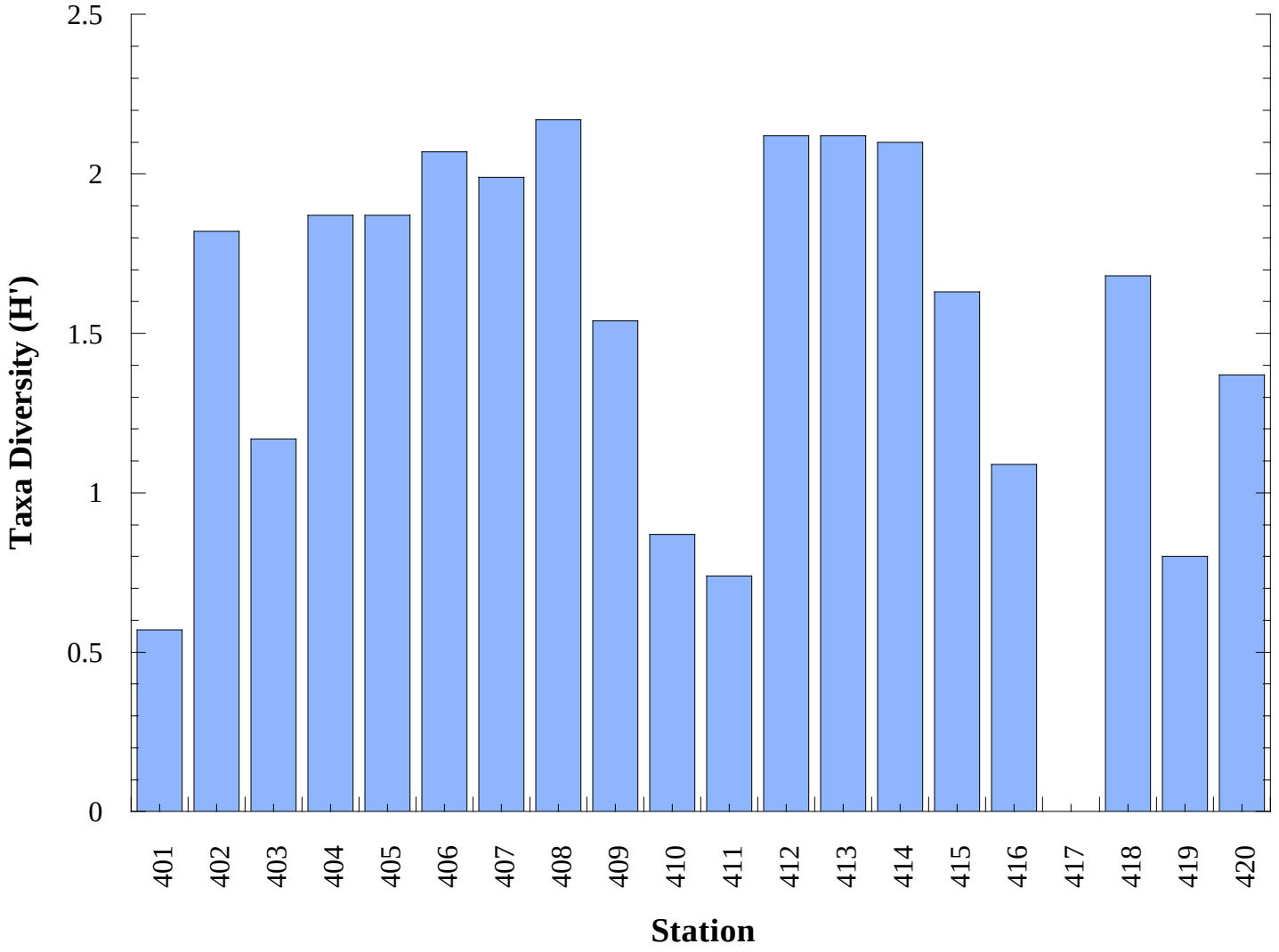

Figure 5. Taxa diversity (H') for the EMAP Carolinian Province, North Carolina Stations, July 1998.

