Piedmont Stream Survey – Broad River Basin

Completion Report

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Submitted by

Jason Bettinger, John Crane, and James Bulak

South Carolina Department of Natural Resources

EXECUTIVE SUMMARY

1. We collected 49 fish samples from 45 sites in the upper and lower Broad River drainages during the study. Thirty-eight samples were collected from least impacted sites and 11 samples were collected from randomly chosen sites in the upper Broad River drainage.

2. More than 20,000 fish representing 8 families and 45 species were collected. No federally-listed threatened or endangered species were collected; however, we did collect 12 fish species of conservation concern. The most commonly collected species included bluehead chub, rosyside dace, yellowfin shiner, sandbar shiner, creek chub, and redbreast sunfish.

3. Macroinvertebrate samples were collected from 37 sites during the study. Those samples resulted in the collection of more than 11,000 specimens, representing 323 taxa. No federally-listed threatened or endangered taxa were collected; however, we did collect 2 crayfish species and 4 mussel species that are of conservation concern in South Carolina.

4. Basic information on habitat and water quality was collected at each sample location and a suite of watershed characteristics were calculated for the drainage area of each sample site.

5. The most influential predictors of fish community composition at the sites we sampled in the Broad River drainages were those associated with natural habitat variation (i.e., stream size and stream topography).

6. Fish community condition index values were calculated for each of the sites sampled during the current study plus 28 historical sites sampled by the SCDNR. Nine of the sites sampled had "Excellent" fish communities based on our fish condition index and are considered prime candidates for conservation efforts and use as reference sites in future work. Twenty-two sites were identified has having "Poor" fish communities that would likely benefit from appropriate stream restoration activities.

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Introduction

The Piedmont region of South Carolina has undergone extensive development during the last century and a half. Early on, forests gave way to cropland and pastures. More recently farmland has been transformed at an accelerating rate by urban, suburban, commercial, and industrial development. Agricultural development of lands of moderate slope with erodible soils led to substantial sedimentation in Piedmont streambeds. Runoff from fields contributed to nutrient loading in streams. Modern soil conservation practices have reduced those impacts, but pasturage of cattle and other farm animals on lands adjacent to streams continues to degrade stream banks and channels and affect water quality. Timber harvest, instream sand and gravel mining, road and bridge construction, and dam construction are similarly destructive of Piedmont stream habitat, and have potentially adverse effects on fish and other aquatic organisms. These and other practices have altered the natural ecological conditions of Piedmont streams and rivers and placed considerable stress on fish and other biological aquatic resources.

A comprehensive survey of Piedmont streams was needed to define the present status of their biotic resources. Fish species of uncertain status in Broad River drainage streams included thicklip chub *Cyprinella labrosa*, fieryblack shiner *C. pyrrhomelas*, Santee chub *C. zanema*, whitemouth shiner *Notropis alborus*, greenhead shiner *Notropis chlorocephalus,* swallowtail shiner *N. procne*, V-lip redhorse *Moxostoma pappillosum*, robust redhorse *M. robustum*, Carolina darter *Etheostoma collis*, fantail darter *E. flabellare*, and Piedmont darter *Percina crassa*. Additional information was needed to adequately characterize their current population status. Information obtained on species

distribution and relative abundance, combined with an inventory of ecological conditions and an assessment of habitat quality, will provide resource managers and planners with a sound baseline for making future management and conservation decisions. The information will also be useful in identifying least impacted habitats that should be protected, as well as targeting habitat restoration activities in areas that have degraded aquatic communities.

This survey concentrated on the Broad River drainage. The Broad River drainage was selected because of ongoing hydroelectric re-licensing activities and its relatively high conservation potential. The primary objectives for this study were to: (1) conduct a comprehensive fish community inventory of wadeable streams of the upper Broad (U.S. Geological Survey hydrologic unit 3050105) and lower Broad (hydrologic unit 3050106) sub-drainages; (2) obtain basic information on habitat and water quality at the study sites; (3) compile all new and pertinent historic data into a publicly accessible geographic database; (4) develop a preliminary list of species having the greatest conservation need; and (5) identify opportunities for conducting habitat conservation and/or restoration activities expected to have a beneficial effect on aquatic communities generally and on those fish species of special concern in particular.

Methods

Site Selection

Fish sample locations were chosen that were perceived to have the greatest chance of harboring species of conservation concern (i.e., least impacted sites). A GIS database for

the two Broad River sub-drainages was constructed to aid in the selection of least impacted sites and to ensure that sites were selected proportionally among ecoregions and basins. The database included information on land use, point-source discharge sites, stream order, ecoregions, drainage basins, and roads. We divided all 1st though 3rd order streams in the Broad River drainage into 100 m sampling units. Using the GIS we eliminated sampling units that were in close proximity to urban areas (within 2 km), agricultural operations (within 0.5 km), roads (within 50 m), and NPDES discharge sites (3 km). Sample sites were then randomly selected from the remaining least impacted sample units. Ultimately, a site was sampled if, after a visual inspection, it appeared to have relatively good habitat and reasonable access. Several of the least impacted sites were sampled in both years of the study to explore temporal variability and sampling precision. In addition, a group of entirely randomly selected sites in the upper Broad River sub-drainage was sampled as part of an ongoing statewide stream inventory.

Fish Sampling

Streams were sampled following South Carolina Department of Natural Resources (SCDNR) protocols for sampling fish in wadeable streams (Thomason et al. 2002) during the summer and fall of 2003 and 2004. At each sample site a stream reach of at least 100 m, depending on stream width, that contained representative habitat was selected for sampling. Block nets were placed at the upper and lower limits of the sample reach. One to four Smith-Root™ 24-volt battery-powered backpack electrofishing units were used to make three consecutive upstream passes through the sample reach. One unit was used for every 3 m of stream width. If a new species was encountered on the third electrofishing

pass a fourth pass was conducted. Collected fish were identified to species and 25 randomly chosen individuals from each species were measured (TL mm). Representatives of each species collected were preserved in 10% formalin and maintained in a reference collection.

Macroinvertebrate Sampling

Macroinvertebrate samples were collected from 37 of the 45 fish sampling sites during summer and fall of 2005. Macroinvertebrates were collected following the Timed-Qualitative Multiple Habitat Sampling Protocol (MHSP) of South Carolina Department of Health and Environmental Control (SCDHEC 1999). The MHSP is a disciplined procedure designed to ensure that all habitats present at a site are thoroughly sampled. At each site three man-hours were devoted to collecting as many macroinvertebrate taxa as possible utilizing three different sampling implements and a visual search. A fine mesh sampler was used to collect chironomids from the substrate; a D-frame dip net was used to sample rootbanks, leafpack and aquatic vegetation, when present; and a kick seine was used to sample sand, gravel and cobble riffle areas. Each gear type was employed for approximately 0.5 h total effort, including collecting, rough sorting, and picking. At each site 1.5 h of effort was expended visually searching for macroinvertebrates on logs, rocks and aquatic vegetation, while a #10 hand sieve was used to sift through substrate. All macroinvertebrates collected were preserved in 85% ethanol. Macroinvertebrate samples were transferred to Shealy Environmental Services Inc., Cayce, SC, where they were identified to the lowest practical taxonomic level.

Although we did not use any methods that specifically targeted mussels and crayfish, live native unionids were noted when encountered during visual macroinvertebrate searches. Representative crayfish samples were collected when encountered during both macroinvertebrate and fish sampling. Crayfish were identified to species when practical by John Cooper (North Carolina Museum of Natural Sciences), Jennifer Price (SCDNR) or Shealy Environmental Services.

