State of New Jersey
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BAYNET BIOMONITORING NETWORK

Atlantic Coastal Drainage Basin

South-Central Portion

1996 Benthic Macroinvertebrate Data

New Jersey Department of Environmental Protection
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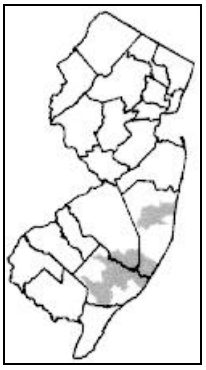
INTRODUCTION

BayNet is an ambient biomonitoring network that was established to gather data on indigenous benthic macroinvertebrate communities inhabiting fresh and saltwater tidal zones in New Jersey's stream and river systems. While a significant store of data has been compiled for the state's inland streams and, to a degree, for its bays and near-coastal waters, such biological/water quality data is particularly lacking for the tidal riverine segments. BayNet forms the tidal component of the Ambient Biomonitoring Network (AMNET) program, conducted by the New Jersey Department of Environmental Protection (NJDEP) Bureau of Freshwater and Biological Monitoring. AMNET incorporates stream macroinvertebrates, largely bottom-dwelling (benthic) communities, as effective indicators of water and/or habitat quality (see NJDEP, 1996). This program was initiated in 1991 to develop a statewide network, with sufficient density of sampling points, to provide adequate data resolution in support of NJDEP's water quality and watershed management efforts. A total of almost 800 non-tidal stream sites were included, to be sampled once every five years. This ambitious effort is made possible by the use of US Environmental Protection Agency Rapid Bioassessment Protocols (USEPA, 1989), which provide an expedient tool for screening, ranking and trend monitoring of a large number of sites. The information gathered is considered valuable to environmental planners for use-attainability assessments according to State Water Quality Standards, and for incorporation into Statewide Water Quality Inventory [305(b)] reports (see NJDEP, 1993). BayNet constitutes a major step toward establishing a biological database for New Jersey's tidal rivers and streams, to complement that which exists for its inland and coastal zones.

Because of its ecological, economic and recreational importance, the Atlantic Coastal basin was selected for the first phase of BayNet sampling. Perspective of the study area is shown in the map below.



Map of Study Area

METHODS

Site Selection

Initial sampling for the BayNet project was conducted in the summer of 1996. As time and personnel constraints prohibited complete coverage of the State's tidal rivers in just one season, the first round of sampling was directed toward the Atlantic coastal drainage; this has been an area of particular interest for ecological and economic, as well as recreational and cultural, reasons. An upper site (freshwater, head-of-tide) and lower site (brackish or saltwater, just above the river mouth) were sampled in each of seven major stream systems, as follows: Toms River and Cedar Creek, which drain into Barnegat Bay; Tuckerton Creek, which drains into Little Egg Harbor Bay; the Wading River, which drains into the lower Mullica River, which drains into Great Bay; Absecon Creek, which drains into Absecon Bay; and the Great Egg Harbor River, which drains into Great Egg Harbor Bay (Maps 1 thru 8). Accessibility, i.e. closest access points to head-of-tide and to the lower most riverine sites, were contributing factors to site location on each estuary. Latitude and longitude at all locations were determined via satellite, using Global Positioning System units (Table 1).

Field and Analytical Methods

Field methods were in conformance with those given in (NJDEP, 1992) and (USEPA, 1989) for macroinvertebrate collections. All BayNet sampling was done by boat, thus requiring considerably more time than the AMNET sites which, for the most part, are wadeable. Field observations taken included turbidity, macrophyte presence and substrate composition; these and other pertinent measurements and observations are recorded for each site in Appendices A and B. Laboratory methods were conducted following Standard Operating Procedures (SOP) of the NJDEP Aquatic Biomonitoring Laboratory, based on RBPII protocols (USEPA, 1989) for the freshwater tidal sites, and USEPA (1990) for the salt (brackish) water sites.

A qualitative or semi-quantitative, multihabitat macroinvertebrate sample was collected from the freshwater tidal zone, an area where certain fish species are known to spawn. A hand-held, #30 mesh net was used to take macroinvertebrates from the stream bottom and banks, and from macrophytes and snags, if present. The extent of the area sampled varied at the discretion of the sampler, and with the availability of habitat, in order to obtain at least a 100-organism sample. For each sample, a subsample of 100 organisms (or more) was sorted out. Under 7 - 400X magnification, macroinvertebrates were identified to species (where possible) and counted. A collection of taxonomic references used is maintained in our laboratory and listed in the laboratory Standard Operating Procedure manual. Biometric data analysis, however, employed just family level taxonomy (Table 2).

Twelve quantitative samples were collected from the brackish/salt waters just upriver from the bay, at sites generally shallow enough to support submerged aquatic vegetation (which can provide a favorable environment for benthic invertebrates and small fish). This is an area where detrital matter, nutrients, and pollutants tend to concentrate. This lower subestuary site, in all cases, was at least 1,000 feet above the mouth of the stream. Twelve Petite Ponar Dredge samples were collected across the stream in 3 clusters (left, middle, and right), each consisting of 4 grabs. When possible, 1 cluster was taken amid submerged aquatic plants. Collections were made during or near low tide to ensure that sampling points were continuously submerged (i.e., the intertidal zone was avoided). In each sample, the entire complement of organisms was identified and counted under 7 - 400X magnification. Macroinvertebrates were identified to species, wherever possible. Species level taxonomy, which drew heavily from Gosner (1971), was employed in the data analysis (Table 3).

Site Assessment

In evaluating the quality of the segments sampled, the results obtained were judged against the criteria for designated "use attainability" (e.g., fishability, swimmability) for the respective areas (USEPA, 1983; NJDEP, 1993). Assessment of use-attainability in the tidal freshwater zone was based upon a Protocol II rapid bioassessment of the study area (see Table 2). A nonimpaired classification implied that the stream segment had met its designated use; if moderately impaired, the stream segment was considered to have partially met its designated use; and, if, severely impaired, the stream segment was judged as having failed to meet its designated use. Assessment of use-attainability in the tidal brackish water zone was based upon the area's suitability to sustain commercially or recreationally important fish and shellfish species (USEPA, 1983) assuming trophic relationships with macroinvertebrate species found (Festa, 1979). Finfish were not collected for this study; therefore, the diversity and abundance of macroinvertebrate species that serve as their prey (see Table 4) determined their potential presence. Important fish species were *Pseudopleuronectes americanus* (winter flounder), *Paralichithys dentatus* (summer flounder), *Pomatomus saltatrix* (bluefish), *Morone saxatilis* (striped bass), *Anguilla rostrata* (American eel), *Cynoscion regalis* (weakfish), and *Morone americana* (white perch). Indigenous macroinvertebrate species of commercial or recreational importance included *Crassostrea virginica* (eastern oyster) and *Callinectes sapidus* (blue claw crab). These are all resource species generally sought by commercial and/or recreational fishermen in the region (see Hildebrand, 1972; USEPA, 1983).

Benthic macroinvertebrate community structure is normally influenced by several environmental factors such as substrate type, rate of tidal flushing, type or amount of riparian vegetation, and salinity levels. For example, diversity and abundance are lower with a silt and clay substrate, and increase when coarser sediments predominate; certain mollusks, such as *Mya arenaria* (softshell clam), are not found in a silt and clay substrate as they prefer sand. Salinity also significantly affects diversity. Diversity is theoretically at a minimum at a salinity of about 7 ‰, and increases with more or less salinity. Thus, the river segments that range from fresh to brackish (dependent on the stage of the tide) would exhibit the fewest benthic species. Diversity can also be influenced according to surrounding land use(s) and other water quality/habitat perturbations of anthropogenic origin. Also, relative abundance of certain taxa (e.g., insect orders EPT*/Diptera in freshwater) can indicate good or poor quality. In estuaries, ratios of annelids to crustaceans and annelids to mollusks are indicators of environmental stress levels, a lower ratio indicating less stress. Crustaceans are among the first organisms to be eliminated by pollution, then mollusks; annelids tend to be pollution tolerant (see Gosner, 1971; Tait, 1983; USEPA, 1989; Day, 1989).

* = Ephemeroptera, Plecoptera, Trichoptera

RESULTS AND DISCUSSION

Results of sample and data analysis, field observations and measurements are presented in Appendix A for the freshwater sites and Appendix B for the saltwater sites. Appendix C includes a taxonomic list of species from the freshwater sites, where the data analysis employed just family level taxonomy. Statistics and functional groupings for the saltwater sites are given in Table 3. A discussion of results follows for each stream system sampled:

Toms River (Map #1)

The Toms River tidal freshwater segment (BN0001) received an RBP score of 24, and thus was categorized as nonimpaired. Of the 28 families recovered, 10 were EPTs. This segment, therefore, has met its designated use.

The tidal brackish segment (BN0003) displayed several deficiencies. The sample contained nine taxa, the lowest number recovered from all the brackish sites. Macrophytes and macroalgae were absent from the samples. Crustaceans constituted merely 2% of the sample population. Mollusks were absent from the samples, even though the substrate appeared to be a preferred type. Annelids and crustaceans constituted 94% and 2% of the samples, respectively. This high ratio of environmental stress indicators suggested a pollution problem in the subestuary. Fish prey was represented by six species of annelids that potentially would provide food for four primary and three secondary level predators. The low populations of annelids, however, would limit the propagation of important fish species. Productivity has likely been limited by surrounding urban and suburban development, as well as by a lack of riparian vegetation. Additionally, the dredging of this segment in the fall of 1995 has probably caused further reduction in diversity and density of organisms, primarily in the middle sample area. This site, therefore, has failed to meet its designated use.

Wrangle Brook (Map #1)

Wrangle Brook's tidal freshwater segment (BN0002) received an RBP score of 15, with a classification of moderately impaired. Only two of the thirteen families recovered were EPTs. This segment is likely subject to increased salinity during low flow periods, which would be detrimental to EPT families. A previously sampled AMNET site (AN0539), situated at the head of tide and with a nonimpaired rating, may provide a more reliable bioassessment of Wrangle Brook's tidal zone, and should possibly replace BN0002. Based on available data, this segment has met its designated use. The brackish water zone is downstream of Wrangel Brook's confluence with the Toms River.

Cedar Creek (Map #2)

Cedar Creek's tidal fresh water segment (BN0004) received an RBP score of 21, positioning its classification at the "moderately impaired" borderline. Closer examination showed that this segment could realistically be categorized as approaching nonimpaired. The population was diverse (23 families), EPT families (10) were well represented, and no deficiencies were uncovered. Designated use status was thus attained.

The tidal brackish segment (BN0005) displayed an excellent species diversity (3.8) and a healthy population density (243 ind/sq ft). Thirty-nine taxa were recovered. The segment flows between two artificial lagoon systems where many boats are moored. The channel was last dredged in 1989. Approximately half of the subestuary riparian zone is developed; the remainder consists of man-made

woodland or salt marsh. The undeveloped tract provides detritus, which is utilized by pollution-intolerant crustaceans. A variety of crustaceans constituted one-third of the sample. The growth of red and green macroalgae on the substrate reflected low water column turbidity. Filterers, which normally dominate in an estuarine environment, constituted 77% of the sample. A low annelids/crustacea (0.54) ratio indicated nonpolluted conditions. The substrate, being mostly detritus, was not conducive to mollusks, hence their low numbers. Fish food organisms were represented by 14 taxa, which potentially provide food for 7 primary and 4 secondary level predators. This was the only site where *Callinectes sapidus* (blue claw crab) was recovered. The population density appeared adequate to support the propagation of commercial/recreational fish species. This segment, therefore, met its designated use.

Tuckerton Creek (Map #3)

Tuckerton Creek has no tidal fresh zone. Nonetheless, a site (BN0006) was selected a few hundred feet downstream of the dam (head of tide) at Route 9, where the north shore is bulkheaded, and the south shore is mostly wooded or otherwise vegetated. Using a rectangular net from a boat, a qualitative collection was made, sampling at intervals along the south shore for a distance of approximately 300 feet. Of the 1,402 organisms recovered, 27 taxa were represented, including 10 species of insects. The dominant species was the dipteran *Nilodorum devineyae*, a midge fly that is tolerant of brackish waters. Annelids and crustaceans were abundant. Fish food organisms comprised 13 taxa that potentially provide food for six primary and three secondary level predators. *Callinectes sapidus* (blue claw crab) was observed during a previous visit. The macroinvertebrate population appeared adequate to support the propagation of important fish species, which was deemed consistent with designated use status.