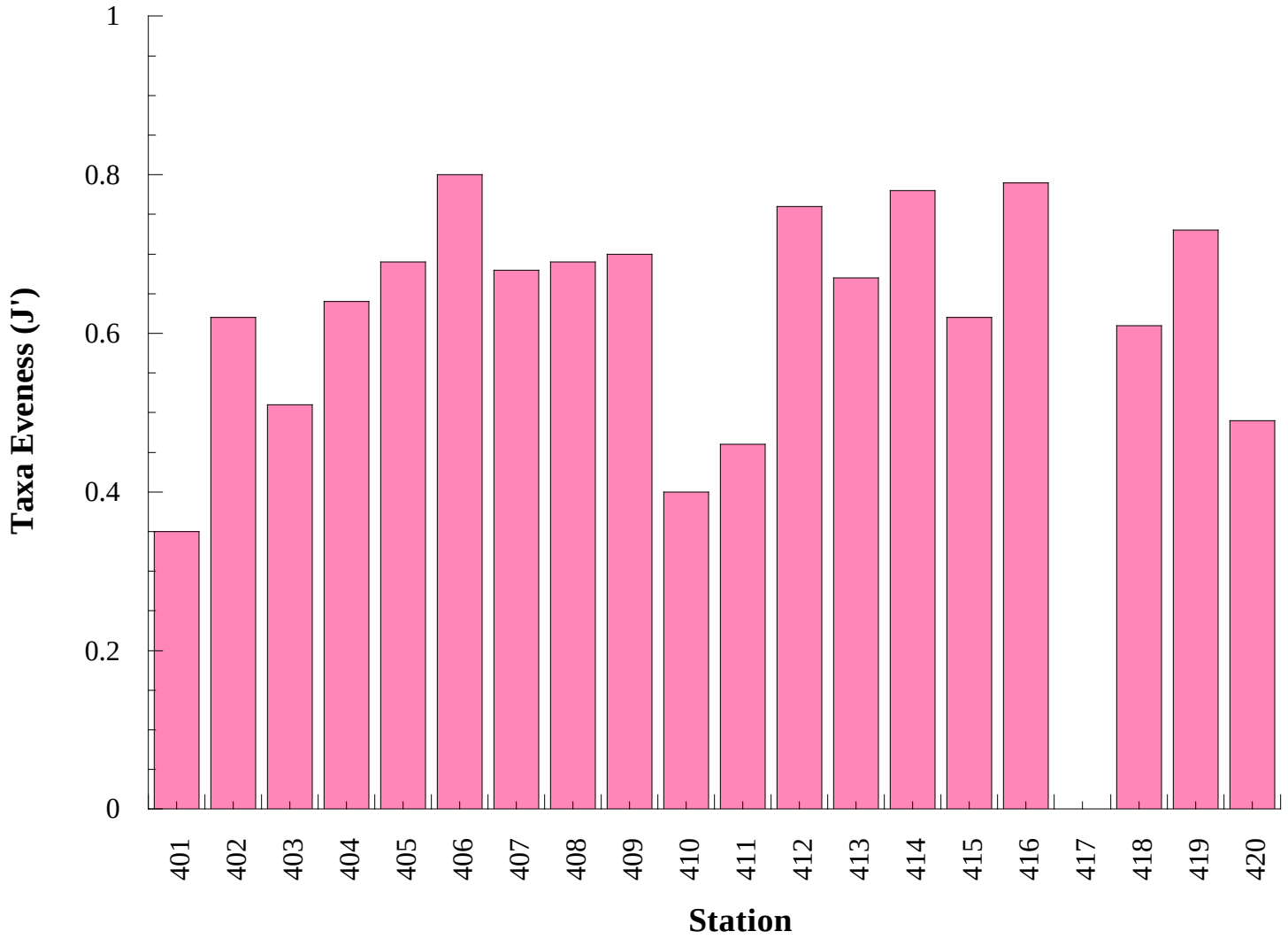

Figure 6. Taxa eveness (J') for the EMAP Carolinian Province, North Carolina Stations, July 1998.