Habitat

Physical and chemical habitat data were collected at each site. We measured water temperature, dissolved oxygen, conductivity, and pH using a YSI Model 556 multi-probe meter, and turbidity using a LaMotte Model 2020 turbidimeter at each fish and macroinvertebrate sampling site. We also calculated average stream width and average depth at each sampling site. Average stream width was determined by measuring the wetted stream width at the downstream limit of each sample reach and then every 25 m to the upstream limit of the sample reach. Average depth was determined by measuring water depth at three positions along each transect where wetted width was measured. Stream habitat quality was assessed with the U.S. Environmental Protection Agency's (EPA) Rapid Bioassessment Visual Estimation Technique (Barbour 1999). That habitat assessment technique involves scoring 10 habitat parameters (e.g., sediment deposition) from 1 – 20 and then classifying the scoring for each habitat parameter as "Optimal", "Suboptimal", "Marginal" or "Poor" by quartile. We calculated an overall habitat condition score by summing the scores of each habitat parameter by site and classifying those scores into one of the four classifications (e.g., "Optimal") by quartile. In addition

to collecting habitat data at the site level we also collected habitat information at the watershed level using ArcGIS® (ArcMap™ 9.1, Environmental Systems Research Institute, Redlands, California). For each sample location we delineated the drainage area using the Spatial Analyst Extension in ArcGIS. We then calculated numerous watershed characteristics for each of the sampled sites (Table 1). Land use characteristics (e.g., % agriculture) were derived from SCGAP data, which is based on 30-m resolution satellite imagery collected from 1991 through 1993 (SCGAP 2001). Land use characteristics were calculated for the entire drainage area of each site as well as within a 250 m buffer around all stream segments above the sample site.

Statistical Analysis

A cluster analysis was used to group sites based on the similarity of their fish communities (McCune et al. 2002). Fish catch data from sites that were sampled during both years were pooled across years and averaged to eliminate the potential influence of repetitive sampling on the subsequent analysis of the association between fish community composition and environmental variables. Three sites considered to be outliers were eliminated from the analysis to remove their impact on the hierarchical classification of groups. Two of the eliminated sites (82003 and 42003) had extremely small drainage areas with depauperate fish populations where only 2 and 11 fish were collected, respectively. The third site (222004) was impacted by a beaver pond and contained a drastically different fish community than the other sites. A fourth root power transformation was applied to the fish catch data to minimize large differences in

abundance among sites (Clarke 1993). The Sorensen (Bray-Curtis) distance equation was used to calculate similarity, and groups were linked with the flexible beta method (-0.25).

Cluster analysis was also used to investigate temporal variation and sampling precision at sites that were sampled during both 2003 and 2004. That cluster analysis included only those sites that were sampled during both years and followed the same methods described above, except fish catch data was not pooled across years.

In addition to cluster analysis, we also used the non-metric multidimensional scaling (NMS) method (Clarke 1993) to ordinate the sample sites. NMS is useful in ecological data analysis because it is appropriate for data sets that are non-normal, discontinuous or contain many zeros (Clarke 1993; McCune and Mefford 1999). The NMS was performed on the same transformed data set as the cluster analysis and used the same Sorensen distance equation. The NMS ordination was plotted and coded for the site groupings determined in the cluster analysis to highlight similarities between the two methods.

To investigate the association between environmental variables (Table 1) and fish community composition a habitat matrix was constructed and plotted against the NMS ordinations.

To identify sites that contained "high quality" fish communities we calculated an overall fish community condition value for each of the sites we sampled, as well as 28 additional

sites previously sampled by the SCDNR in the Broad River drainage. The fish community condition value was based on three metrics: species richness, conservation species richness, and Simpson's diversity index. Three conservation species (snail bullhead, flat bullhead and highback chub) were removed from the conservation species richness metric. The two bullhead species were removed because they are of conservation concern more because of nonnative species introductions (i.e., flathead catfish) than habitat sensitivities (SCDNR 2005a). Highback chub was removed because it was so prevalent in our samples that it did not seem to be a good indicator of habitat quality. Because species richness (and potentially conservation species richness) is highly correlated with drainage size (Karr 1981), linear regression was used to correct those two metrics for drainage area. Simpson's diversity index was calculated as

$$D = \sum_{i=1}^{s} \left[\frac{n_i(n_i - 1)}{N(N-1)} \right],$$

where n_i = Number of individuals of species i in the sample

N = Total number of individuals in the sample

s = Number of species in the sample.

Each of the metrics was classified by site into one of four classes and assigned a numerical value (poor = 1, fair = 2, good = 3, or excellent = 4), using ArcGIS® based on the Natural Breaks classification method (also known as Jenks' Method) (Jenks 1977). The Natural Breaks method assigns data into classes so that the variances within all classes are minimized, while variances among classes are maximized. The three classified metrics were then averaged and those values were again classified using the Natural Breaks method to assign an overall fish community condition value to each site. A Wilcoxon Two-Sample Test was used to investigate differences in fish community

condition values between least impacted and randomly selected sites in the upper Broad River drainage. Two least impacted sites (#82003 and #62003) were eliminated from the analysis because they had very small drainage areas and one site (#82003) was located in the Blue Ridge ecoregion at significantly higher elevation than all other sites. A Chi-Square test was used to determine if fish community condition index classifications differed among ecoregions. Samples collected from the Blue Ridge and Southern Inner Piedmont ecoregions were eliminated from the analysis because only two and three samples were collected from each ecoregion, respectively. To maximize counts within cells, sites classified as "Excellent" and "Good" were grouped and sites classified as "Fair" and "Poor" were grouped.

Invertebrate collections were used to calculate bioclassification scores for each site sampled. The South Carolina Bioclassification score (SCDHEC 1999) is a system that classifies stream water quality into five categories from "Poor" to "Excellent" based on macroinvertebrate communities. The South Carolina Bioclassification score is based on North Carolina's macroinvertebrate Biotic Index (BI) (NCDEHNR 1997) and Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa richness.

Pearson Correlation was used to investigate the relationships between our visual habitat scores, invertebrate bioclassification scores, percentage of disturbed land, and fish community condition index. Percentage of disturbed land was the total percentage of land in each drainage that was agricultural, cleared, or urban.

All multivariate analysis was conducted with PC-ORD software for the analysis of ecological data (McCune and Mefford 1999). All other statistical tests were performed in SAS (SAS 1988).

Results

Fish

Forty-nine fish samples were collected from 45 sites during the study (Table 2, Figure 1). Thirty-eight samples were collected from least impacted sites and 11 were collected from random sites in the upper Broad River drainage as part of the statewide stream sampling program. Four of the least impacted sites were sampled during both 2003 and 2004.

More than 20,000 fish representing 8 families and 45 species were collected (Table 3). The most abundant fish was bluehead chub, accounting for nearly 28% of all fish collected and present at 42 of the 45 sampling locations. Other commonly encountered fish included rosyside dace, yellowfin shiner, sandbar shiner, creek chub, and redbreast sunfish. Each species represented more than 5% of all fish collected. The rarest fish in our samples included chain pickerel, Santee chub, flier, and black crappie. Four species - fieryblack shiner, Santee chub, chain pickerel and coastal shiner - were collected at only one site.

Six of the eleven species identified as species of uncertain status at the beginning of this project and 12 species of conservation concern (SCDNR 2005b) were collected from streams in the Broad River drainage (Table 3). Five of the species of uncertain status

collected were also conservation species. Only swallowtail shiner was not on both lists. Five species identified as species of uncertain status at the beginning of the study were not collected during our survey. Those species included whitemouth shiner, greenhead shiner, thicklip chub, V-lip redhorse and robust redhorse. The number of conservation species at each site ranged from 0 at seven sites to 8 at site 342004 (Table 4). Most sites (82%) where conservation species were encountered contained three or fewer conservation species. Total relative abundance (RA) of species of conservation concern varied by site, from 0 at seven sample sites to 32% at site 182003. Species of conservation concern accounted for nearly 9% of all fish collected and at least one species of conservation concern was collected at 38 of the 45 sample sites. Highback chub was, by far, the most abundant species of conservation concern, occurring at 23 sites and accounting for nearly half the RA of all conservation species. Most other species of conservation concern accounted for less than 1% of the total fish collected.

Cluster analysis indicated there were five main fish community types in the Broad River sub-drainages (Figure 2). Cluster analysis of sites that were sampled in both 2003 and 2004 indicated that there was little temporal variation and high sampling precision between years (Figure 3). All four of the sites sampled during both years clustered close together with 90% or more of the information remaining between them.