The tidal brackish segment (BN0007) exhibited good diversity (36 taxa) and a healthy population density (1214 ind/sq ft). Low species diversity (1.6) and equitability (0.1) indices implied impaired conditions, reflecting the high proportion of one species in the sample. The particular species, *Ampelisca abdita*, is, however, a pollution intolerant crustacean (USEPA, 1983). Crustaceans, mostly filtering species, made up 79% of the sample. The substrate, consisting mostly of detritus, was ideal for these crustaceans (the creek hasn't been dredged in 20 years). The salt marsh on the south shore provides a detrital source; the bulkheaded north shore, with its many boat yards, appeared not to be having a negative effect on the macroinvertebrate community. The low annelids/crustacea (0.19) ratio indicated nonpolluted conditions. Mollusks, however, were few in number. Fish food organisms comprised 15 taxa potentially providing food for six primary and four secondary level predators. Red algae was present in the samples. The invertebrate population was more than adequate to support the propagation of commercial fish species; this segment thus met its designated use.

Wading River (Map #4)

Wading River's tidal fresh water segment (BN0008) received an RBP score of 18, categorizing it as moderately impaired. No outstanding deficiencies were noted; however, the very low percentage of EPT families we found, in this relatively pristine area, suggests some subtle impact on the macroinvertebrate community. Naturally low productivity, as typically assumed for acid Pine Barrens waters, may not account for this, as many other sites in the region have exhibited high production, as well as diversity (NJDEP, 1996). This segment partially met its designated use.

Although Wading River's tidal brackish segment (BN0009) displayed fair to good species diversity (2.8) and equitability (0.7) indices, the total number of species, as well as the population density (50 ind/sq ft), was low; albeit, even in the presence of an adjacent salt marsh to provide a source of food for crustaceans. Because of the detrital substrate, the high annelids/mollusks (6.8) ratio that we found was

not unpredictable. Salinity, which was 7.5 ‰ at the time of sampling, may have restricted diversity (since, theoretically, diversity is at a minimum when salinity is at 7 ‰). Toxicity may be contributing to the paucity of organisms, as cranberry bogs are located upstream of site BN0008, and USGS (1996) has found evidence of pesticide contamination in this segment, as far down river as site BN0009. Fish food organisms were represented by seven taxa that would potentially provide food for eight primary and four secondary level predators. This site failed to meet its designated use since the population density was inadequate to sustain a viable commercial fishery.

Mullica River (Maps #5 & # 6)

Mullica River's tidal freshwater segment (BN0010) had an RBP score of 21, placing it in the category of borderline, moderately impaired. Closer examination showed that this segment should actually be categorized as approaching nonimpaired. The population was diverse (28 families) and no deficiencies were uncovered. This segment, therefore, met its designated use.

The tidal brackish segment (BN0011) displayed low species diversity (1.3) and equitability (0.1) indices, and thus, was rated severely impaired. Even though 23 taxa were recovered, 94% of the sample population was represented by filter feeding hydroids and bryozoans. Although filterers should predominate in the subestuary, a significant portion of this group should also include the pollution intolerant mollusks and crustaceans. About two-thirds of the sampled substrate (detritus) appeared favorable for crustaceans and annelids, and the remainder (hard bottom) favorable for mollusks; yet, crustaceans and annelids each made up only 2% of the sample, and mollusks <1 %. Pollution would favor the annelids over the crustaceans, but both were low in number. USGS (1996) has found evidence of pesticide pollution in this river. Cranberry bogs, and other agricultural operations upstream of this site, are possible sources of degradation. Fish food organisms comprised 11 taxa that would potentially provide food for seven primary and four secondary level predators; however, the population density was not adequate to support a significant fishery. Only one important molluscan species, *Crassostrea virginica* (oyster), was present, represented by 13 individuals. Based on our findings, this site failed to meet its designated use.

Absecon Creek (Map #7)

Absecon Creek's tidal fresh segment (BN0012) received an RBP score of only six (6), rating it as severely impaired. Only eight families, including one EPT family, were recovered. This segment failed to meet its designated use.

The tidal brackish segment (BN0013) exhibited fairly good species diversity (3.1) and equitability (0.6) indices. Bryozoans constituted 26% of the sample. Overall, filtering organisms constituted 43% of the sample. Low numbers of pollution intolerant filtering crustaceans and mollusks were attributed, at least in part, to the hard clay substrate. Pollution tolerant, deposit-feeding annelids made up 42% of the sample. An insignificant amount of detritus in the samples suggested that the adjacent salt marsh was an inadequate source of consumables. Additionally, the swift flow in the deep, narrow channel expedited the removal of detritus. This segment is bordered on three sides by the town of Absecon, and the area upstream is in a state of ongoing development. Contaminants in storm water runoff are a likely source of degradation to this segment. Fish prey was represented by nine taxa, potentially providing food for six primary and four secondary level predators but, again, their population density appeared inadequate to sustain a significant fishery. This segment, therefore, failed to meet its designated use.

Great Egg Harbor River (Map #8)

The Great Egg Harbor River's tidal fresh segment (BN0014) had an RBP score of 21 and received a borderline rating of moderately impaired. Thirty-one percent of the sample was comprised of EPT taxa, and no deficiencies were noted. This site would be more realistically categorized as approaching nonimpaired; as such, this segment was meeting its designated use.

The tidal brackish segment (BN0015) displayed good diversity (3.6) and equitability (0.9) indices, but the population density was very low. Considering the extensive salt marsh and upstream-forested areas, this segment's production should have been greater. Filterers, representing several different taxa, predominated in our samples. However, despite the favorable substrate, both crustaceans (generally pollution-sensitive) and annelids (generally pollution-tolerant) were low in numbers. USGS (1996) has uncovered evidence of pesticide contamination in this river (agriculture is one possible source). Although ratios of crustaceans and mollusks to annelids indicated little stress, the low population density implied a general stress on the entire community. Fish prey comprised eight taxa, which would potentially provide forage for five primary level predators and three secondary level predators, but their population density was inadequate to sustain a viable fishery. Based on these results, this site failed to meet its designated use.

SUMMARY

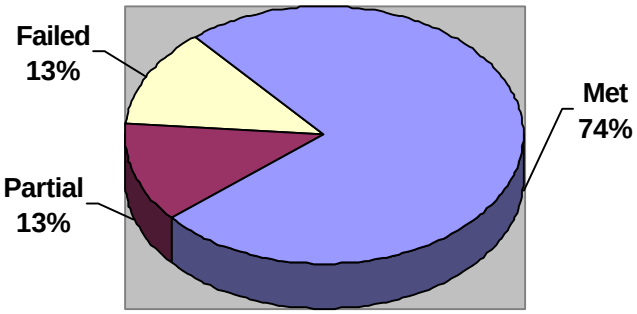
Of all 15 sites sampled, eight met their use-attainability criteria. Of eight freshwater sites, six qualified and one partially qualified for use attainability, while only one site failed to meet its designated use. In contrast, of the seven salt (brackish) water sites, only two (Cedar Creek and Tuckerton Creek) attained designated use status, while the other five failed to do so (Figure 1). Only Absecon Creek failed in both its freshwater and saltwater segments. Four of the five saltwater sites that failed were in the southern portion of the sampling range.

The influence of environmental factors was seen in our results. Three of the five saltwater sites that failed were in the low salinity range (7 - 10 ‰), which is associated with low species diversity. Substrate types had an apparent effect on species composition, as well as numbers of individuals. Detrital bottoms in the estuaries, as do heterogeneous substrates in the freshwater, tended to harbor more species (mollusks being an exception), and more individuals of certain species, than the more homogeneous (sand-silt) bottoms. Of the functional groupings, filter feeders, and to a lesser degree, other detrital or deposit feeders, constituted a majority of the populations recovered at most estuarine sites. Hard (clay) bottom appeared to restrict the number of species, or individuals, which might colonize it. Some possible indirect effects of riparian conditions (e.g., vegetation, agriculture, suburbanization) were also noted.

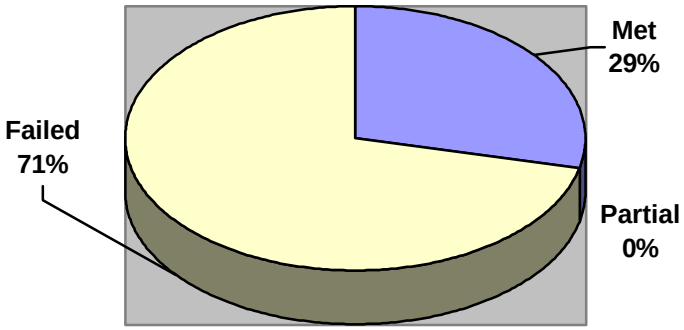
For future surveys, it may be advisable to sample a greater area (or greater number of transects), covering multiple habitats and salinity ranges, within a tidal stream/river segment. Further field study and research also is needed to develop a more definitive scheme for biometric and habitat assessment of our tidal riverine systems.

BayNet 1996

Freshwater



Brackish Water



Total

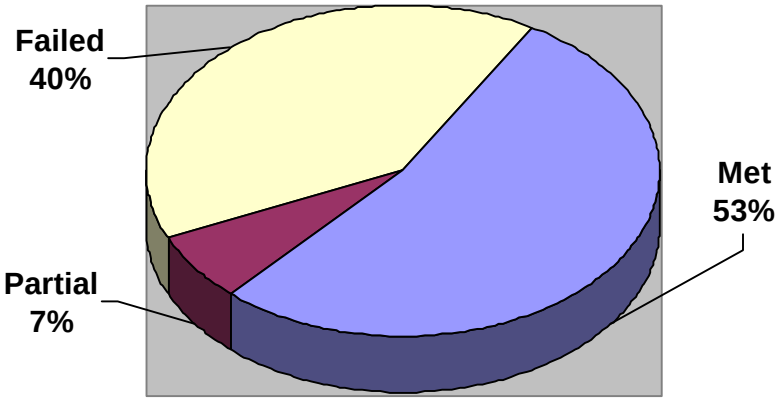


Figure 1 **Pie charts illustrating relative numbers (%) of freshwater & brackish water sampling locations that met, failed or partially met their designated uses.**

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Table 1 List of sampling stations for the 1996 BayNet survey

BN0001 .....Toms River; tidal freshwater, ~3/4 miles downstream of Oakridge Parkway, Dover Township, Ocean County; Toms River quadrangle (USGS); latitude 39° 57' 40.423", longitude 74° 12' 37.533".

BN0002 .....Wrangle Brook; tidal freshwater, ~1000 feet upstream of Toms River confluence, Berkeley Township, Ocean County; Toms River quadrangle (USGS); latitude 39° 57' 03.701", longitude 74° 12' 35.670".

BN0003 .....Toms River; tidal brackish water, across estuary from Pine Beach Point to Cranmoor Country Club, Ocean County; Toms River quadrangle (USGS); latitude 39° 56' 41.344", longitude 74° 10' 45.735".

BN0004 .....Cedar Creek; tidal freshwater, ~1000 feet downstream of Route 9, Lanoka Harbor, Ocean County; Forked River quadrangle (USGS); latitude 39° 52' 06.421", longitude 74° 09' 58.056".

BN0005 .....Cedar Creek; tidal brackish water, ~1/2 mile downstream of Route 9, Ocean County; Forked River quadrangle (USGS); latitude 39° 52' 10.339", longitude 74° 09' 16.071".

BN0006 .....Tuckerton Creek; tidal brackish water, ~600 feet downstream of Route 9, Tuckerton, Ocean County; Tuckerton quadrangle (USGS); latitude 39° 35'53.598", longitude 74° 20' 25.272".

BN0007 .....Tuckerton Creek; tidal brackish water, ~2000 feet upstream of mouth, Tuckerton, Ocean County; Tuckerton quadrangle (USGS); latitude 39° 34' 56.131", longitude 74° 20' 20.401".

BN0008 .....Wading River; tidal freshwater, ~1 mile downstream of Harrisville, nr Bodine Field, Bass River Township, Burlington County; Jenkins quadrangle (USGS); latitude 39° 39' 02.189", longitude 74° 31' 07.892".

BN0009 .....Wading River; tidal brackish water, ~1/2 mile upstream of mouth, Burlington County; New Gretna quadrangle (USGS); latitude 39° 33' 55.205", longitude 74° 28' 38.465".

BN0010 .....Mullica River; tidal freshwater, ~1/2 mile downstream of Pleasant Mills, Washington Township, Burlington County; Atsion quadrangle (USGS); latitude 39° 38' 22.876", longitude 74° 39' 32.993".

BN0011 .....Mullica River; tidal brackish water, ~1000 feet downstream of Route 9, Burlington County; New Gretna quadrangle (USGS); latitude 39° 33' 03.874", longitude 74° 27' 37.281".

BN0012 .....Absecon Creek; tidal freshwater, ~500 feet downstream of Mill Road, Atlantic County; Pleasantville quadrangle (USGS); latitude 39° 25' 42.825", longitude 74° 31' 12.847".

BN0013 .....Absecon Creek; tidal brackish water, ~1/2 mile upstream of mouth, Faunces Landing, Atlantic County; Oceanville quadrangle (USGS); latitude 39° 25' 34.381", longitude 74° 29' 15.607".