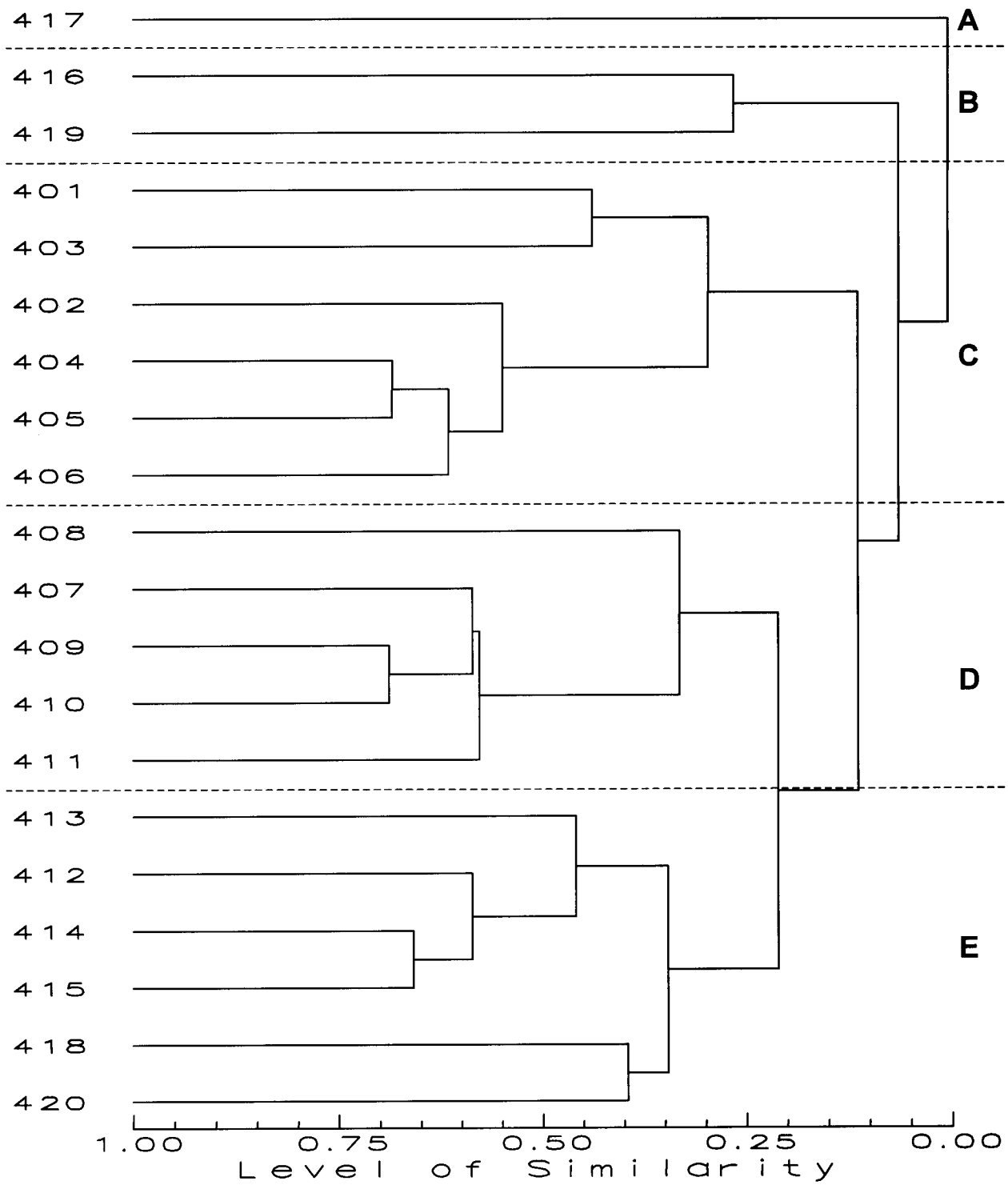

Figure 7. Normal (station) classification analysis for the EMAP Carolinian Province, North Carolina stations, July 1998.