NMS ordination produced similar groupings as the cluster analysis (Figure 4). The NMS analysis resulted in a three-dimensional solution with a final stress of 12.0. Based on Monte Carlo simulations, each dimension obtained in the analysis was significant (P =

0.032). The three ordination axes together explained 89.9% of the variation in the dissimilarity matrix. Axis 1 accounted for most of the variation (66.7%) while axis 2 and 3 explained 17.3% and 5.8%, respectively. Stream width, depth, gradient, elevation, and drainage area (ha) were the most influential predictors of the ordination axes (Table 5, Figure 4).

Fish community condition values were assigned to each of the sites sampled during 2003 and 2004 as well as 28 historic sites sampled by the SCDNR between 1993 and 2001 (Table 6, Figure 5). The only sites that scored "Excellent" were least impacted locations sampled during the current study (Table 7). Least impacted sites in the upper Broad River sub-drainage had significantly higher fish community condition values than randomly selected sites in the same sub-drainage (Wilcoxon; P = 0.02).

There was a significant difference in fish community condition classifications among ecoregions (Chi-Square; P = 0.002) (Table 8). The Kings Mountain and Carolina Slate Belt ecoregions had more sites classified as "Excellent – Good" and fewer sites classified as "Fair – Poor" than expected. Conversely, the Southern Outer Piedmont had fewer sites classified as "Excellent – Good" and more sites classified as "Fair – Poor" than expected.

Macroinvertebrates

Macroinvertebrate samples were collected from 37 sites; the results of those collections are included in a report prepared by Shealy Environmental Services, attached as

Appendix 1. Bioclassification scores ranged from Fair to Good, with the majority of sites classified as "Good" or "Good-Fair" (Table 6).

Live crayfish were collected from 26 sites during the fish and macroinvertebrate surveys (Table 9, Appendix 1). Twelve species or forms of crayfish were identified (Table 9). Two of those species (*Cambarus howardi* and C*ambarus spicatus*) are considered to be of conservation concern in South Carolina (SCDNR 2005b). Live native unionids were observed at only one site (3839, Clarks Fork) during our survey. Live mussels at the site were abundant. We identified four species: *Elliptio producta*, *Elliptio angustata*, *Elliptio complanata*, and *Villosa delumbis*. All four of the mussel species we collected are considered to be of conservation concern in South Carolina (SCDNR 2005b).

Habitat

The water quality and physical parameters we measured at each site are reported in Table 10. Mean widths of our sample sites ranged from 1.4 m to 14.2 m and averaged 5 m. The average stream depth was 0.18 m (range, 0.05 – 0.39 m). Dissolved oxygen ranged from 4.5 to 12.0 mg/L, pH values ranged from 4.6 to 7.3, conductivity ranged from 17 to 227 ΦS and turbidity ranged from 0.7 to 11.1 NTU. When water quality data were plotted spatially in our GIS no spatial relationships were observed. However, there was a negative linear relationship between conductivity and elevation (as elevation increased conductivity decreased). Visual habitat scoring resulted in optimal overall habitat condition for 21 of the 45 sites surveyed. Eighteen sites had suboptimal overall habitat condition and six sites had marginal overall habitat condition (Table 11).

Pearson correlation analysis indicated that there was a significant relationship ($P < 0.05$) between our visual habitat scores and fish community condition index, invertebrate bioclassification and percentage of disturbed land. A positive relationship was observed between visual habitat scores and fish community condition index ($r = 0.38$) and between visual habitat scores and bioclassification ($r = 0.48$). A negative relationship was observed between visual habitat scores and percentage of disturbed land in the drainage area ($r = -0.24$). There was not a significant relationship between fish community condition index and invertebrate bioclassification.

Discussion

Six of the eleven species identified as species of uncertain status at the beginning of this project and 12 species of conservation concern (SCDNR 2005b) were collected from streams in the Broad River drainage. In general, our survey collections of streams in the Broad River drainage support the conservation status of fishes outlined in the South Carolina Comprehensive Wildlife Conservation Plan (SCCWCP) (SCDNR 2005b). Fieryblack shiner is restricted to the to the Santee and Pee Dee River systems above the Fall Line in North Carolina and South Carolina. We only collected fieryblack shiner at one site during our survey; its limited distribution throughout South Carolina and North Carolina coupled with its rarity in our survey support its inclusion in the list of conservation concern species. Only two individuals of Santee chub were collected from one site during our survey. The Santee chub is restricted to the Broad and Saluda River drainages in the upper Santee basin. Like the fieryblack shiner, the restricted distribution

of Santee chub and its rarity in our collections support its inclusion in the list of conservation concern species. Swallowtail shiner was listed as a species of uncertain status at the beginning or our study, but was not identified as a species of conservation concern in the SCCWCP (SCDNR 2005b). Swallowtail shiner in South Carolina is considered by NatureServe (2004) to be imperiled and was relatively rare in our collections (51 individuals were collected from 5 sites). As such it may warrant inclusion in the list of conservation concern species.

Each of the darter species identified as species of uncertain status at the beginning of this study are included in the SCCWCP list of species of conservation concern (SCDNR 2005b); based on the current survey that status is warranted. There are, however, some taxonomic discrepancies with two of the species. The broader Carolina darter *Etheostoma collis* does not occur in the Broad River drainage, but is restricted, in South Carolina, to the Catawba River drainage (Fred Rohde, personal communication). We did, however, collect the Saluda form of the Carolina darter, *Etheostoma saludae*, which is considered to be an evolutionary significant unit of the broader Carolina darter (Joe Quattro, personal communication). That species/form was more common than anticipated. We collected 96 individuals from eight different locations. However, based on its narrow range endemism, restricted to the upper Congaree, Saluda and Broad River drainages, its status as a species of conservation concern is warranted. The form of fantail darter we collected has been named the "Carolina" fantail darter *Etheostoma flabellare brevispina* (Warren et al. 2000) and may warrant species level differentiation from the broader fantail darter (Blanton 2001). The *E. f. brevispina* form is endemic to

the Piedmont and Blue Ridge sections of the upper Pee Dee and Santee River drainages in South Carolina (Warren et al. 2000). We collected 51 individuals of the "Carolina" fantail darter from four sites in the upper Broad River drainage. Its limited global distribution and rarity in our survey of the Broad River drainage support its status as a species of conservation concern in South Carolina. Those species identified in Table 3 as species of conservation concern, plus swallowtail shiner, should be considered species of conservation concern within the Broad River drainage.

Five species identified as species of uncertain status at the beginning of this project were not collected. Two of those species, whitemouth shiner and greenhead shiner, are likely not currently present in the Broad River drainage. In South Carolina, whitemouth shiner is apparently restricted to the slate belt region of the upper Lynches and Pee Dee systems (SCDNR 2005a), and greenhead shiner is endemic and thus restricted to the Catawba River drainage (Rohde et al. 1994). Although V-lip redhorse is present, although uncommon, in the mainstem of the Broad River (Bettinger et al. 2003) we did not collect any in its tributary streams. V-lip redhorse typically inhabit larger streams and medium-sized rivers (Jenkins and Burkhead 1993) so its absence in our survey of small to medium-sized streams was not unexpected. Naturally-reproducing populations of robust redhorse in South Carolina are currently known only from the Savannah River and Pee Dee River (SCDNR 2005a). While it has recently been stocked into the mainstem of the Broad River, its potential utilization of smaller streams in the Broad River drainage is unknown. We did not collect any thicklip chub during our survey which was surprising.

Thicklip chub are common in the mainstem of the Broad River (Bettinger et al. 2003) and may prefer larger streams.

Although our crayfish and mussel survey were not quantitative, they do give a preliminary indication of the species inhabiting streams in the Broad River drainage. Two of the crayfish we collected, *Cambarus howardi* and C*ambarus spicatus,* were identified in the SCCWCP (SCDNR 2005b) as species of conservation concern. *Ccambarus spicatus* (Broad River spiny crayfish) is endemic to the Broad River drainage and is currently considered vulnerable to imperilment (S3) in South Carolina (NatureServe 2004). The only site where we collected the Broad River spiny crayfish was Wateree Creek (#242004), which also had an excellent fish community. *Cambarus howardi* was more common in our collections; it was collected from four sites, all of which had good to excellent fish community condition indices. Live native mussels were only observed at one of our sample locations (Clarks Fork). We did not specifically target mussels during fish sampling so we cannot rule out their occurrence at the other sites; however, our inability to find live mussels during our macroinvertebrate visual searches does indicate the scarcity of mussels in the streams we surveyed. All four of the mussel species we collected from Clarks Fork are considered to be of moderate conservation priority in the SCCWCP (SCDNR 2005b).