BN0014 .....Great Egg Harbor River; tidal freshwater, ~2500 feet downstream of Mays Landing, Atlantic County; Mays Landing quadrangle (USGS); latitude 39° 26' 37.294", longitude 74° 43' 24.311".

BN0015 .....Great Egg Harbor River; tidal brackish water, ~2 miles upstream of mouth, Atlantic County; Marmora quadrangle (USGS); latitude 39° 19' 04.668", longitude 74° 39' 17.248".

Table 2: Data analysis methods for assessment of water / habitat quality of freshwater sites (BayNet and AMNET surveys) based on RBP-II protocols.

Biological impairment (most typically caused by organic enrichment) can be assessed using "biometrics" which measure different components of community structure, including population and functional parameters, and have different ranges of sensitivity to stress (Klemm *et al*., 1990). The use of more different metrics assures a more valid assessment; the results (based on 100-organism subsamples) are integrated through common scoring criteria, derived from an established comparable database, to give an overall numerical rating. For RBP II protocols, scoring criteria have been adjusted and validated for family level taxonomy, with three final condition categories (nonimpaired, moderately and severely impaired). The biometrics we employ (listed below) are modified from Plafkin *et al.* (1989) and follow Kurtenbach (1991):

Total Taxa or **Taxa Richness** (total # families) — an index of community diversity; the # usually increases with increasing water or habitat quality.

E+P+T Index (EPT) — the # families represented within the orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera[1] (caddisflies), which are generally pollution-sensitive.

Percent Dominance (%CDF) (to the total # families) — domination by relatively few species / families would indicate environmental stress.

Percent EPT (to the total # families) — would increase with increasing water quality.

Modified Family (Hilsenhoff) **Biotic Index** (FBI) — tolerance values of 0 - 10 assigned to individual families increase as water quality decreases; summarizes the overall (organic) pollution tolerance of the entire benthic macroinvertebrate community with a single value.

The individual biometrics and respective scoring criteria (above) have been statistically validated for New Jersey by Kurtenbach (1991) based on data from 200 sites throughout the state.

Table 2 is continued on the following page.

[1] includes the family *Hydropsychidae* (deleted by Kurtenbach, 1991)

TABLE 2

CRITERIA FOR SCREENING WATER AND HABITAT QUALITY IN NEW JERSEY FRESHWATER STREAMS*

Scoring Criteria For Rapid Bioassessments[1]

Biometrics	6	3	0
Taxa Richness (total Families)	> 10	10-5	4-0
E + P + T Index[2] (EPT)	> 5	5-3	2-0
Percent Dominance[3] (%CDF)	< 40	40-60	> 60
Percent EPT[4] (%EPT)	> 35	35-10	< 10
Modified Family Biotic Index[5] (FBI)	< 5	5-7	> 7

NOTE: The previous AMNET reports (1994-1996) contained incorrect number ranges for Modified Family Biotic Index. Using the incorrect numbers could lower the biological assessment on 9% of the sites evaluated. The numbers now presented in this table are correct and scores from previous reports were calculated using these ranges. No incorrect biological assessments exist in the previous reports.

Biological Assessment	**Total Score**
Nonimpaired	24-30
Moderately Impaired	9-21
Severely Impaired	0-6

Attributes

Nonimpaired: Benthic community comparable to other undisturbed streams within the region. A community characterized by a maximum taxa richness, balanced taxa groups, and good representation of intolerant individuals.

Moderately Impaired: Macroinvertebrate richness is reduced, in particular EPT taxa. Taxa composition changes result in reduced community balance and intolerant taxa become absent.

Severely Impaired: A dramatic change in the benthic community has occurred. Macroinvertebrates are dominated by a few taxa, which are very abundant. Tolerant taxa are the only individuals present.

*From Kurtenbach, 1991, based on USEPA, 1989
[1] Follows RBP Protocol II; using 100 organism subsample, family level taxonomy
[2] Ephemeroptera, Plecoptra, Trichoptera
[3] % contribution of the dominant family
[4] Including the hydropsychid family
[5] Also known as the Hilsenhoff Biotic Index

Table 3. Statistics, feeding niches, and environmental stress indicators for saltwater sites in the 1996 BayNet survey

Site ID >	BN0003	BN0005	BN0007	BN0009	BN0011	BN0013	BN0015
Number of Taxa (species)*	9	39	36	14	23	20	21
Number of Individuals	207	729	3642	150	2630	378	172
Species Diversity*	2	3.8	1.6	2.8	1.3	3.1	3.6
Equitability*	0.6	0.5	0.1	0.7	0.1	0.6	0.9
Filter Feeders (# (%))	0 (0)	562 (77)	2952 (81)	2 (1)	2567 (98)	163 (43)	109 (63)
Detritivores (# (%))	0 (0)	37 (5)	45 (1)	47 (31)	4 (<1)	29 (8)	8 (5)
Predators (# (%))	40 (19)	78 (11)	418 (11)	2 (1)	13 (<1)	22 (6)	24 (14)
Scavengers (# (%))	4 (2)	18 (2)	19 (<1)	4 (3)	19 (<1)	3 (1)	12 (7)
Periphyton Feeders (# (%))	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Deposit Feeders (# (%))	163 (79)	34 (5)	208 (6)	95 (63)	27 (1)	161 (42)	19 (11)
Stress Indicators							
Crustacea (#)*	4	219	2880	51	51	48	27
Crustacea (%)*	2%	30%	79%	34%	2%	13%	16%
Annelids (#)	195	119	544	95	75	180	32
Annelids/Crustacea	48.75	0.54	0.19	1.86	1.47	3.75	1.18
Mollusks (#)*	0	19	80	2	15	46	41
Mollusks (%)*	0%	3%	2%	1%	<1%	12%	24%
Annelids/Mollusks	195	6.26	6.8	47.5	5	3.91	0.78

* higher values indicate better water/habitat quality

Table 4. Saltwater fish forage macroinvertebrate species in the 1996 BayNet survey, showing site #'s at which they were found, and their potential primary and secondary level predators*

	Potential Primary Level Predators								
	Pseudopleuronectes americanus (winter flounder)	*Leiostomus xanthurus* (spot)	*Menidia menidia* (silversides)	*Anchoa mitchilli* (bay anchovy)	*Apeltes quadracus* (four spine stickleback)	*Anguillla rostrata* (eel)	*Morone americana* (white perch)	*Fundulus heteroclitus* (mummichog)	*Bairdiella chrysura* (silver perch)
Fish Food Organisms									
Phyllodoce mucosa	7	7							
Eteone heterpoda	7,13	7,13							
Eteone lactea	3,5	3,5							
Eteone trilineata	7,15	7,15							
Nereiphylla fragilis		5							
Glycera dibranchiata	3,5,7,15	15		15					
Glycinde solitaria	7,15	15		15					
Nereis zonata	3,5,6,7,11,13,15		3,5,6,7,11,13,15	3,5,6,7,11,13,15					
Scolecolepides viridis	3,7,9,13	3,7,9,13		3,7,9,13					
Streblospio benedicti	3,5,6,7,11,13	3,5,6,7,11,13		3,5,6,7,11,13					
Scolelepis squamata		11		11					
Maldanopsis elongata	7								
Prionospio sp		5		5					
Polydora colonia	7	7		7					
Polydora ligni	13	5,13		5,13					
Polydora sp	9,11	9,11		9,11					
Dicrotendipes sp			11	11					
Aricidea jeffreysii	3,5,6,7,9,13,15								
Lumbrineris tenuis	7,15								
Hypaniola grayi	6	6							
Rheotanytarsus sp			6	6				6	
Nilodorum devineyae			6	6				6	
Chironomus decorus			6	6				6	
Palpomyia tibialis			6	6				6	
Culicoides sp			6	6				6	
Tripodura scalaenum			5	5	5				
Microdeutopus gryllotalpa					5,7,9,13				
Neomysis americana			11,13,15	11,13,15			13,15		11
Crangon septemspinosa			9,11						9,11
Ampelisca abdita			5,6,7,11,13,15						
Corophium sp							6,9,11		
Gammarus tigrinus								6,9	
Palaemonetes pugio	6,11						6,11	6,11	
Rhithropanopeus harrisii	11								
Callinectes sapidus	5					5			

Table 4. (cont.) Saltwater fish forage macroinvertebrate species in the 1996 BayNet survey, showing site #'s at which they were found, and their potential primary and secondary level predators*

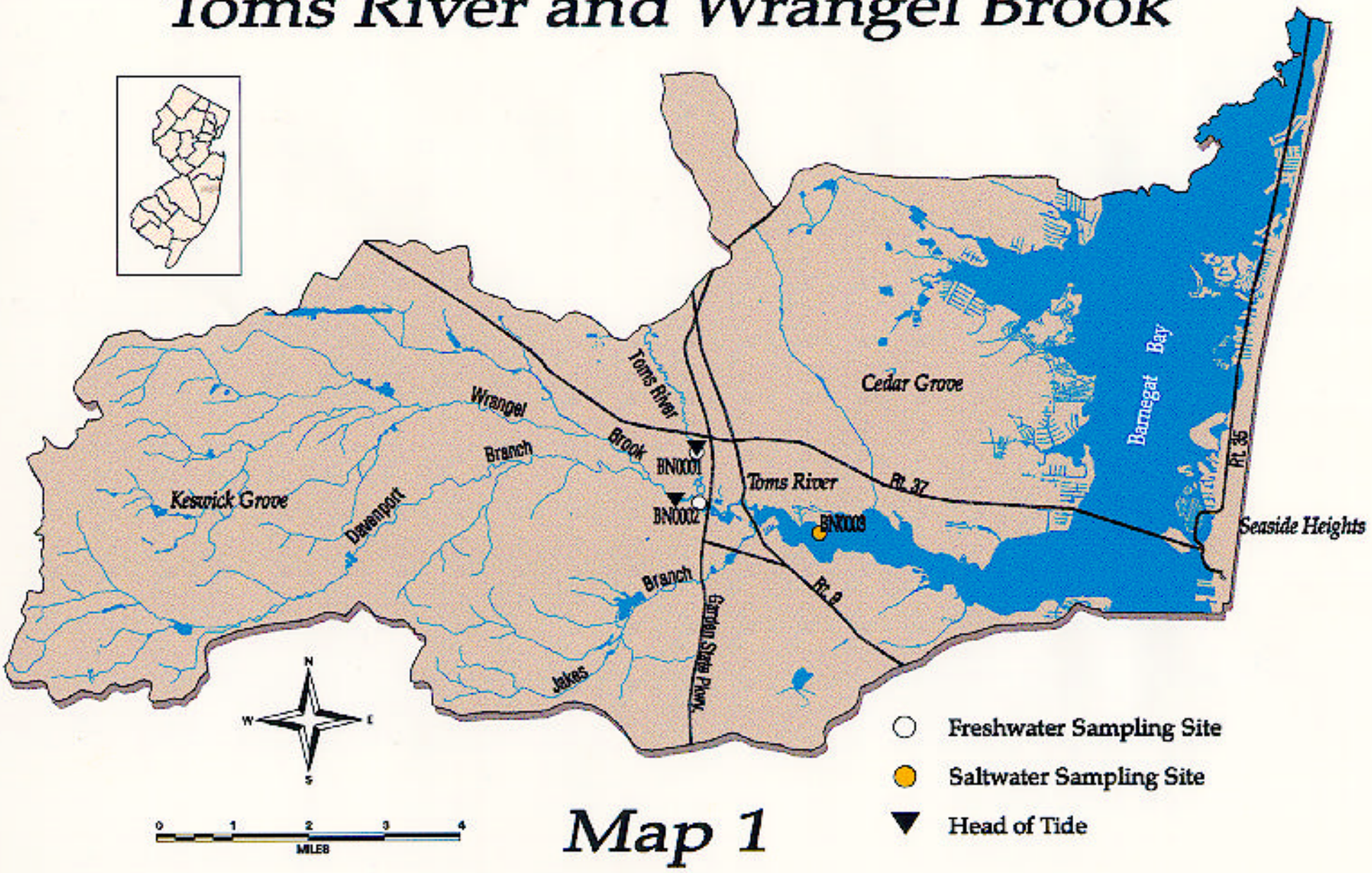
	Potential Primary Level Predators								
	Pseudopleuronectes americanus (winter flounder)	*Leiostomus xanthurus* (spot)	*Menidia menidia* (silversides)	*Anchoa mitchilli* (bay anchovy)	*Apeltes quadracus* (four spine stickleback)	*Anguillla rostrata* (eel)	*Morone americana* (white perch)	*Fundulus heteroclitus* (mummichog)	*Bairdiella chrysura* (silver perch)
Fish Food Organisms									
Mysidopsis bigelowi			5,7	5,7			5,7		
Potential Secondary Level Predators									
Pomatomus saltatrix (bluefish)		3,5,6,7,9,11,13,15	3,5,6,7,9,11,13,15	3,5,6,7,9,11,13,15				6,9,11	
Morone saxatilis (striped bass)			3,5,6,7,9,11,13,15						
Cynoscion regalis (weakfish)				3,5,6,7,9,11,13,15					
Paralichithys dentatus (summer flounder)					5,7,9,13				9,11