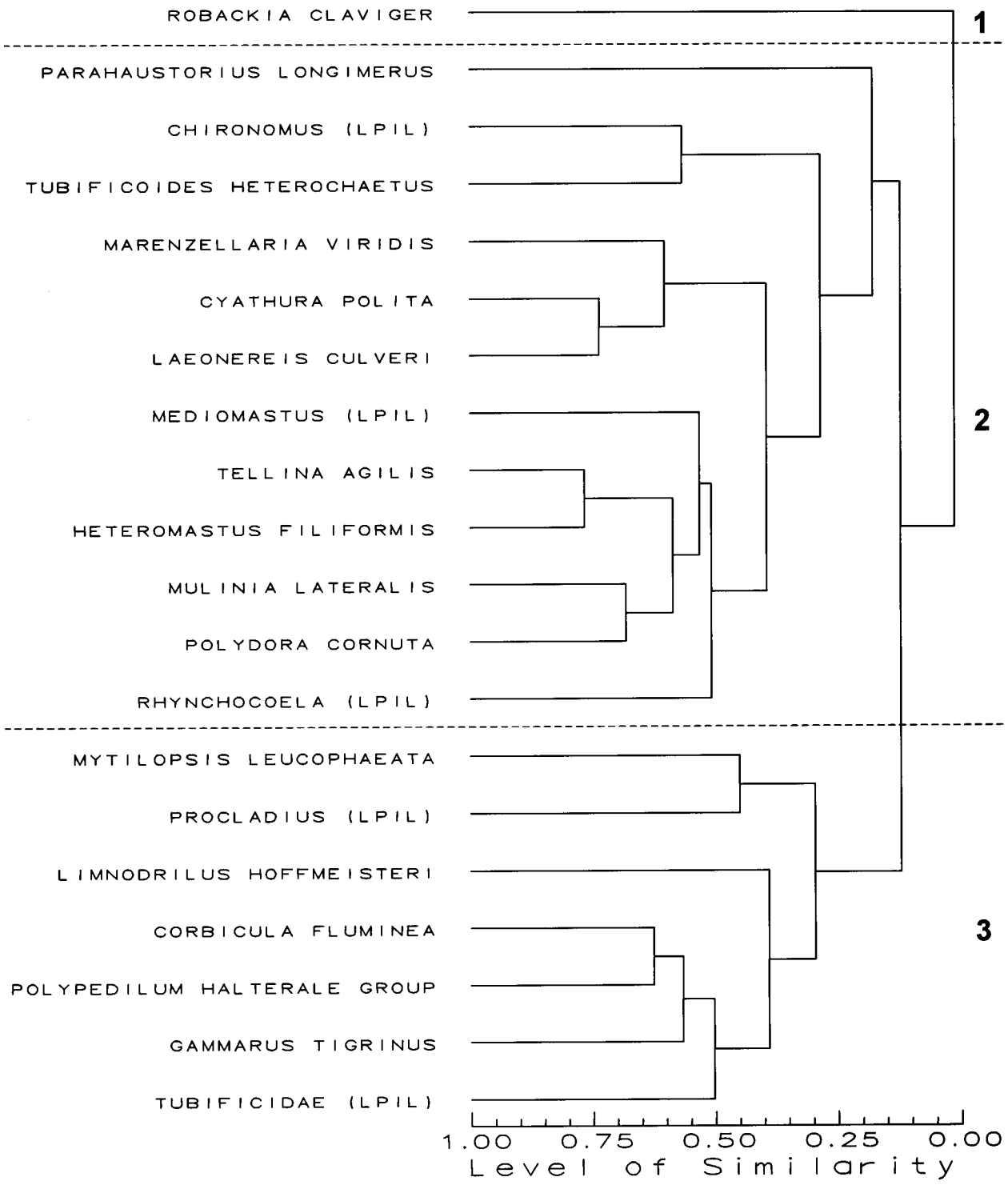

Figure 8. Inverse (taxa) classification analysis for the EMAP Carolinian Province, North Carolina stations, July 1998.

Table 6. Two-way matrix of station and species groups for the EMAP Carolinian Province, North Carolina Stations, July 1998.