In general, the water quality and physical parameters we measured were consistent with expected values for piedmont streams in the Broad River drainage. Channel alteration, vegetative protection, and riparian width were not problematic at most sites because those

with severe, localized anthropogenic influences were eliminated through our selection of least impacted sites. Three of the four sites that scored less than optimal for channel alteration, all four sites that scored less than optimal for vegetative protection, and both sites that scored less than suboptimal for riparian width were included as part of the random statewide stream survey. Although many of our sites scored as "Optimal" overall, the habitat at most sites, including least impacted sites, was impaired in at least one of the habitat condition categories. At more than 75% of sites surveyed, bank stability, sediment deposition, and embeddedness were less than optimal.

The multivariate analysis of our fish sampling of least impacted sites and a small set of random sites indicated that the most significant predictors of fish community composition in the Broad River drainage are those associated with natural habitat variation. Stream size (width, depth, and drainage area) and stream topography (gradient and elevation) were more influential predictors of fish community composition than any of the anthropogenic variables we measured. However, that is not an indication that anthropogenic impacts have had little effect on stream biota in the Broad River drainage. Our study design was primarily focused on identifying the locations and condition of species of conservation concern and their habitats; therefore, we directed our sampling effort toward least impacted sites. If a completely random design had been employed, a larger range of anthropogenic impacts would have been encountered and the results of our analysis may have differed. In addition to the sample design being focused on least impacted sites, the land cover data (SCGAP 2001) we used may not be current enough to accurately quantify present conditions. Although the GAP data is the best data we had

available, it is 10 – 13 years old and may not reflect recent and current landuse activities in the Broad River drainage. During our site reconnaissance and sampling we encountered numerous instances of recent and current land clearing activity in the drainage that would not have been captured in our analysis.

Our procedure for selecting least impacted sites seemed effective given that our fish community condition index scores were significantly higher at our least impacted sites than randomly selected sites in the upper Broad River drainage.

We identified 30 sites from our current survey and historic data that had "Excellent" or "Good" fish communities, based on our fish community condition index. Sites that scored "Excellent" could be used as reference sites in future work. They should also be considered prime candidates for future conservation efforts. Sites that scored "Good" should be considered the second tier for stream conservation efforts. The Clarks Fork site should also be considered as a conservation candidate, even though it only had a "Fair" fish community rating, as it was the only site we sampled that had an obvious native mussel community.

Forty-three sites from our current survey and historic data had "Fair" or "Poor" fish communities based on our fish community condition index. Those sites, especially those that scored "Poor", could be considered candidates for stream restoration efforts. However, priority should be given to protecting/conserving those sites that scored

"Excellent" opposed to restoring the degraded sites, as it is much easier and more successful to maintain quality habitat then to restore degraded habitats.

Interestingly, sites within the Kings Mountain and Carolina Slate Belt ecoregions tended to have higher fish community condition values than those in the Southern Outer Piedmont. The higher values in the Kings Mountain ecoregion may be partly due to protections afforded four sites whose drainage areas extend into Kings Mountain State Park and/or Kings Mountain National Military Park. However, of those four sites only three have a significant portion (>50%) of their drainage areas protected within park boundaries, and one of those sites (Clarks Fork) scored only "Fair", likely due to several impoundments upstream of our fish sampling site. Conversely, sites located within the Southern Outer Piedmont had poorer fish community condition values than expected, even at sites with partially protected drainages. We calculated fish community condition values for six sites that were completely contained (five sites) or partially contained (one site) within Sumter National Forest. Five of those sites had "Poor" fish community condition values and one site was assigned a "Fair" condition value.

Sedimentation from nonpoint sources is the greatest threat to aquatic fauna in the eastern USA (Richter 1997), and likely poses the greatest threat to streams in the Broad River drainage as well. Ground disturbance from development activities (e.g., residential, commercial, transportation, and utility construction), agriculture and silviculture are primary sources of erosion that lead to sedimentation in piedmont streams. Many corporate and private timber managers fail to follow best management practices (BMPs),

which contribute significant siltation and other nonpoint source pollution within the Broad River drainage. Stream bank erosion due to loss of riparian areas, livestock grazing, and altered hydrology also contribute to sedimentation in piedmont streams. Therefore, conservation efforts within the Broad River drainage should focus on educating land owners of proper soil conservation practices, responsible riparian management, and enforcing the South Carolina Forestry Commission's BMPs for silviculture operations. Several opportunities exist to partner with federal agencies (United States Forest Service, Natural Resources Conservation Service, United States Fish and Wildlife Service), state agencies (South Carolina Department of Health and Environmental Control, South Carolina Forestry Commission), nonprofit organizations (The Nature Conservancy), corporate entities (Duke Power, SCE&G, Lockhart Power Company), and citizen-based groups (Broad River Advisory Council) to plan, fund and carry out restoration activities.

Within the confines of Sumter National Forest, other strategies may be implemented to restore the condition of aquatic communities through localized habitat enhancement. Although most of the land within the National Forest is currently forested, the streams we sampled and encountered during reconnaissance had very poor aquatic habitats that likely contributed to their "Poor" fish community condition scores. Most sites we visited had extremely homogenous habitat, characterized by long straight stretches of shallow "runs" with substrates consisting of shifting sand and fine sediments. The sites we visited also lacked instream structure (e.g., large woody debris). The degraded habitat conditions we observed in the Sumter National Forest are likely the result of historic land clearing and

timbering of riparian forests that retarded the recruitment of large woody debris to the stream channel. Assuming that BMPs for silviculture operations are followed, additional sedimentation and channel degradation of USFS streams should not be a major concern. There is a long history of implementing stream restoration projects on forested lands aimed at improving stream habitat for coldwater fisheries (Hunt 1988; Binns 1994; Kaufmann et al. 1997). Those projects often include the introduction of large woody debris and other structures to improve fish habitat by restoring channel complexity (Cederholm et al. 1997; Martin 2001). It would seem appropriate to apply such methods to streams in the Sumter National Forest to improve aquatic habitat in general for all aquatic biota.

Significant deviations

Some modifications were made to the sample selection procedure. Instead of randomly selecting sites, we selected sites that had the greatest chance of harboring species of conservation concern (i.e., least impacted areas). Least impacted sites were chosen using our GIS database. Sites near industrial effluent, large agricultural operations, and urban areas were eliminated from the selection procedure. During 2004 eleven completely random sites from the upper Broad River sub-drainage were added to the study because that basin was included in the annual statewide stream survey; however, no completely random sites were sampled from the lower Broad River sub-drainage during either year.

In our report we highlighted potential areas that may be in need of restoration based on the condition of their fish communities. We intended to identify individual streams that

needed restoration, based on physical habitat data, and recommend specific remedies for those streams; however, those recommendations were dependent on the completion of a Rosgen habitat inventory that was to be carried out in a companion project. Unfortunately that companion project was never initiated and as a result we are unable to provide specific habitat enhancement recommendations.

A publicly accessible geographic database has not yet been developed, although the data are available upon request. The SCDNR is currently developing a geographic database that will contain fish distribution information. That database will be accessible to the public and contain the data collected during this study.

Recommendations

1. **Conservation fish species**: Based on fish data collected during this study and the information compiled in the SCWCCP (SCDNR 2005b) we recommend that the following species be considered species of conservation concern in the Broad River drainage; greenfin shiner, fieryblack shiner, highback chub, Santee chub, swallowtail shiner, silver redhorse, V-lip redhorse, robust redhorse, snail bullhead, flat bullhead, "Carolina" fantail darter, Saluda darter, seagreen darter, and Piedmont darter.