* taken from Festa, 1979

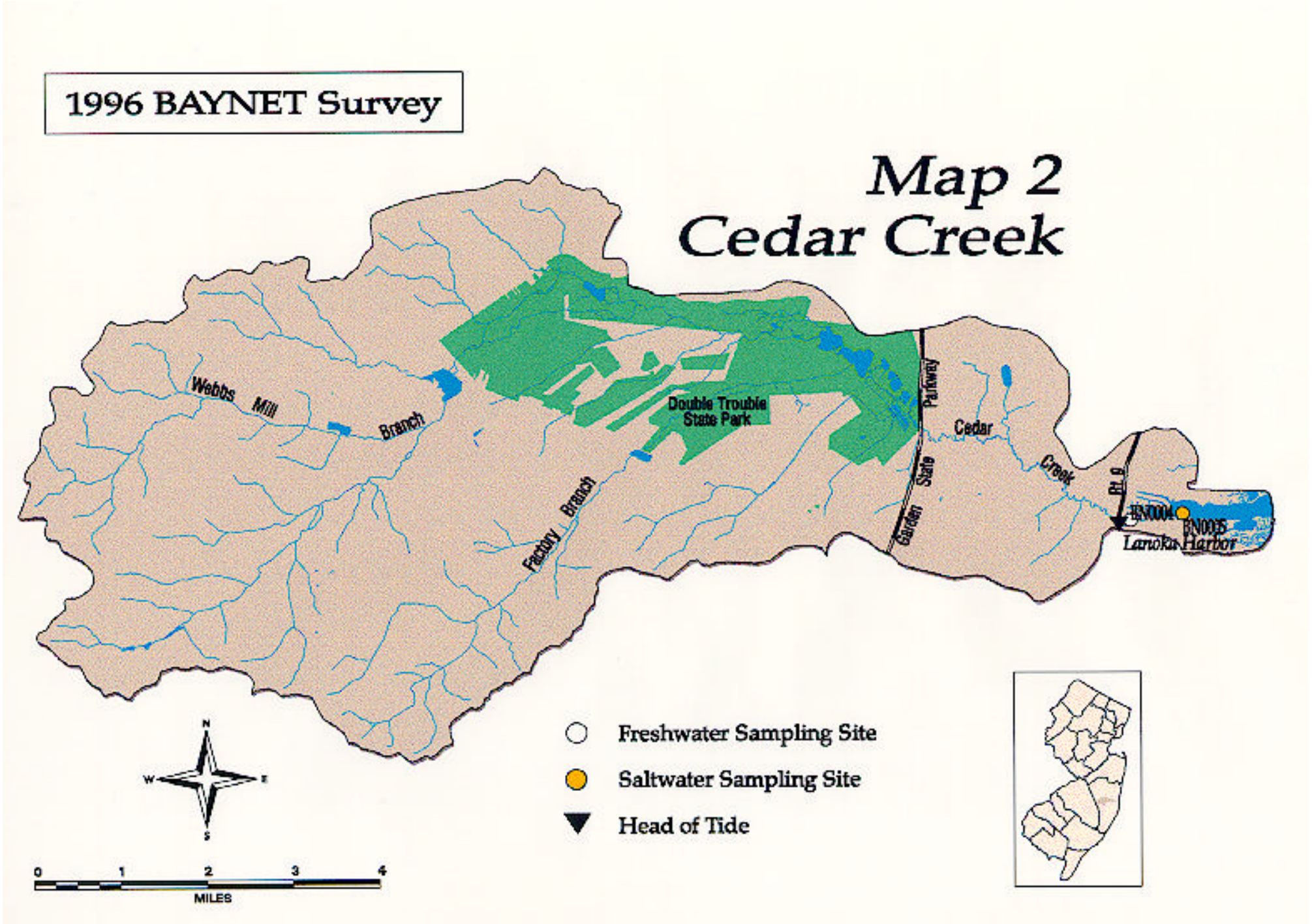
MAPS

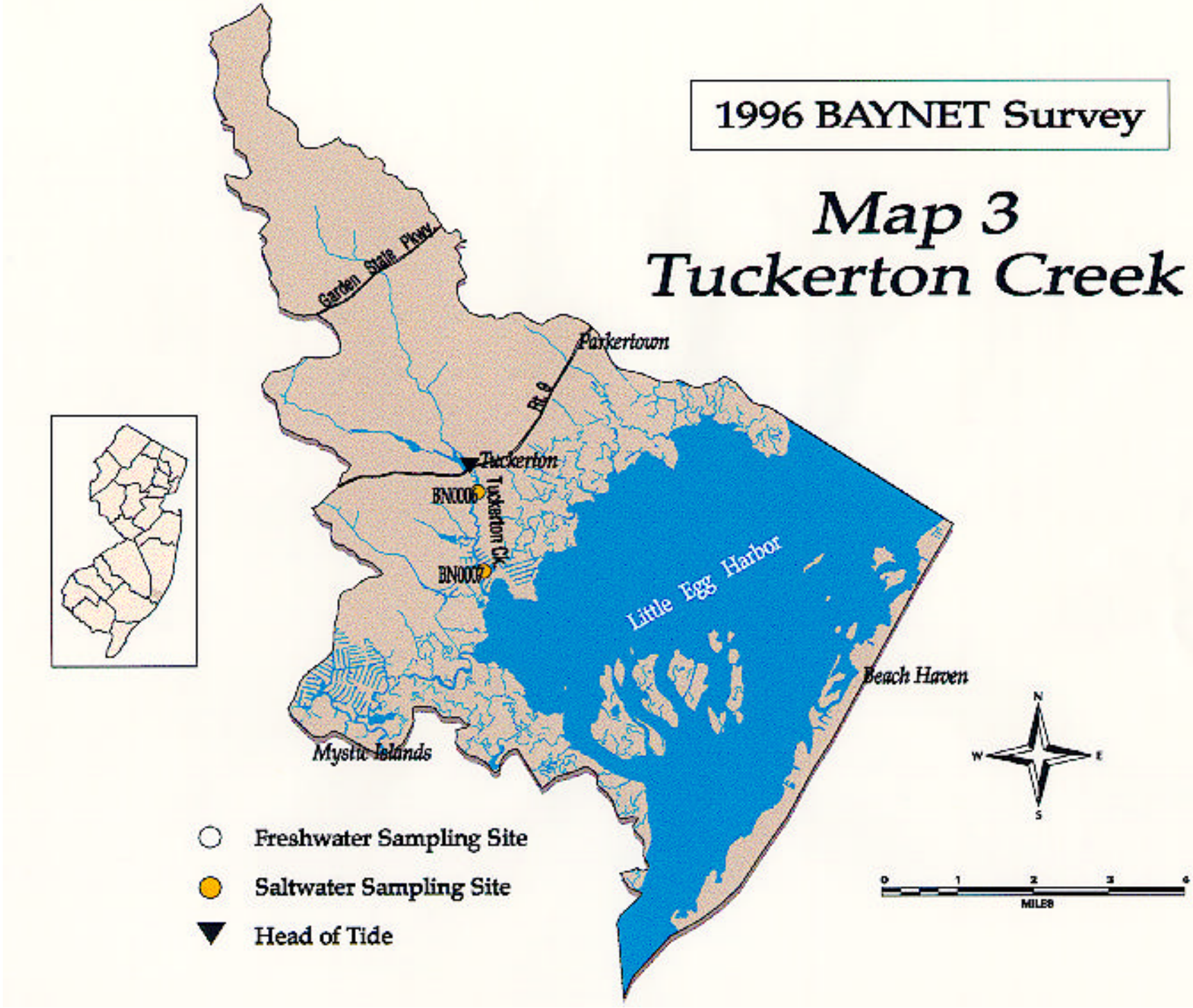
1996 BAYNET Survey

Toms River and Wrangel Brook

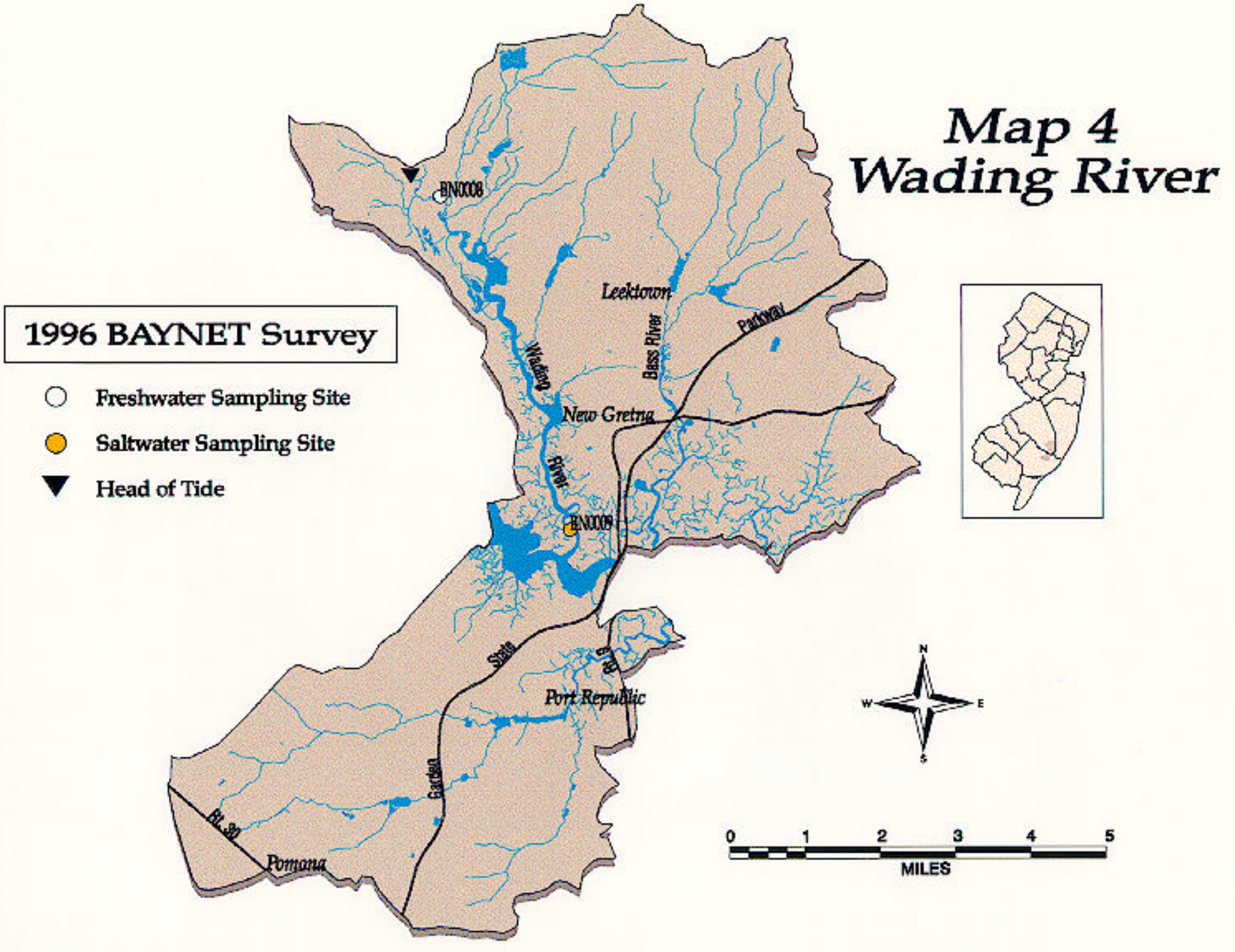


Map 1

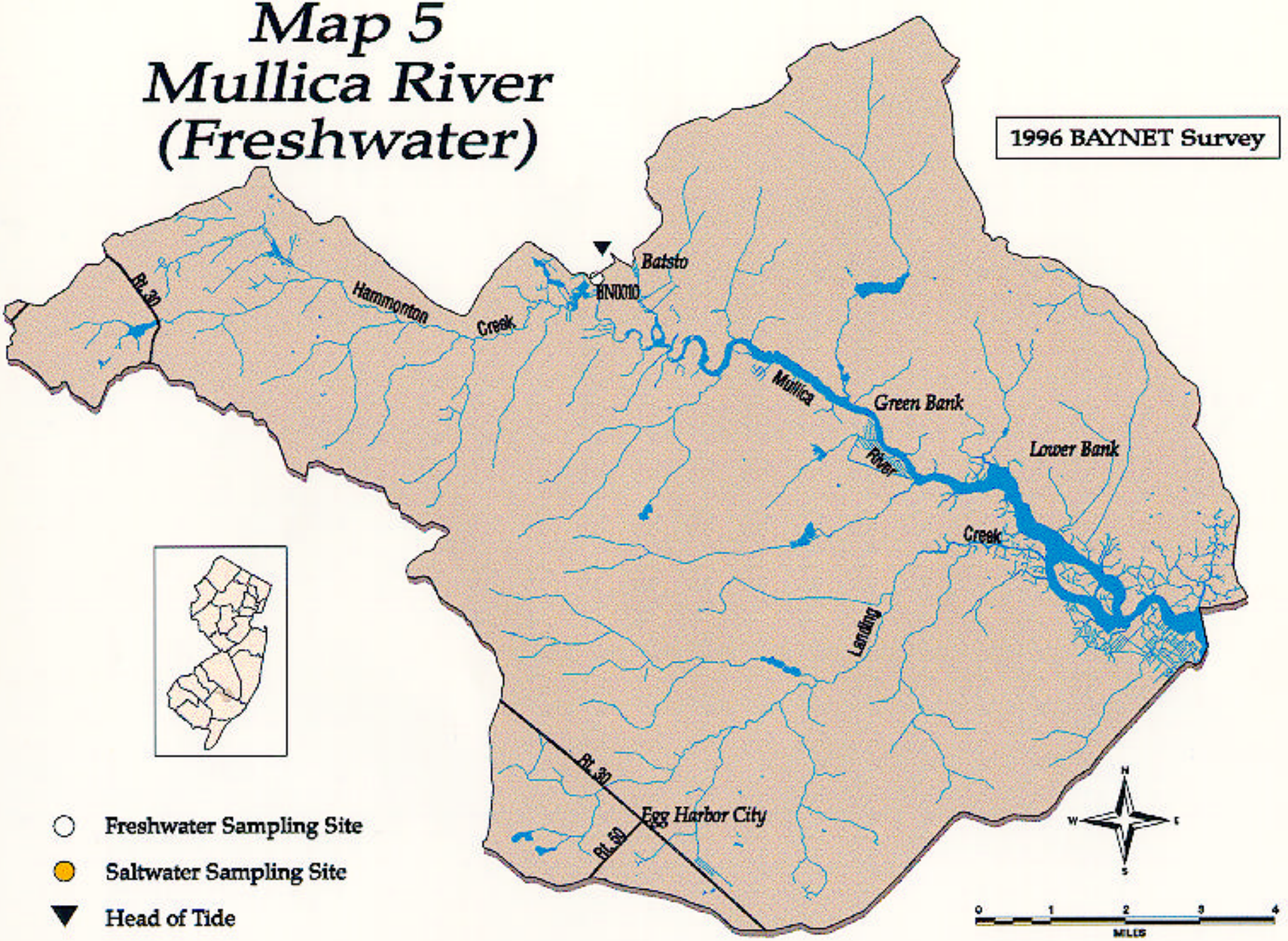

1996 BAYNET Survey
Map 2
Cedar Creek
Webbs Mill Branch
Double Trouble State Park
Factory Branch
Garden State Parkway
Cedar Creek
Rt 9
BN004
BN005
Lanoka Harbor
Freshwater Sampling Site
Saltwater Sampling Site
Head of Tide
N
W
E
S
0 1 2 3 4
MILES

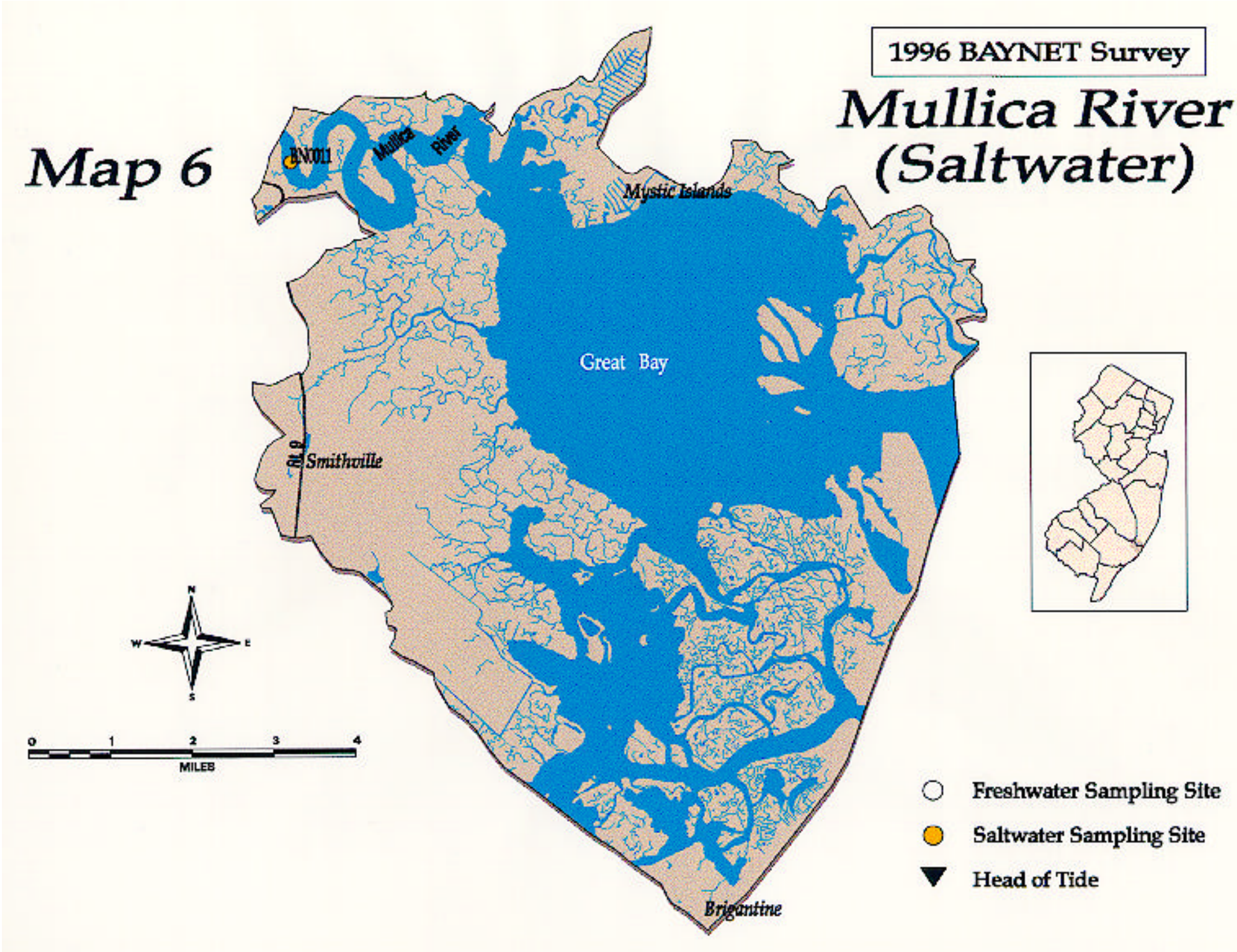

1996 BAYNET Survey
Map 3
Tuckerton Creek
Garden State Pkwy.
Parkertown
Rt. 9
Tuckerton
BN0006
Tuckerton Cr.
BN0007
Little Egg Harbor
Beach Haven
Mystic Islands
N
W
E
S
0
1
2
3
4
MILES
Freshwater Sampling Site
Saltwater Sampling Site
Head of Tide

Map 4
Wading River



Map 5
Mullica River
(Freshwater)