	A	B		C						D					E						
	417	**416**	**419**	**401**	**403**	**402**	**404**	**405**	**406**	**408**	**407**	**409**	**410**	**411**	**413**	**412**	**414**	**415**	**418**	**420**	
Robackia claviger				201																	**1**
Parahaustorius longimerus	1														3					251	
Chironomus (LPIL)		1								11	52	44	219	79	3	124		6			
Tubificoides heterochaetus										11	1	19	44			3					
Marenzellaria viridis										152					213	2	93	1	67	15	
Cyathura polita										45					85		4			7	
Laeonereis culveri										4					75		6		1		**2**
Mediomastus (LPIL)											2	34	2			57	18	10			
Tellina agilis															20	46	46	101	42	85	
Heteromastus filiformis															34	32	18	38	1	2	
Mulinia lateralis		6								4			1	2	4	9	55	39		2	
Polydora cornuta										12	4	2	1	7	16	5	42	5			
Rhynchocoela (LPIL)		2	2									2			2	10	3	4	8	1	
Mytilopsis leucophaeata									1	154	1										
Procladius (LPIL)						5	2	6		21	11										
Tubificidae (LPIL)					1	48	23	27	10	20	8	5	9	1	5	44	7	1			
Corbicula fluminea				25	72	127	103	158	21	1		1			1						**3**
Polypedilum halterale group						7	38	184	30	150											
Gammarus tigrinus					3	2	9	57	2			1									
Limnodrilus hoffmeisteri						1		8	15				1								