2. **Freshwater mussels:** Native mussels in the Broad River drainage are a poorly understood resource. Their scarcity in our qualitative survey suggests that a concentrated study is needed to better define their distribution and status within the Broad River drainage.

3. **Habitat conservation/protection:** Several of the streams we sampled had "Excellent" fish communities and should be considered candidates for habitat conservation and protection efforts. Ideal candidates for conservation/protection efforts would include; Sites Creek (22003), Harmon Creek (32003), Obed Creek (52003), Wolf Creek (142003), Big Cedar Creek (162003), Wateree Creek (242004), Jumping Run Creek (282004), Little Cedar Creek (292004), Kings Creek (342004), John's Creek (112003), Blue Branch (122003), and Long Branch (172003). Clark Fork (3839) is also a prime conservation target due to the presence of a large population of native mussels.

4. **Habitat restoration:** Streams within the Sumter National Forest could benefit from stream restoration activities. Based on current and historic data collected from streams within the Sumter National Forest in the Broad River drainage several streams may benefit from restoration activities. Those streams include Rocky Creek (102003), Gregory Creek (212004), Terrible Creek (222004), McClures Creek (232004), Neals Creek (128) and Hellers Creek (158).

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Table 1. Watershed and stream site habitat characteristics that were investigated as potential predictors of stream fish assemblages in the Broad River drainage, SC. Land use characteristics (e.g., % agriculture) were calculated for the entire drainage area of each site as well as within a 250 m buffer around all stream segments above each sample site.

Habitat Characteristics	
Watershed Scale	Site Scale
% Agriculture	Elevation (m)
% Forest	Mean width (m)
% Open	Mean depth (m)
% Scrub	Dissolved oxygen (mg/L)
% Urban	pH
% Water	Conductivity (ΦS)
Drainage area (ha)	Turbidity (NTU)
Road density (km/ha)	Temperature (C°)
Stream road intersection density (No./km^2)	EPA rapid bioassessment habitat score
Dam density (No./km^2)	
NPDES density (No./km^2)	
Stream gradient (m/m)	
Ecoregion (level III)	
Lentic area (m^2)	
Lentic density (No. impoundments/ha)	

Table 2. Sites sampled for fish in the Broad River drainage during summer/fall 2003 and 2004, and historic sites sampled by the SCDNR from 1993 – 2001.

Date	Site No.	Stream	Long	Lat	Ecoregion
9/9/2003	12003	Crims Creek	-81.3674	34.2605	Southern Outer Piedmont
9/23/2003	22003	Site's Creek	-81.2706	34.183	Carolina Slate Belt
9/24/2003	32003	Harmon Creek	-81.0977	34.1644	Carolina Slate Belt
10/22/2004	32004	Harmon Creek[2]	-81.0976	34.1643	Carolina Slate Belt
9/24/2003	42003	Crooked Creek	-81.3163	34.1653	Carolina Slate Belt
9/29/2003	52003	Obed Creek	-81.9958	35.1223	Southern Outer Piedmont
9/29/2003	62003	Tributary to N. Pacolet River	-82.0778	35.1741	Southern Outer Piedmont
9/30/2003	72003	Vaughn Creek	-82.2503	35.1825	Southern Inner Piedmont
9/30/2003	82003	Tributary to Vaughn Creek	-82.2723	35.1949	Blue ridge
10/2/2003	92003	Weir Creek	-81.2662	34.5587	Southern Outer Piedmont
10/19/2004	92004	Weir Creek[2]	-81.2661	34.5586	Southern Outer Piedmont
10/9/2003	102003	Rocky Creek	-81.3722	34.4307	Southern Outer Piedmont
10/9/2003	112003	Johns Creek	-81.3831	34.5836	Southern Outer Piedmont
10/13/2003	122003	Blue Branch	-81.3558	34.8600	Southern Outer Piedmont
10/21/2004	122004	Blue Branch[2]	-81.3559	34.8600	Southern Outer Piedmont
10/14/2003	132003	Guyon-Moore Creek	-81.4466	34.9968	Southern Outer Piedmont
10/15/2003	142003	Wolf Creek	-81.4614	35.0418	Kings Mountain
10/15/2003	152003	Garner Branch	-81.4194	35.1006	Kings Mountain
10/20/2003	162003	Big Cedar Creek	-81.0571	34.2401	Carolina Slate Belt
10/22/2003	172003	Long Branch	-81.3575	35.1361	Kings Mountain
10/28/2004	172004	Long Branch[2]	-81.3574	35.1361	Kings Mountain
10/22/2003	182003	Rocky Branch	-81.3347	35.0468	Southern Outer Piedmont
10/7/2004	192004	Gilky Creek	-81.6197	35.0200	Kings Mountain
10/7/2004	202004	Cowcastle Creek	-81.7570	35.0053	Southern Outer Piedmont
10/8/2004	212004	Gregory Creek	-81.5306	34.6938	Southern Outer Piedmont
10/11/2004	222004	Terrible Creek	-81.3671	34.3885	Southern Outer Piedmont
10/11/2004	232004	McClures Creek	-81.3888	34.4998	Southern Outer Piedmont
10/15/2004	242004	Wateree Creek	-81.2839	34.1899	Carolina Slate Belt
10/19/2004	252004	West Fork Little River	-81.2631	34.4533	Southern Outer Piedmont
10/21/2004	262004	Dry Fork	-81.3063	34.9610	Southern Outer Piedmont
10/27/2004	272004	Sandy River	-81.3219	34.6573	Southern Outer Piedmont
11/3/2004	282004	Jumping Run Creek	-81.6968	34.8692	Southern Outer Piedmont
11/5/2004	292004	Little Cedar Creek	-81.0975	34.2415	Carolina Slate Belt
11/5/2004	302004	Horse Creek	-81.0870	34.2125	Carolina Slate Belt

[1] Sites sampled as part of the random statewide stream survey.
[2] Sites resampled in 2004

Table 2. (Continued)

Date	Site No.	Stream	Long	Lat	Ecoregion
11/16/2004	312004	Tributary to Crims Creek	-81.4223	34.2611	Southern Outer Piedmont
11/18/2004	322004	Sudybole Creek	-81.3253	34.8208	Southern Outer Piedmont
11/18/2004	332004	Big Creek	-81.1925	34.552	Southern Outer Piedmont
11/30/2004	342004	Kings Creek	-81.4774	35.0413	Kings Mountain
8/5/2004	6389	Carlisle Branch[1]	-81.9208	35.0681	Southern Outer Piedmont
8/5/2004	3018	Little Buck Creek[1]	-81.8836	35.1286	Southern Outer Piedmont
8/5/2004	169	Arrowood Branch[1]	-81.9047	35.1700	Southern Outer Piedmont
8/10/2004	2512	Thicketty Creek[1]	-81.7147	35.0489	Southern Outer Piedmont
8/23/2004	11652	Peter Hawk Creek[1]	-81.6097	34.8464	Southern Outer Piedmont
10/7/2004	65	Wolfe Creek[1]	-82.1631	35.1909	Southern Inner Piedmont
10/7/2004	3839	Clark Fork[1]	-81.3417	35.1169	Kings Mountain
10/7/2004	7006	Bullock Creek[1]	-81.3153	35.0700	Southern Outer Piedmont
11/15/2004	2577	Green Creek[1]	-82.2647	35.1336	Southern Inner Piedmont
11/18/2004	10573	Gilkey Creek[1]	-81.5575	34.9650	Kings Mountain
11/18/2004	9484	Lawsons Fork Creek[1]	-81.9669	35.0081	Southern Outer Piedmont
10/4/2000	3	Crim's Creek[3]	-81.3688	34.2623	Southern Outer Piedmont
10/24/2001	4	Cannons Creek[3]	-81.4645	34.2753	Southern Outer Piedmont
10/16/2000	20	Beasely Creek[3]	-81.0021	34.1442	Carolina Slate Belt
6/15/2000	21	Big Cedar Creek[3]	-81.0566	34.2392	Carolina Slate Belt
6/15/2000	22	Jackson Creek[3]	-81.1913	34.3765	Southern Outer Piedmont
10/11/2001	23	West Fork Little River[3]	-81.2622	34.4527	Southern Outer Piedmont
6/14/2000	24	East Fork Little River[3]	-81.2230	34.5177	Southern Outer Piedmont
5/26/2000	26	Sandy River[3]	-81.2394	34.7303	Southern Outer Piedmont
4/24/2001	37	Green Creek[3]	-82.0785	35.0492	Southern Outer Piedmont
4/24/2001	38	Lawsons Fork Creek[3]	-82.0433	35.0235	Southern Outer Piedmont
9/26/2001	65	Little Thicketty Creek[3]	-81.7893	35.0281	Southern Outer Piedmont
9/26/2001	66	Thicketty Creek[3]	-81.7578	35.0852	Southern Outer Piedmont
4/11/2001	94	Page Creek[3]	-82.1465	35.1815	Southern Inner Piedmont
4/11/2001	96	Jamison Mill Creek[3]	-82.1981	35.1397	Southern Inner Piedmont
5/22/2001	112	Rocky Creek[3]	-81.3938	34.2433	Southern Outer Piedmont
7/25/2001	128	Neals Creek[3]	-81.4576	34.6650	Southern Outer Piedmont
10/11/2001	132	Rocky Creek[3]	-81.3739	34.4307	Southern Outer Piedmont