1996 BAYNET Survey
Mullica River
(Saltwater)
Map 6
BN011
Mullica
River
Mystic Islands
Great Bay
Smithville
N
W
E
S
0
1
2
3
4
MILES
Freshwater Sampling Site
Saltwater Sampling Site
Head of Tide
Brigantine

1996 BAYNET Survey

Map 7
Absecon Creek

Atlantic City Airport

North Branch

South Branch

Atlantic City

Reservoir

State Parkway

Rt. 30

Atlantic City Expressway

Garden State Parkway

Rt. 9

Absecon Creek

BN0012

BN0013

Absecon

Freshwater Sampling Site

Saltwater Sampling Site

Head of Tide

0 1 2 3

MILES

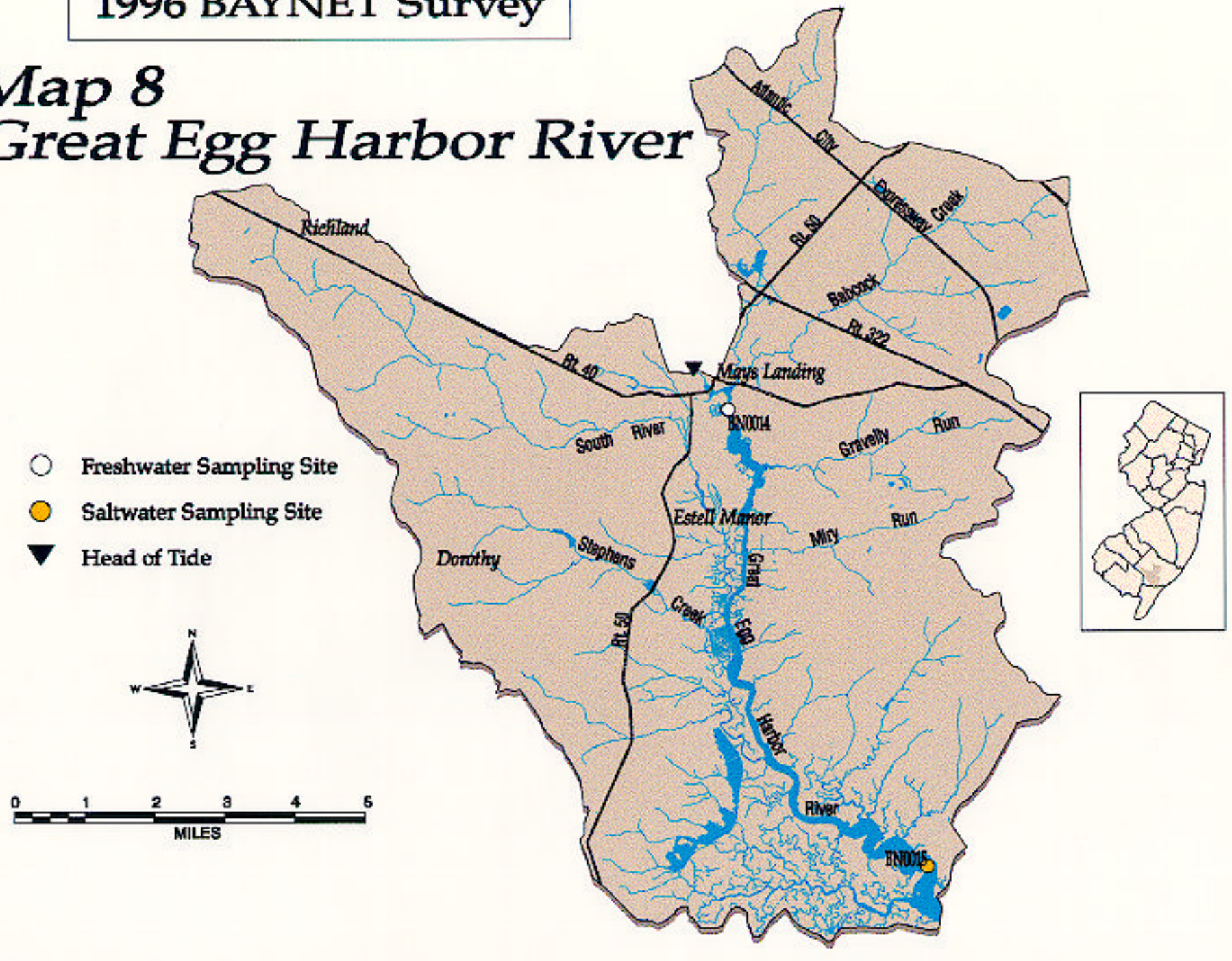
N

W E

S

1996 BAYNET Survey

Map 8
Great Egg Harbor River



Appendix A

Results of Sample and Data Analysis,
with Field Observations,
for Freshwater Sites in the
1996 BayNet Survey

BN0001 **P** Toms R, tidal fresh, ~3/4 mi dwnstr of Oak Ridge Pkwy, Dover Twp, Ocean Co, Toms R Quad