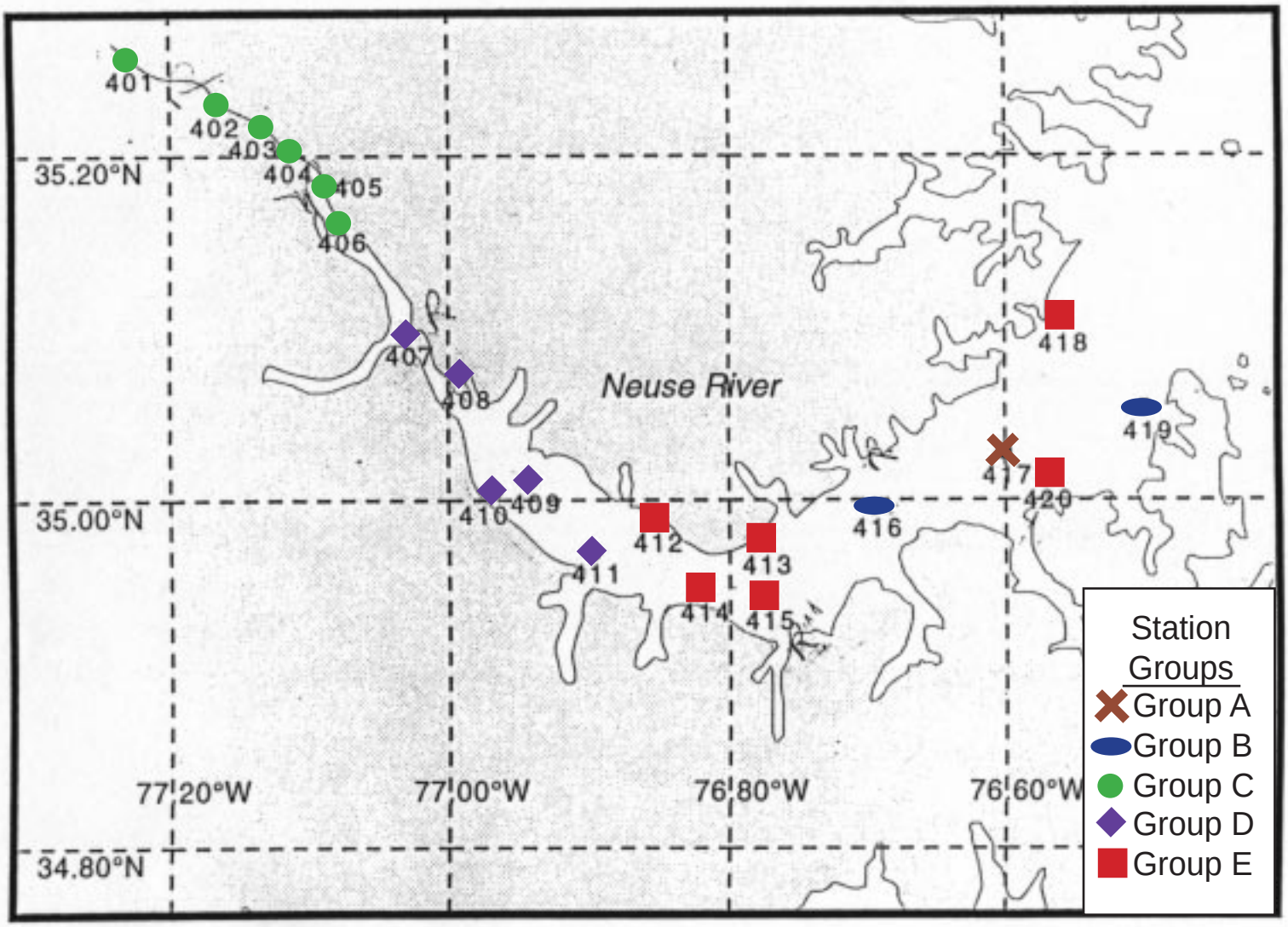

Figure 9. Survey map of station groups for EMAP Carolinian Province, North Carolina Stations, July 1998.