[1] Sites sampled as part of the random statewide stream survey.
[2] Sites resampled in 2004.
[3] Historical sites sampled by the SCDNR.

Table 2. (Continued)

Date	Site No.	Stream	Long	Lat	Ecoregion
5/23/2000	148	Bullock Creek[3]	-81.3561	34.9829	Southern Outer Piedmont
6/27/2000	150	Cherokee Creek[3]	-81.6802	35.1187	Southern Outer Piedmont
6/27/2000	154	Goforth Creek[3]	-81.6417	35.1580	Southern Outer Piedmont
11/3/1993	157	Harmon Creek[3]	-81.0803	34.1618	Carolina Slate Belt
2/19/1998	158	Hellers Creek[3]	-81.4690	34.3795	Southern Outer Piedmont
10/4/1993	160	Horse Creek[3]	-81.0883	34.2123	Carolina Slate Belt
5/23/2000	162	Kings Creek[3]	-81.4366	35.1182	Kings Mountain
4/16/1998	168	Peters Creek[3]	-81.8719	34.9957	Southern Outer Piedmont
4/16/1998	169	Peters Creek[3]	-81.8965	35.0172	Southern Outer Piedmont
6/20/2000	176	Turkey Creek[3]	-81.3251	34.9075	Southern Outer Piedmont
2/20/1998	177	West Fork Little River[3]	-81.2973	34.5444	Southern Outer Piedmont

[1] Sites sampled as part of the random statewide stream survey.
[2] Sites resampled in 2004.
[3] Historic sites sampled by SCDNR.

Table 3. Total number of each species collected from streams within the Broad River drainage during 2003 and 2004, the number of sites each species was collected from, and the species conservation priority status, if any, according to the South Carolina Comprehensive Wildlife Conservation Plan (SCDNR 2005b).

Family	Scientific Name	Common Name	Total Collected	Sites	Conservation Priority
Escocidae	*Esox americanus*	Redfin pickerel	31	5	
	Esox niger	Chain pickerel	1	1	
Cyprinidae	*Clinostomus funduloides*	Rosyside dace	1,035	13	
	Cyprinella chloristia	Greenfin shiner	173	17	Moderate
	Cyprinella nivea	Whitefin shiner	140	4	
	Cyprinella pyrrhomelas	Fieryblack shiner[1]	57	1	Moderate
	Hybognathus regius	E. silvery minnow	612	10	
	Hybopsis hypsinotus	Highback chub	891	23	Moderate
	Hybopsis zanema	Santee chub[1]	2	1	High
	Nocomis leptocephalus	Bluehead chub	5,533	42	
	Notemigonus crysoleucas	Golden shiner	17	5	
	Notropis cummingsae	Dusky shiner	77	5	
	Notropis hudsonius	Spottail shiner	703	14	
	Notropis lutipinnis	Yellowfin shiner	2,393	39	
	Notropis petersoni	Coastal shiner	24	1	
	Notropis procne	Swallowtail shiner[1]	51	5	
	Notropis scepticus	Sandbar shiner	1,649	27	
	Semotilus atromaculatus	Creek chub	1,205	31	
Catostomidae	*Catostomus commersoni*	White sucker	35	8	
	Erimyzon oblongus	Creek chubsucker	207	21	
	Hypentelium nigricans	Northern hogsucker	234	15	
	Moxostoma anisurum	Silver redhorse	21	5	Moderate
	Scartomyzon rupiscartes	Striped jumprock	348	31	
	Scartomyzon sp.	Brassy jumprock	341	11	
Ictaluridae	*Ameiurus brunneus*	Snail bullhead	12	3	Moderate
	Ameiurus natalis	Yellow bullhead	25	12	
	Ameiurus platycephalus	Flat bullhead	161	26	Moderate
	Noturus insignis	Margined madtom	449	24	
Aphredoderidae	*Aphredoderus sayanus*	Pirate perch	161	9	
Poeciliidae	*Gambusia holbrooki*	Eastern mosquitofish	14	6	
Centrarchidae	*Centrarchus macropterus*	Flier	5	3	
	Lepomis auritus	Redbreast sunfish	1,160	38	
	Lepomis cyanellus	Green sunfish	43	8	
	Lepomis gibbosus	Pumpkinseed	29	4	
	Lepomis gulosus	Warmouth	66	15	

[1] Identified as species of uncertain status at the beginning of the study

Table 3 (Continued).

Family	Scientific Name	Common Name	Total Collected	Sites	Conservation Priority
	Lepomis macrochirus	Bluegill	822	29	
	Lepomis microlophus	Redear sunfish	31	8	
	Micropterus dolomieu	Smallmouth bass	29	1	
	Micropterus salmoides	Largemouth bass	195	34	
	Pomoxis nigromaculatus	Black crappie	9	4	
Percidae	*Etheostoma flabellare*	Fantail darter[1]	51	4	High
	Etheostoma olmstedi	Tessellated darter	666	27	
	Etheostoma saludae	Saluda darter[1]	96	8	Highest
	Etheostoma thalassinum	Seagreen darter	203	20	High
	Percina crassa	Piedmont darter[1]	66	8	High
		Total Fish	20,073		
		Total species	45		

[1] Identified as species of uncertain status at the beginning of the study

Table 4. Relative percent abundance (RA) of conservation species collected in Broad River tributary streams, by site, during summer/fall 2003 and 2004.

Site Number	Greenfin shiner	Fieryblack shiner	Highback chub	Santee chub	Swallowtail shiner	Silver redhorse	Snail bullhead	Flat bullhead	Fantail darter	Saluda darter	Seagreen darter	Piedmont darter	Overall RA
12003	4.58		5.54				0.25	1.25			0.25	0.25	12.48
22003										1.23			1.23
32003								5.96		0.79	1.18		7.87
32004						4.12		6.87		0.34	0.34		11.68
42003													
52003	0.82	11.63		0.48		0.48		0.25			6.94	0.61	21.25
62003													
72003											5.69		5.69
82003													
92003			21.58					0.72					22.32
92004			12.91										12.91
102003	0.47		4.35										4.82
112003	0.64		11.67				0.72	0.86				0.52	13.74
122003			1.72					0.43		3.86			6.86
122004			5.77					0.64		2.56			8.97
132003	1.49		1.50					2.25					4.80
142003	0.22		18.82					0.44	3.23				22.62
152003	0.44		0.88						1.33				2.65
162003					0.23			1.87		5.15		0.47	7.73
172003			3.96							0.16			4.11
172004			3.24					0.73		0.42			4.39
182003			31.93										31.93
192004			5.64								1.25		6.90
202004			2.60					0.87			2.39		5.84
212004											2.90		2.90
222004													
232004													
242004						0.21		1.72		4.72	1.71	0.17	7.82
252004	0.75				7.47			0.75					8.89
262004	0.66		5.96					1.99		4.64			13.25
272004	6.97		0.19		3.39			0.56			0.56	0.19	11.86
282004	0.59		2.68								1.19		4.45
292004			0.85			0.57		0.28		0.28	0.28	0.85	3.13
302004								1.67					1.67
312004			1.21					0.45					1.62
322004	0.38										0.38		0.75
332004	0.49		3.28		3.28			0.66			0.33		8.46
342004	3.90		0.11		0.11	0.17		0.96	0.67		1.57	2.70	9.38

Table 4 (Continued).