July 24, 1996

Taxon (Family Level)	FTV*	NOI*
DUGESIIDAE	9	2
LUMBRICULIDAE	8	6
ENCHYTRAEIDAE	10	7
NAIDIDAE	7	3
TUBIFICIDAE	10	3
ASELLIDAE	8	11
LEUCTRIDAE	0	2
PERLIDAE	1	3
EPHEMERELLIDAE	1	1
HEPTAGENIIDAE	4	4
GOMPHIDAE	1	2
CORIXIDAE	7	1
BRACHYCENTRIDAE	1	2
HYDROPSYCHIDAE	4	3
LEPTOCERIDAE	4	3
LEPIDOSTOMATIDAE	1	2
HYDROPTILIDAE	4	3
POLYCENTROPODIDAE	6	1
GYRINIDAE	3	3
PTILODACTYLIDAE	1	1
DYTISCIDAE	5	2
ELMIDAE	5	13
TABANIDAE	6	1
CERATOPOGONIDAE	6	1
EMPIDIDAE	6	1
CHIRONOMIDAE	6	26
BLOODREDCHIRONOMIDAE	8	3
SPHAERIIDAE	8	6

Number of Taxa + 28 **P** Population + 116

Dominant Family(s) + CHIRONOMIDAE 22%
Family Biotic Index + 5.87
E(phemeroptera) + P(lecoptera) + T(richoptera) + 10
%EPT + 21

NJIS/Rating + 24/non-impaired

Deficiency(s) noted + none

OBSERVATIONS

Clarity + clear cedar
Flow + moderate
Width/Depth(ft) + 30-40/4
Substrate + sand
Streambank Vegetation/Stability + good/good
Canopy + mostly closed
Other + woods; fish (minnow); freshwater tidal

* FTV = Family Tolerance Value, NOI = Number of Individuals

BN0002 P Wrangle Bk, tidal fresh, ~1000 ft upstr of mouth, Berkeley Twp, Ocean Co, Toms R Quad

August 6, 1996

Taxon (Family Level)	FTV*	NOI*
NAIDIDAE	7	39
LUMBRICULIDAE	8	1
TUBIFICIDAE	10	2
GLOSSIPHONIIDAE	8	3
ASELLIDAE	8	19
TALITRIDAE	8	3
CORIXIDAE	7	5
MOLANNIDAE	6	1
LEPTOCERIDAE	4	1
HALIPLIDAE	5	1
HYDROPHILIDAE	5	1
ELMIDAE	5	4
CHIRONOMIDAE	6	22

Number of Taxa + 13 P Population + 102

Dominant Family(s) + NAIDIDAE 38%
Family Biotic Index + 6.94
E(phemeroptera) + P(lecoptera) + T(richoptera) + 2
%EPT + 2

NJIS/Rating + 15/moderately impaired

Deficiency(s) noted + paucity of clean water organisms

OBSERVATIONS

Clarity + clear
Flow + slow
Width/Depth(ft) + 10-15/2-3
Substrate + sand
Streambank Vegetation/Stability + good/good
Canopy + open
Other + freshwater tidal

* FTV = Family Tolerance Value, NOI = Number of Individuals

BN0004 **P** Cedar Ck, tidal fresh, ~1000 ft dwnstr of Rt 9, Lanoka Harbor, Ocean Co, Forked R Quad

Apr 22, 1997

Taxon (Family Level)	FTV	NOI
ENCHYTRAEIDAE	10	28
LUMBRICULIDAE	8	1
PERLODIDAE	2	1
METRETOPODIDAE	2	1
LEPTOPHLEBIIDAE	2	1
EPHEMERELLIDAE	1	5
NOTONECTIDAE	9	1
HYDROPTILIDAE	4	3
MOLANNIDAE	6	2
LEPTOCERIDAE	4	3
LEPIDOSTOMATIDAE	1	1
POLYCENTROPODIDAE	6	2
CHIRONOMIDAE	6	71
TIPULIDAE	3	1
CERATOPOGONIDAE	6	2

Number of Taxa + 15 **P** Population + 123

Dominant Family(s) + CHIRONOMIDAE 58%
Family Biotic Index + 6.49
E(phemeroptera) + P(lecoptera) + T(richoptera) + 9
%EPT + 15

NJIS/Rating + 21/moderately impaired

Deficiency(s) noted + none

OBSERVATIONS

Clarity +
Flow +
Width/Depth(ft) + /
Substrate +
Streambank Vegetation/Stability + /
Canopy +
Other +

* FTV = Family Tolerance Value, NOI = Number of Individuals

BN0004 **P** Cedar Ck, tidal fresh, ~1000 ft dwnstr of Rt 9, Lanoka Harbor, Ocean Co, Forked R Quad

September 24, 1996

Taxon (Family Level)	FTV*	NOI*
LUMBRICULIDAE	8	3
ENCHYTRAEIDAE	10	22
MALACONOTHRIDAE	5	1
BAETISCIDAE	3	3
EPHEMERELLIDAE	1	1
HEPTAGENIIDAE	4	1
LEPTOPHLEBIIDAE	2	2
COENAGRIONIDAE	9	1
CORIXIDAE	7	2
SIALIDAE	4	2
POLYCENTROPODIDAE	6	5
PHILOPOTAMIDAE	3	11
LIMNOPHILIDAE	4	3
LEPIDOSTOMATIDAE	1	2
LEPTOCERIDAE	4	2
HYDROPSYCHIDAE	4	4
PYRALIDAE	5	2
HELODIDAE	7	1
CHRYSOMELIDAE	5	1
SIMULIIDAE	6	2
TIPULIDAE	3	1
CHIRONOMIDAE	6	78
BLOODREDCHIRONOMIDAE	8	1

Number of Taxa **+** 23 **P** Population **+** 151

Dominant Family(s) **+** CHIRONOMIDAE 52%
Family Biotic Index **+** 6.04
E(phemeroptera) + P(lecoptera) + T(richoptera) **+** 10
%EPT **+** 22

NJIS/Rating **+** 21/moderately impaired

Deficiency(s) noted **+** none

OBSERVATIONS

Clarity **+** clear clear
Flow **+** moderate
Width/Depth(ft) **+** 130/5
Substrate **+** sand/gravel
Streambank Vegetation/Stability **+** good/good
Canopy **+** mostly open
Other **+** forested/residential

* FTV = Family Tolerance Value, NOI = Number of Individuals

BN0008 P Wading R, tidal fresh, ~ 1 mi dwnstr of Harrisville, nr Bodine Field, Bass R Twp, Burlington Co, Jenkins Quad

September 13, 1996

Taxon (Family Level)	FTV*	NOI*
LUMBRICULIDAE	8	2
ASELLIDAE	8	4
PERLIDAE	1	1
METRETOPODIDAE	2	1
COENAGRIONIDAE	9	14
AESHNIDAE	3	1
CORIXIDAE	7	1
SIALIDAE	4	2
LEPTOCERIDAE	4	8
PHRYGANEIDAE	4	1
PYRALIDAE	5	1
HYDROPHILIDAE	5	1
ELMIDAE	5	9
DYTISCIDAE	5	1
GYRINIDAE	3	4
EMPIDIDAE	6	1
TABANIDAE	6	1
TIPULIDAE	3	2
CHIRONOMIDAE	6	54

Number of Taxa + 19 P Population + 109

Dominant Family(s) + CHIRONOMIDAE 49%
Family Biotic Index + 5.92
E(phemeroptera) + P(lecoptera) + T(richoptera) + 4
%EPT + 10

NJIS/Rating + 18/moderately impaired

Deficiency(s) noted + none

OBSERVATIONS

Clarity + clear cedar
Flow + slow
Width/Depth(ft) + 80/6
Substrate + sand/gravel
Streambank Vegetation/Stability + good/good
Canopy + open
Other + woods; macrophytes; freshwater tidal

* FTV = Family Tolerance Value, NOI = Number of Individuals

BN0010 **P** Mullica R, tidal fresh, ~1/2 mi dwnstr of Pleasant Mills, Washington Twp, Burlington Co, Atsion Quad

September 16, 1996

Taxon (Family Level)	FTV	NOI
LUMBRICULIDAE	8	1
NAIDIDAE	7	1
TUBIFICIDAE	10	6
ENCHYTRAEIDAE	10	1
ERPOBDELLIDAE	8	1
ASELLIDAE	8	1
PALAEMONIDAE	6	1
PERLIDAE	1	2
METRETOPODIDAE	2	1
BAETIDAE	4	1
COENAGRIONIDAE	9	1
GOMPHIDAE	1	3
CORDULIIDAE	5	1
VELIIDAE	9	1
GERRIDAE	8	1
SIALIDAE	4	1
LEPTOCERIDAE	4	2
POLYCENTROPODIDAE	6	1
HYDROPSYCHIDAE	4	1
PHRYGANEIDAE	4	1
LEPIDOSTOMATIDAE	1	1
ELMIDAE	5	5
DYTISCIDAE	5	1
GYRINIDAE	3	1
BLOODREDCHIRONOMIDAE	8	5
CHIRONOMIDAE	6	57
SIMULIIDAE	6	1

Number of Taxa + 28 **P** Population + 101

Dominant Family(s) + CHIRONOMIDAE 56%
Family Biotic Index + 5.94
E(phemeroptera) + P(lecoptera) + T(richoptera) + 8
%EPT + 10

NJIS/Rating + 21/moderately impaired

Deficiency(s) noted + none

OBSERVATIONS

Clarity + clear cedar
Flow + moderate
Width/Depth(ft) + 30/6
Substrate + sand/gravel
Streambank Vegetation/Stability + good/good
Canopy + open
Other + woods

* FTV = Family Tolerance Value, NOI = Number of Individuals

BN0012 P Absecon Ck, tidal fresh, ~500 ft dwnstr of Mill Rd, Pleasantville Quad

May 1, 1997

Taxon (Family Level)	FTV	NOI
HYDRIDAE	4	1
TUBIFICIDAE	10	26
NAIDIDAE	7	1
GAMMARIDAE	7	17
COENAGRIONIDAE	9	2
HYDROPTILIDAE	4	1
CHIRONOMIDAE	6	57
BLOODREDCHIRONOMIDAE	8	5

Number of Taxa + 8 P Population + 110

Dominant Family(s) + 52%
Family Biotic Index + 7.22
E(phemeroptera) + P(lecoptera) + T(richoptera) + 1
%EPT + 1

NJIS/Rating + 6 /severely impaired

Deficiency(s) noted + significant organic pollution
paucity of clean water organisms

OBSERVATIONS

Clarity + clear
Flow + moderate
Width/Depth(ft) + 40/2
Substrate + sand/muck/mud/some gravel
Streambank Vegetation/Stability + poor/poor
Canopy + open
Other + marsh; reservoir upstr; pH = 6.2, conductivity = 70 µhmos, salinity 0 I

* FTV = Family Tolerance Value, NOI = Number of Individuals

BN0014 **P** Great Egg Harbor R, tidal fresh, ~2500 ft dwnstr of Mays Landing, Atlantic Co, Mays Landing Quad

May 8 , 1997

Taxon (Family Level)	FTV	NOI
ENCHYTRAEIDAE	10	15
LUMBRICULIDAE	8	1
TUBIFICIDAE	10	6
NAIDIDAE	7	1
ASELLIDAE	8	4
GAMMARIDAE	7	3
TALITRIDAE	8	1
CAENIDAE	7	19
EPHEMERELLIDAE	1	1
EPHEMERIDAE	4	5
LEPTOCERIDAE	4	8
ELMIDAE	5	5
CHIRONOMIDAE	6	33
SIMULIIDAE	6	1
CERATOPOGONIDAE	6	4

Number of Taxa **+** 15 **P** Population **+** 107

Dominant Family(s) **+** CHIRONOMIDAE (31%)
Family Biotic Index **+** 6.78
E(phemeroptera) + P(lecoptera) + T(richoptera) **+** 4
%EPT **+** 31

NJIS/Rating **+** 21/moderately impaired

Deficiency(s) noted **+** none

OBSERVATIONS

Clarity **+** clear cedar
Flow **+** -
Width/Depth(ft) **+** 500/>5
Substrate **+** sand/gravel
Streambank Vegetation/Stability **+** good/good
Canopy **+** open
Other **+** tree-lined; residential; docks and boats

* FTV = Family Tolerance Value, NOI = Number of Individuals

Appendix B

Results of Sample and Data Analysis,
with Field Observations,
for Saltwater Sites in the
1996 BayNet Survey

BN0003 ■ Toms R, tidal brackish, across estuary from Pine Beach Pt to Cranmoor Country Club, Toms R Quad

August 27, 1996 Petite Ponar Dredge

	Individuals			
Taxa	Left	Middle	Right	Total
NEMERTEA				
Tubulanus pellucidus	6	1	1	8
POLYCHAETA				
Streblospio benedicti	86	3	27	116
Glycera dibranchiata		7	2	9
Nereis zonata	24		8	32
Aricidea jeffreysii			1	1
Eteone lactea			1	1
Scolecolepides viridis	9	2		11
OLIGOCHAETA				
Limnodrilus sp	2	2	21	25
OSTRACODA	4			4
Total Taxa	6	5	7	9
Total Individuals	131	15	61	207
Individuals/Sq Ft	131	15	61	69
Species Diversity	1.6	2	1.9	2
Equitability	0.6	1.1	0.7	0.6