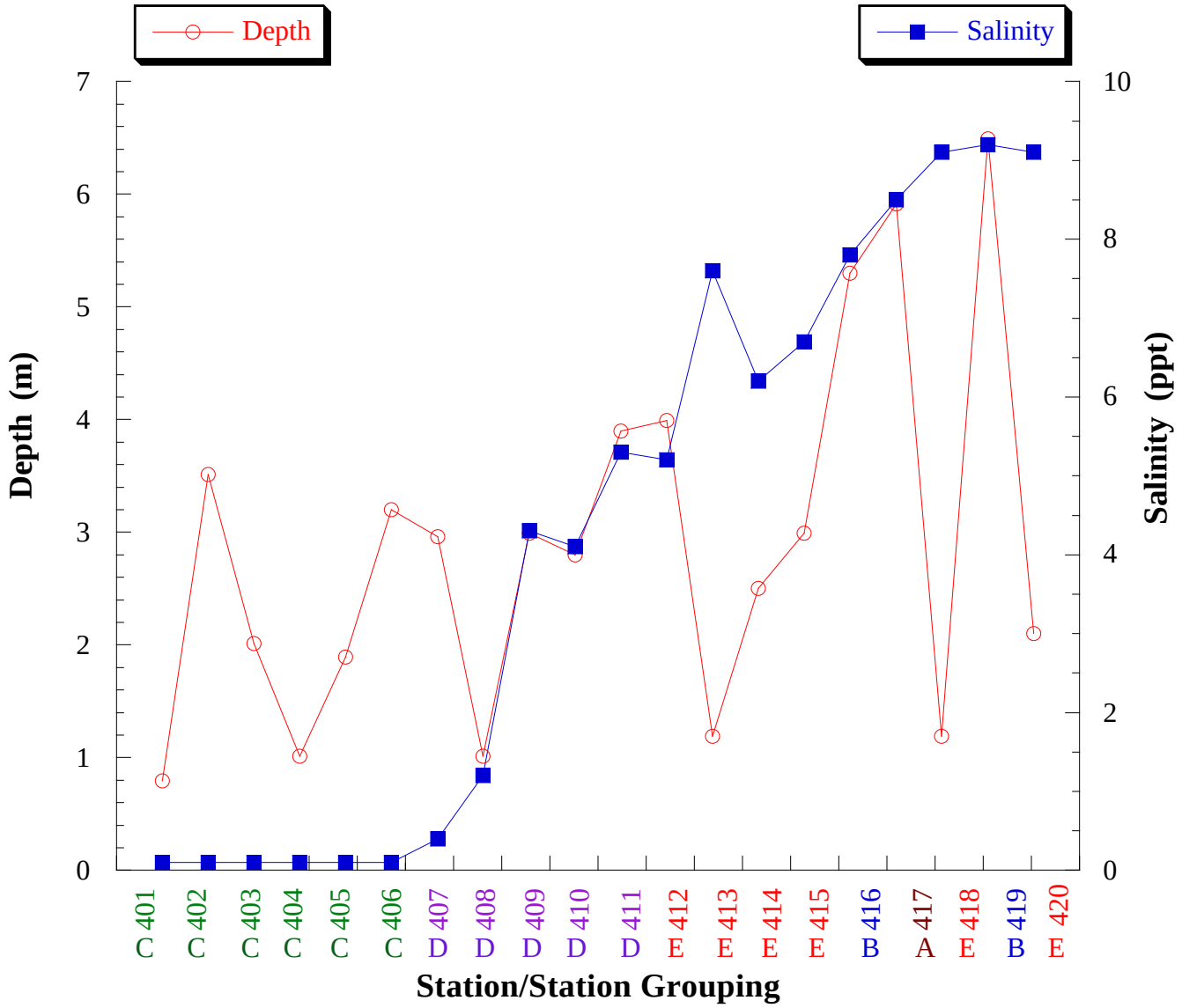

Figure 10. Depth and salinity data for the EMAP Carolinian Province, North Carolina Stations, July 1998.

which is a freshwater species generally inhabiting sandy habitats. Group 2 includes a complex of 12 taxa found in brackish to fully marine waters. Group 3 includes 7 taxa representing freshwater species and brackish water opportunists.

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APPENDIX

QUALITY ASSURANCE STATEMENT

Client/Project NOAA

Work Assignment Title 1998 Carolinian Province-Neuse River

Work Assignment Number Task Number 7

Description of Data Set or Deliverable: 60 Benthic macroinvertebrate samples collected in July 12-17, 1998; 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
Work Assignment Title Carolinian Province 1998
Work Assignment Number CP98 Task Number 7

Sorting Results:

Sample #	% Accuracy
403-3	100%
406-1	100%
406-3	100%
411-3	100%
414-1	100%
414-2	100%
417-2	100%
417-3	100%
418-3	100%

Taxonomy Results:

Sample #	Taxa	% Accuracy
413-3	Crust./Moll.	98.8%
406-1	Crust./Moll.	100%
405-3	Crust./Moll	98%.
410-3	Crust./Moll.	100%
401-3	Crust./Moll.	96%
412-1	Crust./Moll.	96%
413-2	Poly/Misc.	97.8%
415-3	Poly./Misc.	100%
413-1	Poly./Misc.	100%
419-2	Poly./Misc.	100%
412-1	Poly./Misc.	99%
407-3	Poly./Misc.	100%
413-2	Poly/Misc.	96%
418-3	Poly/Misc.	100%
402-1	Insects	100%
406-1	Insects	100%
404-2	Diptera/Oligochaeta	100%
410-2	Diptera/Oligochaeta	100%
405-3	Diptera/Oligochaeta	97.3%
413-3	Diptera/Oligochaeta	100%
402-1	Diptera/Oligochaeta	100%

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

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Signature of QA Officer or Reviewer Date

Identification Level Comments

Taxon Name	Comments
Marenzellaria viridis	
Chironomus (LPIL)	4th instar, associated pupae, or adult needed for species ID
Corbicula fluminea	
Polypedilum halterale group	
Tellina agilis	
Chironomidae (LPIL)	specimen damaged
Parahaustorius longimerus	
Bivalvia (LPIL)	crushed and/or juvenile specimen.
Tubificidae (LPIL)	sexually immature
Robackia claviger	
Mytilopsis leucophaeata	
Cyathura polita	
Heteromastus filiformis	
Mediomastus (LPIL)	anterior portions only, pygidium needed for species ID.
Mulinia lateralis	
Polydora cornuta	
Tellinidae (LPIL)	crushed, and/or juvenile specimens
Laeonereis culveri	
Tubificoides heterochaetus	
Gammarus tigrinus	
Procladius (LPIL)	4th instar, associated pupae, or adult needed for species ID
Gammaridae (LPIL)	immature and/or damaged specimen
Rhynchocoela (LPIL)	no identifible characters.
Coelotanypus (LPIL)	4th instar, associated pupae, or adult needed for species ID
Cryptochironomus (LPIL)	4th instar, associated pupae, or adult needed for species ID
Limnodrilus hoffmeisteri	