Site Number	Greenfin shiner	Fieryblack shiner	Highback chub	Santee chub	Swallowtail shiner	Silver redhorse	Snail bullhead	Flat bullhead	Fantail darter	Saluda darter	Seagreen darter	Piedmont darter	Overall RA
6389													
3018													
1691									2.51				2.51
2512	0.39		0.97				0.97	0.77			1.35		3.57
11652											1.54		1.54
651			6.34					0.24			6.75		13.29
3839								1.47					1.47
7006			2.55					1.26					21.55
2577											0.62		0.62
10573	5.16		7.23					0.43			1.49		14.26
9484								0.45			2.56		2.50
Total No. Collected	173	57	891	2	51	21	12	161	51	96	203	66	
Total RA	0.86	0.28	4.44	0.01	0.25	0.10	0.06	0.80	0.25	0.48	1.01	0.33	8.89
No. sites	17	1	23	1	5	5	3	26	4	8	20	8	

Table 5. Pearson and Kendall habitat correlations based on NMS ordination of first two axes calculated from fish community information and environmental variables collected and derived from the Broad River drainage, 2003 and 2004.

Axis	1			2		
	r	r^2	tau	r	r^2	tau
Mean width (m)	0.68	0.47	0.60	-0.38	0.14	-0.32
Mean depth (m)	0.63	0.40	0.46	-0.58	0.34	-0.38
Drainage area (ha)	0.53	0.28	0.53	-0.28	0.08	-0.15
Stream gradient (m/m)	-0.53	0.28	-0.36	-0.07	0.01	-0.09
Elevation (m)	-0.48	0.23	-0.33	-0.36	0.13	-0.28
Water (%)	0.45	0.21	0.34	0.16	0.02	0.13
pH	0.42	0.18	0.22	-0.05	0.00	0.01
Lentic area (m2)	0.42	0.17	0.40	-0.23	0.06	-0.18
Scrub (%)	-0.35	0.12	-0.24	-0.03	0.00	0.01
Water buffer (%)	0.32	0.10	0.27	0.21	0.05	0.15
Conductivity	0.32	0.10	0.26	0.27	0.07	0.14
Scrub buffer (%)	-0.30	0.09	-0.21	0.02	0.00	0.01
Forest buffer (%)	0.20	0.04	0.10	0.01	0.00	0.06
Forest (%)	0.18	0.03	0.09	0.07	0.01	0.08
Agriculture (%)	-0.18	0.03	-0.11	-0.04	0.00	-0.06
Lentic density (No./ha)	0.16	0.03	0.31	-0.17	0.03	-0.18
Temperature (Cº)	-0.13	0.02	-0.05	0.07	0.00	0.06
Open (%)	-0.12	0.01	0.05	0.14	0.02	0.17
Urban (%)	0.11	0.01	0.19	-0.23	0.05	-0.11
Dissolved oxygen (mg/L)	-0.11	0.01	-0.10	-0.13	0.02	-0.12
Stream road density (No./km2)	0.10	0.01	0.16	-0.12	0.02	-0.17
Urban buffer (%)	0.09	0.01	0.18	-0.20	0.04	-0.14
Open buffer (%)	-0.09	0.01	0.06	0.20	0.04	0.20
NPDES density (No./km2)	0.05	0.00	0.23	-0.21	0.04	-0.25
Agriculture buffer (%)	-0.04	0.00	0.02	-0.09	0.01	-0.12
Road density (km/ha)	-0.03	0.00	0.06	-0.15	0.02	-0.08
Dam density (No./km2)	-0.01	0.00	0.37	0.04	0.00	-0.15

Table 6. Fish community condition categories for Species Richness (S), Conservation Species Richness (CS), Simpson's Diversity Index (D), Overall fish community condition value, and invertebrate Bioclassification scores.

Site No.	S	CS	D	Overall	Bioclassification
12003	Good	Excellent	Good	Good	Good-Fair
22003	Excellent	Excellent	Good	Excellent	Good-Fair
32003	Excellent	Excellent	Excellent	Excellent	Good-Fair
42003	Poor	Poor	Poor	Poor	Good-Fair
52003	Excellent	Excellent	Excellent	Excellent	Good
62003	Fair	Poor	Poor	Poor	Good
72003	Poor	Good	Fair	Fair	Good
82003	Poor	Poor	Poor	Poor	Good
92003	Excellent	Poor	Excellent	Good	Good
102003	Poor	Poor	Good	Poor	Good
112003	Good	Good	Good	Good	Good-Fair
122003	Good	Good	Excellent	Good	Good
132003	Good	Poor	Fair	Fair	Good
142003	Excellent	Excellent	Excellent	Excellent	Good
152003	Good	Excellent	Poor	Good	Good
162003	Good	Excellent	Excellent	Excellent	Good-Fair
172003	Good	Good	Good	Good	Good
182003	Good	Poor	Good	Fair	Good
192004	Good	Good	Good	Good	Good
202004	Good	Fair	Fair	Fair	Good
212004	Poor	Good	Fair	Fair	Good-Fair
222004	Poor	Poor	Good	Poor	Fair
232004	Poor	Poor	Fair	Poor	Fair
242004	Excellent	Excellent	Excellent	Excellent	Good-Fair
252004	Fair	Poor	Excellent	Fair	Good-Fair
262004	Good	Excellent	Good	Good	Good-Fair
272004	Fair	Excellent	Excellent	Good	Good
282004	Excellent	Excellent	Good	Excellent	Good-Fair
292004	Excellent	Excellent	Good	Excellent	Good
302004	Fair	Poor	Good	Fair	Good-Fair
312004	Good	Poor	Good	Fair	Good
322004	Fair	Good	Poor	Fair	Good

Table 6 (Continued).

Site No.	S	CS	D	Overall	Bioclassification
332004	Good	Excellent	Good	Good	Good
342004	Excellent	Excellent	Excellent	Excellent	
6389	Fair	Poor	Poor	Poor	
3018	Fair	Poor	Good	Fair	
1691	Fair	Excellent	Fair	Good	
2512	Good	Poor	Good	Fair	
11652	Poor	Good	Poor	Poor	Good-Fair
651	Good	Poor	Good	Fair	
3839	Good	Poor	Good	Fair	Good
7006	Good	Poor	Excellent	Good	
2577	Poor	Good	Fair	Fair	Good
10573	Good	Fair	Excellent	Good	
9484	Poor	Poor	Fair	Poor	
3	Good	Poor	Good	Fair	
4	Fair	Poor	Excellent	Fair	
20	Fair	Poor	Fair	Poor	
21	Fair	Good	Good	Good	
22	Fair	Poor	Good	Fair	
23	Poor	Poor	Excellent	Fair	
24	Good	Good	Excellent	Good	
26	Poor	Poor	Poor	Poor	
37	Fair	Poor	Poor	Poor	
38	Poor	Poor	Fair	Poor	
65	Good	Poor	Good	Fair	
66	Fair	Poor	Poor	Poor	
94	Fair	Fair	Poor	Poor	
96	Good	Good	Fair	Good	
112	Fair	Poor	Good	Fair	
128	Poor	Good	Poor	Poor	
132	Poor	Poor	Good	Poor	
148	Good	Poor	Excellent	Good	
150	Poor	Poor	Poor	Poor	
154	Fair	Good	Excellent	Good	
157	Fair	Good	Good	Good	

Table 6 (Continued).