OBSERVATIONS
Salinity o/oo: 8-10
Depth in feet: 2-6
Substrate: sand/silt
Macroalgae: none
Riparian Conditions:
boat docks/suburban

BN0005 ■ Cedar Ck, tidal brackish, ~1/2 mi dwnstr of Rt 9, Forked R Quad

October 3, 1996 Petite Ponar Dredge

Taxa	Individuals			
	Left	Middle	Right	Total
THECATA				
Clytia inconspicua		100		100
ACTINARIA				
Diadumene leucolena		1		1
Haliplanella luciae	2			2
NEMERTEA				
Tubulanus pellucidus	6			6
BRYOZOA				
Aeverillia armata		100		100
Electra crustulenta		50		50
Bowerbankia gracilis	100			100
Amathia convoluta	10			10
GASTROPODA				
Nassarius trivittatus		2		2
Ilyanassa obsoleta	4			4
Retusa obtusa			3	3
BIVALVIA				
Macoma tenta	3		2	5
Mulinia lateralis	1	3	1	5
POLYCHAETA				
Aricidea jeffreysii	4			4
Glycinde solitaria	12	6	13	31
Nereis zonata	5	9		14
Prionospio sp	1	4		5
Podarke obscura	12	10		22
Glycera dibranchiata	1			1
Pectinaria gouldii	2			2
Polydora commensalis	1			1
P. ligni		9		9
Eteone lactea		3	1	4
Nereiphylla fragilis		1		1
Brania clavata		1		1
Potamilla neglecta		1	9	10
Spiochaetopterus oculatus		6	1	7
Streblospio benedicti			5	5
OLIGOCHAETA				
Limnodrilus sp	2			2
PANTOPODA				
Nympnon stromi		2		2
INSECTA				
Tripodura scalaenum			1	1
OSTRACODA	2	4	1	7
CUMACEA				
Cyclaspis sp	1	1	3	5
ISOPODA				
Cyathura burbancki	3	1	3	7
AMPHIPODA				
Microdeutopus gryllotalpa	11	18		29
Ampelisca abdita	13	24	124	161
Lysianopsis alba	3			3
DECAPODA				
Callinectes sapidus	1			1
MYSIDACEA				
Mysidopsis bigelowi		5	1	6
Total Taxa	23	23	14	39
Total Individuals	200	361	168	729
Individuals/Sq Ft	200	361	168	243
Species Diversity	3	3.1	1.6	3.8
Equitability	0.5	0.5	0.3	0.5

OBSERVATIONS
Salinity o/oo: 18
Depth in feet: 7
Substrate: detritus
Macroalgae: red algae/ulva
Riparian Conditions: lagoons/woods

BN0006 ■ Tuckerton Ck, tidal brackish, ~600 ft dwnstr of Rt 9, Tuckerton Quad

October 4, 1996 Qualitative sample with KickNet

Taxa	Individuals
NEMERTEA	
Tubulanus pellucidus	4
BRYOZOA	
Nolella sp	20
POLYCHAETA	
Hypaniola grayi	243
Nereis zonata	85
Streblospio benedicti	41
Aricidea jeffreysii	3
OLIGOCHAETA	
Monopylephorus sp	123
Limnodrilus sp	3
Nais elinguis	1
ODONATA	
Ischnura sp	1
HEMIPTERA	
Notonecta sp	3
Trichocorixa sp	5
Trepobates sp	1
TRICHOPTERA	
Oxyethira sp	1
DIPTERA	
Rheotanytarsus sp	2
Nilodorum devineyae	563
Chironomus decorus	68
Palpomyia tibialis	4
Culicoides	9
OSTRACODA	53
CUMACEA	
Leucon sp	5
ISOPODA	
Cyathura polita	7
Cassidisca lunifrons	6
AMPHIPODA	
Gammarus tigrinus	98
Ampelisca abdita	1
Corophium sp	46
DECAPODA	
Palaemonetes pugio	6
Total Taxa	27
Total Individuals	1402
Species Diversity	2.9
Equitability	0.4

OBSERVATIONS
Salinity o/oo: 9
Depth in feet: -
Substrate: sand/gravel
Macroalgae: -
Riparian Conditions: woods/boat docks

BN0007 ■ Tuckerton Ck, tidal brackish, ~2000 ft upstr of mouth, Tuckerton Quad

October 16, 1996 Petite Ponar Dredge

	Individuals			
Taxa	Left	Middle	Right	Total
ACTINIARIA				
Haliplanella luciae		1	1	2
Diadumene leucolena			3	3
NEMERTEA				
Tubulanus pellucidus		9	9	18
Amphiporus bioculatus	17	2	2	21
Lineus pallidus	41			41
BRYOZOA				
Electra sp			50	50
GASTROPODA				
Acteon punctostriatus			3	3
BIVALVIA				
Gemma gemma	66	8	3	77
POLYCHAETA				
Aricidea jeffreysii	101	9	5	115
Lumbrineris tenuis	126	112	42	280
Glycera dibranchiata	20	12	7	39
Streblospio benedicti	11	1	2	14
Scolecolepis squamata			2	2
Nereis zonata	25	3	2	30
Laeonereis culveri	4			4
Tharyx acutus	2			2
Podarke obscura		3		3
Glycinde solitaria		7	10	17
Phyllodoce mucosa	9	2		11
Lumbrineris acuta	1			1
Eteone heteropoda		1		1
Eteone trilineata	1			1
Thelepus cincinnatus		14	5	19
Maldanopsis elongata		1		1
Polydora colonia		1		1
Spiochaetopterus oculatus		1		1
Cossura longocirrata		1		1
Rhodine attenuata			1	1
PANTOPODA				
Nymphon stromi		3		3
OSTRACODA		16		16
CUMACEA				
Leucon sp		1		1
ISOPODA				
Cyathura polita	14	5	5	24
Edotea montosa		2		2
AMPHIPODA				
Ampelisca abdita	67	2096	654	2817
Microdeutopus gryllotalpa		16	3	19
MYSIDACEA				
Mysidopsis bigelowi		1		1
Total Taxa	15	26	19	36
Total Individuals	505	2328	809	3642
Individuals/Sq Ft	505	2328	809	1214
Species Diversity	3.1	0.8	1.3	1.6
Equitability	0.8	0.08	0.2	0.1

OBSERVATIONS
Salinity o/oo: 21.5
Depth in feet: 2-10
Substrate: detritus/clay
Macroalgae: red algae
Riparian Conditions:
boat docks/suburban/woods/salt marshes

BN0009 ■ Wading R, tidal brackish, ~1/2 mi upstr of mouth, New Gretna Quad

October 17, 1996 Petite Ponar Dredge

	Individuals			
Taxa	Left	Middle	Right	Total
NEMERTEA				
Lineus pallidus		2		2
BIVALVIA				
Macoma tenta		1		1
M balthica			1	1
POLYCHAETA				
Polydora sp	31		1	32
Aricidea jeffreysii		39	1	40
Scolecolepides viridis		19	4	23
ISOPODA				
Cyathura polita	4	7	2	13
Edotea montosa	1			1
Chiridotea tuftsi		1		1
AMPHIPODA				
Corophium sp	5	2		7
Gammarus tigrinus	1		1	2
Microdeutopus gryllotalpa	3	20	2	25
Crangonyx pseudogracilis			1	1
DECAPODA				
Crangon septemspinosa		1		1
Total Taxa	6	9	8	14
Total Individuals	45	92	13	150
Individuals/Sq Ft	45	92	13	50
Species Diversity	1.5	2.2	2.8	2.8
Equitability	0.6	0.7	0.7	0.7

OBSERVATIONS
Salinity o/oo: 7.5
Depth in feet: 5-6
Substrate: detritus/clay/sand
Macroalgae: none
Riparian Conditions: salt marshes

BN0011 ■ Mullica R, tidal brackish, ~1000 ft dwnstr of Rt 9, New Gretna Quad

October 17, 1996 Petite Ponar Dredge

	Individuals			
Taxa	Left	Middle	Right	Total
THECATA				
Eucopella caliculata	20	475	70	565
ACTINIARIA				
Diadumene leucolena	3		8	11
BRYOZOA				
Electra crustulenta	75	1635	200	1910
GASTROPODA				
Epitonium multistriatum		1		1
BIVALVIA				
Crassostaea virginica		9	4	13
Modrolus demissus		1		1
POLYCHAETA				
Nereis zonata	3	3	6	12
Polydora sp	2		1	3
Sabellaria vulgaris		18		18
Streblospio benedicti		1	3	4
Spiochaetopterus oculatus		36		36
Scolelepis squamata			2	2
DIPTERA				
Dicrotendipes sp			1	1
THORACICA				
Balanus amphitrite	2	13	8	23
B. balanoides	1		2	3
AMPHIPODA				
Corophium sp	1		2	3
Ampelisca abdita	1		1	2
Crangonyx pseudogracilis		2	7	9
MYSIDACEA				
Neomysis americana	1			1
DECAPODA				
Crangon septemspinosa	1			1
Rhithropanopeus harrisii		3	4	7
Palaemontes pugio		2		2
PLEUROGONA				
Mogula sp		2		2
Total Taxa	11	14	15	23
Total Individuals	110	2201	319	2630
Individuals/Sq Ft	110	2201	319	876.7
Species Diversity	1.6	1.1	1.8	1.3
Equitability	0.4	0.2	0.3	0.1

OBSERVATIONS
Salinity o/oo: 10
Depth in feet: 6-20
Substrate: detritus/gravel/clay
Macroalgae: none
Riparian Conditions:
salt marshes/boat docks

BN0013 ■ Absecon Ck, tidal brackish, ~1/2 mi upstr of mouth, Oceanville Quad

October 18, 1996 Petite Ponar Dredge

Taxa	Individuals			
	Left	Middle	Right	Total
NEMERTEA				
Tubulanus pellucidus		1	2	3
BRYOZOA				
Electra crustulenta			100	100
ACTINIARIA				
Diadumene leucolena	1			1
BIVALVIA				
Gemma gemma	5	27	11	43
Modiolus modiolus	1			1
Donax fossor			1	1
Tegelus plebeius			1	1
POLYCHAETA				
Streblospio benedicti	5	14	33	52
Aricidea jeffreysii		1		1
Scolecolepides viridis	28	6		34
Polydora ligni	15	51	2	68
Tharyx acutus			1	1
Eteone heteropoda	2	3		5
Nereis zonata	10	7	2	19
ISOPODA				
Cyathura polita	7	11	4	22
Edotea montosa	2	3		5
AMPHIPODA				
Ampelisca abdita		1	1	2
Crangonyx pseudogracilis		3		3
Microdeutopus gryllotalpa			2	2
MYSIDACEA				
Neomysis americana		14		14
Total Taxa	10	13	12	20
Total Individuals	76	142	160	378
Individuals/Sq Ft	76	142	160	126
Species Diversity	2.7	2.8	1.8	3.1
Equitability	0.9	0.8	0.4	0.6

OBSERVATIONS
Salinity o/oo: 23
Depth in feet: 4-20
Substrate: clay
Macroalgae: Fucus
Riparian Conditions:
salt marshes/boat docks

BN0015 ■ Gr Egg Harbor R, tidal brackish, ~2 mi upstr of mouth, Marmora Quad

October 18, 1996 Petite Ponar Dredge

	Individuals			
Taxa	Left	Middle	Right	Total
PORIFERA				
Haliclona palmata	20			20
ATHECATA				
Bougainvillia rugosa		13		13
ACTINARIA				
Diadumene leucolena	1	27		28
NEMERTEA				
Tubulanus pellucidus		7	4	11
BIVALVIA				
Gemma gemma	16	24		40
Donax fossor	1			1
POLYCHAETA				
Aricidea jeffreysii	2	3		5
Glycinde solitaria	1	1	1	3
Nereis zonata	1	5		6
Lumbrineris tenuis	3	1		4
Glycera dibranchiata		4	1	5
Tharyx acutus		1		1
Sabellaria vulgaris		7		7
Eteone trilineata		1		1
CUMACEA				
Leucon sp			3	3
ISOPODA				
Cyathura polita		3		3
Edotea montosa		5		5
AMPHIPODA				
Crangonyx pseudogracilis	2	9		11
Ampelisca abdita	1	1		2
Podoceropsis nitida		1		1
DECAPODA				
Neomysis americana		2		2
Total Taxa	10	18	4	21
Total Individuals	48	115	9	172
Individuals/Sq Ft	48	115	9	57.3
Species Diversity	2.3	3.4	1.8	3.6
Equitability	0.7	0.8	1.1	0.9

OBSERVATIONS
Salinity o/oo: 18
Depth in feet: 5-20
Substrate: detritus/clay
Macroalgae: none
Riparian Conditions: salt marshes

Appendix C

Taxonomic List of Species
Found in the
1996 BayNet Survey

Table 5. Listing of macroinvertebrates recovered from the fresh water sites

PHYLUM	CLASS	ORDER	FAMILY	GENUS	SPECIES
COELENTERATA	HYDROZOA	HYDROIDA	HYDRIDAE	Hydra	sp
PLATYHELMINTHES	TURBELLARIA	TRICLADIA	DUGESIIDAE	Dugesia	tigrina
MOLLUSCA	PELECYPODA	VENEROIDA	SPHAERIIDAE	Pisidium	casertanum
ANNELIDA	OLIGOCHAETA	HAPLOTAXIDA	ENCHYTRAEIDAE		
			TUBIFICIDAE	Aulodrilus	pluriseta
				Limnodrilus	claparedianus
				Monopylephorus	sp
				Tubifex	tubifex
			NAIDIDAE		
				Slavina	appendiculata
				Nais	communis
				Nais	elinguis
				Stylaria	fossularis
				Dero	nivea
				Vejdovskyella	comata
				Chaetogaster	sp
		LUMBRICULIDA	LUMBRICULIDAE	Lumbriculus	variegatus
	HIRUDINEA	RHYNCHOBDELLIDA	GLOSSIPHONIIDAE	Helobdella	stagnalis
				Helobdella	elongata
		PHARYNGOBDELLIDA	ERPOBDELLIDAE	Mooreobdella	fervida
ARTHROPODA	CRUSTACEA	ISOPODA	ASELLIDAE	Asellus	communis
		AMPHIPODA	GAMMARIDAE	Gammarus	fasciatus
			TALITRIDAE	Hyalella	azteca
		DECAPODA	PALAEMONIDAE	Palaemonetes	sp
	ARACHNOIDEA		MALACONOTHURIDAE	Hydrozetes	sp
	INSECTA	PLECOPTERA	LEUCTRIDAE	Leuctra	sp
			PERLIDAE	Perlesta	placida
				Acroneuria	lycorias
				Perlinella	drymo
		EPHEMEROPTERA	EMPHEMERELLIDAE	Ephemerella	sp
				Eurylophella	temporalis
			HEPTAGENIIDAE	Stenonema	smithae
			BAETISCIDAE	Baetisca	obesa
			LEPTOPHLEBIIDAE	Paraleptophlebia	sp
			METRETOPODIDAE	Siphloplecton	sp
			BAETIDAE	Baetis	sp

Table 5. (continued)

PHYLUM	CLASS	ORDER	FAMILY	GENUS	SPECIES
			CAENIDAE	Caenis	sp
			EPHEMERIDAE	Hexagenia	sp
		ODONATA	CORDULIIDAE		
			GOMPHIDAE	Somatochlora	sp
				Dromogomphus	spinosus
			AESHNIDAE	Boyeria	vinosa
			COENAGRIONIDAE	Ischnura	sp
				Enallagma	sp
				Agrion	sp
		HEMIPTERA	CORIXIDAE	Trichocorixa	sp
				Palmocorixa	sp
				Sigara	sp
			GERRIDAE	Trepobates	pictus
			VELLIDAE	Rhagovelia	obesa
			NOTONECTIDAE	Notonecta	sp
		MEGALOPTERA	SIALIDAE	Sialis	sp
		TRICHOPTERA	BRACHYCENTRIDAE	Brachycentrus	numerosus
			HYDROPSYCHIDAE	Symphitopsyche	sparna
				Hydropsyche	decalda
			LEPTOCERIDAE	Mystacides	sp
				Athripsodes	sp
				Oecetis	sp
			LEPIDOSTOMATIDAE	Lepidostoma	sp
			HYDROPTILIDAE	Oxyethira	sp
				Hydroptila	sp
			POLYCENTROPIDAE	Polycentropus	sp
				Neureclipsis	sp
			MOLANNIDAE	Molanna	sp
			PHILOPOTAMIDAE	Chimarra	aterrima
			LIMNOPHILIDAE	Pycnopsyche	sp
			PHRYGENEIDAE	Ptilostomis	sp
		LEPIDOPTERA	PYRALIDAE	Cephalozia	sp
				Langessa	sp
		COLEOPTERA	GYRINIDAE	Dineutus	sp
			PTILODACTYLIDAE	Anchytarsus	bicolor
			DYTISCIDAE	Hydroporus	sp

Table 5. (continued)

PHYLUM	CLASS	ORDER	FAMILY	GENUS	SPECIES
			ELMIDAE	Stenelmis	sp
				Stenelmis	humerosa
				Dubiraphia	quadrinotata
				Ancyronyx	variegata
			HALIPLIDAE	Haliplus	sp
			HELODIDAE	Scirtes	sp
			CHRYSOMELIDAE	Galerucella	nymphaeae
			HYDROPHILIDAE	Berosus	sp
		DIPTERA	TIPULIDAE	Pilaria	tenuipes
				Hexatoma	fultonensis
				Hexatoma	spinosa
				Tipula	ignobilis
			SIMULIIDAE	Simulium	tuberosum
			CHIRONOMIDAE	Conchapelopia	sp
				Ablabesmyia	mallochi
				Ablabesmyia	aspera
				Procladius	culiciformis
				Clinotanypus	thoracicus
				Procladius	culiciformis
				Tvetenia	bavarica
				Tvetenia	discoloripes
				Psectrocladius	psilopterus
				Psectrocladius	elatus
				Orthocladius	annectens
				Cricotopus	verriensis
				Cricotopus	bicinctus
				Parametriocnemus	stylatus
				Thienemanniella	xena
				Paraphaenocladius	sp
				Heterotrissocladius	marcidus
				Rheocricotopus	robacki
				Stenochironomus	sp
				Tribelos	jucundus
				Polypedilum	fallax
				Polypedilum	illinoense
				Cryptochironomus	sp 1

Table 5. (continued)

PHYLUM	CLASS	ORDER	FAMILY	GENUS	SPECIES
				Parachironomus	frequens
				Dicrotendipes	fumidus
				Dicrotendipes	modestus
				Harnischia	sp 2
				Nilodorum	devineyae
				Nilothauma	babyi
				Chironomus	decorus
				Glyptotendipes	sinilis
				Glyptotendipes	lobiferus
				Tripodura	scalaenum
				Tripodura	scalaenum sp a
				Paralauterborniella	nigrohalteralis
				Micropsectra	sp mpm
				Micropsectra	polita
				Micropsectra	sp 7
				Rheotanytarsus	distinctissimus
				Rheotanytarsus	sp
				Calopsectra	guerla
				Cladotanytarsus	sp 2
			CERATOPOGONIDAE	Palpomyia	tibialis
				Probezzia	opaca
				Culicoides	sp
			EMPIDIDAE	Hemerodromia	praccatoria
				Hemerodromia	rogatoris
			TABANIDAE	Tabanus	sp

Table 6. Listing of macroinvertebrates recovered from the brackish water sites

PHYLUM	CLASS	SUBCLASS	ORDER	FAMILY	GENUS	SPECIES
PORIFERA	DESMOSPONGIAE		HAPLOSCLERIDA	HALICLONIDAE	Haliclona	palmata
CNIDARIA	HYDROZOA		ATHECATA	BOUGAINVILLIIDAE	Bougainvillia	rugosa
			THECATA	CAMPANULARIDAE	Eucopella	caliculata
					Clytia	inconspicua
			ACTINIARIA	AIPTASIOMORPHIDAE	Haliplanella	luciae
				DIADUMENIDAE	Diadumene	leucolena
RHYNCHOCOELA	ANOPLA		PALEONEMERTEA	TUBULANIDAE	Tubulanus	pellucidus
			HETERONEMERTEA	LINEIDAE	Lineus	pallidus
	ENOPLA		HOPLONEMERTEA	AMPHIPORIDAE	Amphiporus	bioculata
BRYOZOA	GYMNOLAEMATA		CTENOSTOMATA	NOLELLIDAE	Nolella	sp
				VESICULARIDAE	Bowerbankia	gracilis
					Amathia	convoluta
				WALKERIIDAE	Aeverrillia	armata
			CHEILOSTOMATA	ELECTRIDAE	Electra	crustulenta
MOLLUSCA	GASTROPODA		MESOGASTROPODA	EPITONIIDAE	Epitonium	multistriatum
			NEOGASTROPODA	NASSARIIDAE	Ilyanassa	obsoleta
					Nassarius	trivittatus
			CEPHALASPIDEA	ACTEONIDAE	Acteon	punctostriatus
				RETUSIDAE	Retusa	obtusa
	BIVALVIA		PTEROCONCHIDA	MYTILIDAE	Modiolus	modiolus
					Modiolus	demissus
				OSTREIDAE	Crassostrea	virginica
			HETERODONTIDA	VENERIDAE	Gemma	gemma
				MACTRIDAE	Mulinia	lateralis
				TELLINIDAE	Macoma	balthica
					Macoma	tenta
				MYIDAE	Mya	arenaria
				DONACIDAE	Donax	fossor
				SOLECURTIDAE	Tagelus	plebeius
ANNELIDA	POLYCHAETA		PHYLLODOCIDA	PHYLLODOCIDAE	Phyllodoce	mucosa
					Eteone	lactea
					Eteone	trilineata
					Eteone	heteropoda
					Nereiphylla	fragilis
				GLYCERIDAE	Glycera	dibranchiata
				GONIADIDAE	Glycinde	solitaria

Table 6. (continued)

PHYLUM	CLASS	SUBCLASS	ORDER	FAMILY	GENUS	SPECIES
				SYLLIDAE	Brania	clavata
				HESIONIDAE	Podarke	obscura
				NEREIDAE	Laeonereis	culveri
					Nereis	zonata
			CAPITELLIDA	MALDANIDAE	Rhodine	attenuata
					Maldanopsis	elongata
			SPIONIDA	SPIONIDAE	Scolecolepides	viridis
					Streblospio	benedicti
					Scolecolepis	squamata
					Prionospio	sp
					Polydora	ligni
					Polydora	commensalis
				PARAONIDAE	Aricidea	jeffreysii
				CHAETOPTERIDAE	Spiochaetopterus	oculatus
				SABELLARIIDAE	Sabellaria	vulgaris
			EUNICIDA	LUMBRINEREIDAE	Lumbrineris	acuta
					Lumbrineris	tenuis
			CIRRATULIDA	CIRRATULIDAE	Tharyx	acutus
					Cossura	longocirrata
			TEREBELLIDA	PECTINARIIDAE	Pectinaria	gouldii
				AMPHARETIDAE	Hypanola	grayi
				TEREBELLIDAE	Thelepus	cincinnatus
			SABELLIDA	SABELLIDAE	Potamilla	neglecta
	OLIGOCHAETA		HAPLOTAXIDA	TUBIFICIDAE	Limnodrilus	sp
					Monopylephorus	sp
				NAIDIDAE	Nais	elinguis
ARTHROPODA	PANTOPODA			NYMPHONIDAE	Nymphon	stromi
	INSECTA		ODONATA	ZYGOPTERA	Ischnura	sp
			HEMIPTERA	GERRIDAE	Trepobates	sp
				NOCTONECTIDAE	Notonecta	sp
				CORIXIDAE	Trichocorixa	sp
			TRICHOPTERA	HYDROPTILIDAE	Oxyethira	sp
			DIPTERA	CHIRONOMIDAE	Tripodura	scalaenum
					Rheotanytarsus	sp
					Nilodorum	devineyae

Table 6. (continued)

PHYLUM	CLASS	SUBCLASS	ORDER	FAMILY	GENUS	SPECIES
					Chironomus	decorus
				CERATOPOGONIDAE	Palpomyia	tibialis
					Culicoides	sp
	CRUSTACEA	OSTRACODA				
		CIRRIPEDIA	THORACICA	BALANIDAE	Balanus	balanoides
					Balanus	amphitrite
		MALACOSTRACA	CUMACEA	BODOTRIIDAE	Cyclaspis	sp
				LEUCONIDAE	Leucon	sp
			ISOPODA	ANTHURIDEA	Cyathura	polita
					Cyathura	burbancki
				SPHAEROMIDAE	Cassidisca	lunifrons
				IDOTEIDEA	Chiridotea	tuftsi
					Edotea	montosa
			AMPHIPODA	AMPELISCIDAE	Ampelisca	abdita
				AORIDAE	Microdeutopus	gryllotalpa
				COROPHIIDAE	Corophium	sp
				GAMMARIDAE	Gammarus	tigrinus
					Crangonyx	pseudogracilis
				LYSIANASSIDAE	Lysianopsis	alba
				PHOTIDAE	Podoceropsis	nitida
			MYSIDACEA	MYSIDAE	Mysidopsis	bigelowi
					Neomysis	americana
			DECAPODA	PALAEMONIDAE	Palaemonetes	pugio
				CRANGONIDAE	Crangon	septemspinosa
				PORTUNIDAE	Callinectes	sapidus
				XANTHIDAE	Rhithropanopeus	harrisii
	ASCIDIACEA		PLEUROGONA	MOLGULIDAE	Molgula	sp