Site No.	S	CS	D	Overall	Bioclassification
158	Poor	Poor	Poor	Poor	
160	Poor	Poor	Poor	Poor	
162	Good	Excellent	Fair	Good	
168	Fair	Good	Fair	Fair	
169	Fair	Poor	Poor	Poor	
176	Fair	Good	Fair	Fair	
177	Fair	Poor	Fair	Poor	

Table 7. Number of sites in each of the four fish community condition value categories, pooled by site type (i.e., least impacted, random, or historic) and site location, for sites sampled in the upper Broad River sub-drainage (HUC 3050105) and lower Broad River sub-drainage (HUC 3050106).

	Fish Community Condition Value				
Pooled Sites	Poor	Fair	Good	Excellent	Total
Upper Broad River - Least Impacted	2	4	5	4	15
Upper Broad River - Random	3	4	4		11
Lower Broad River - Least Impacted	4	5	5	5	19
Current Study - Total	9	13	14	9	45
Upper Broad River - historic	6	2	4		12
Lower Broad River - historic	7	6	3		16
Grand Total	22	21	21	9	73

Table 8. Results of Chi-square analysis of Fish Community Condition Index by Ecoregion. Number of observations and expected number of observations in parentheses.

	Fish Community Condition Index		
Ecoregion	Excellent - Good	Fair - Poor	Total Sites
Carolina Slate Belt	7 (4.59)	4 (6.40)	11
Kings Mountain	7 (3.34)	1 (4.66)	8
Southern Outer Piedmont	14 (20.06)	34 (27.94)	48
Total Sites	28	39	67

Table 9. Crayfish species collected during the Broad River tributary stream survey during 2004 and 2005.

Species	Site Number 32004	62003	92004	122004	172004	192004	202004	232004	242004	272004	312004	342004
Cambarus howardi[1]	x			x	x	x						
Cambarus cf. latimanus	x											
Cambarus latimanus			x					x	x			
Cambarus spp.									x		x	
Cambarus striatus										x		
Cambarus robustus						x						
Cambarus spp. C (acuminatus complex)					x	x	x					x
Cambarus spicatus[1]									x			
Cambarus asperimanus[2]		x										
Cambarus robustus[2]						x						
Procambarus cf. acutus												x
Procambarus troglodytes									x			
Total Species	2	1	1	1	2	4	1	1	4	1	1	2

[1] Identified as species of conservation concern in the SCDNR CWCP.
[2] Identified by Shealy Environmental Services, Inc., Cayce, South Carolina.

Table 10. Physical habitat parameters and water quality data collected from streams in the Broad River drainage, during backpack electrofishing, summer/fall 2003 and 2004.

Date	Site No.	Width (m)	Depth (m)	Length (m)	DO (mg/L)	pH	Cond. (ΦS)	Turb. (NTU)	Temp (C°)
9/9/2003	12003	4.5	0.1500	100	6.0	7.2	132	--	20.3
9/23/2003	22003	2.2	0.0559	100	4.5	6.5	151	4.4	21.1
9/24/2003	32003	4.6	0.1355	100	8.3	7.4	88	6.9	20.4
10/22/2004	32004	5.1	0.1389	100	8.5	6.3	80	1.9	18.0
9/24/2003	42003	2.4	0.0466	100	6.1	7.3	82	11.1	20.6
9/29/2003	52003	5.6	0.3360	115	9.4	7.3	36	7.6	16.4
9/29/2003	62003	1.8	0.0700	100	9.0	4.8	37	1.7	15.7
9/30/2003	72003	4.6	0.1775	106	9.5	6.7	24	2.6	15.2
9/30/2003	82003	2.6	0.0947	100	9.6	4.9	17	--	14.8
10/2/2003	92003	4.6	0.0931	100	9.8	6.7	90	3.0	14.8
10/19/2004	92004	4.1	0.1278	100	7.6	5.3	81	4.2	17.3
10/9/2003	102003	3.3	0.1077	100	7.7	6.6	150	2.3	17.6
10/9/2003	112003	6.0	0.2134	109	7.7	6.5	156	2.4	18.7
10/13/2003	122003	3.9	0.1101	100	7.8	4.9	227	0.7	17.8
10/21/2004	122004	3.7	0.1092	100	7.8	7.4	176	1.0	16.7
10/14/2003	132003	5.9	0.1101	100	8.2	7.2	127	2.2	18.9
10/15/2003	142003	6.8	0.2540	135	9.0	6.8	87	2.1	14.8
10/15/2003	152003	4.3	0.2269	100	8.9	5.3	55	6.7	16.7
10/20/2003	162003	7.9	0.2794	142	8.1	6.4	104	4.8	13.9
10/22/2003	172003	4.6	0.1676	108	8.3	6.1	46	1.3	14.6
10/28/2004	172004	5.1	0.1609	100	7.7	6.9	46	1.9	16.1
10/22/2003	182003	6.0	0.2354	105	7.0	--	110	1.2	15.4
10/7/2004	192004	3.0	0.1405	100	7.8	6.3	62	4.0	18.3
10/7/2004	202004	4.2	0.1783	100	7.8	5.8	66	5.2	18.1
10/8/2004	212004	3.3	0.0821	100	8.8	7.3	76	5.9	15.5
10/11/2004	222004	3.6	0.2616	100	7.6	6.0	112	6.5	17.5
10/11/2004	232004	3.2	0.0931	100	8.2	5.0	109	4.7	19.1
10/15/2004	242004	10.4	0.2535	181	5.0	6.9	101	6.7	16.6
10/19/2004	252004	6.3	0.3378	100	7.7	5.2	110	6.2	17.1
10/21/2004	262004	2.7	0.0643	100	6.7	7.1	154	2.1	17.2
10/27/2004	272004	7.6	0.2942	137	7.1	6.5	148	5.4	17.5
11/3/2004	282004	3.3	0.2440	110	6.4	4.6	117	2.9	19.9
11/5/2004	292004	5.0	0.2152	108	7.3	7.5	83	5.8	16.6
11/5/2004	302004	5.9	0.2074	125	6.7	7.6	95	2.2	16.4
11/16/2004	312004	3.0	0.1207	111	12.0	6.4	73	6.1	8.1
11/18/2004	322004	3.8	0.0917	103	11.1	5.3	77	3.8	10.0
11/18/2004	332004	5.1	0.1693	100	11.2	5.5	78	3.5	11.3
11/30/2004	342004	11.3	0.3852	200	9.0	5.9	87	3.1	8.8
8/5/2004	6389	1.4	0.0700	100	7.9	6.1	48	--	20.7
8/5/2004	3018	5.4	0.2400	100	4.8	6.8	68	--	21.4
8/5/2004	1691	2.6	0.1000	100	8.6	6.9	33	--	21.1
8/10/2004	2512	8.5	0.2000	169	8.1	6.8	50	--	20.9

Table 10 (Continued).

Date	Site No.	Width (m)	Depth (m)	Length (m)	DO (mg/L)	pH	Cond. (ΦS)	Turb. (NTU)	Temp (C°)
8/23/2004	11652	3.2	0.0700	100	7.8	6.8	30	--	20.3
10/7/2004	651	5.8	0.1800	116	8.9	6.6	48	4.7	16.6
10/7/2004	3839	5.8	0.2700	100	7.3	7.0	54	--	19.2
10/7/2004	7006	5.4	0.2200	100	9.1	7.5	84	--	16.5
11/15/2004	2577	3.3	0.2400	100	11.0	5.9	20	4.1	10.4
11/18/2004	10573	6.0	0.3600	119	11.2	7.1	71	3.3	9.2
11/18/2004	9484	14.2	0.2800	150	11.0	6.7	52	7.1	10.6

Table 11. The number of sites that scored “Optimal”, “Suboptimal”, “Marginal”, and “Poor” in each of ten habitat condition categories.

	Score			
Habitat Category	Optimal	Suboptimal	Marginal	Poor
Epifaunal Substrate	14	17	9	5
Embeddedness	7	22	15	1
Velocity/Depth Regime	14	20	10	1
Sediment Deposition	11	18	10	6
Flow Status	11	22	12	
Channel Alteration	41	4		
Freq. Of Riffles	25	10	6	4
Bank Stability	10	17	13	5
Vegetative Protection	41	2	1	1
Riparian Width	32	11	2	
Overall Score	21	18	6	

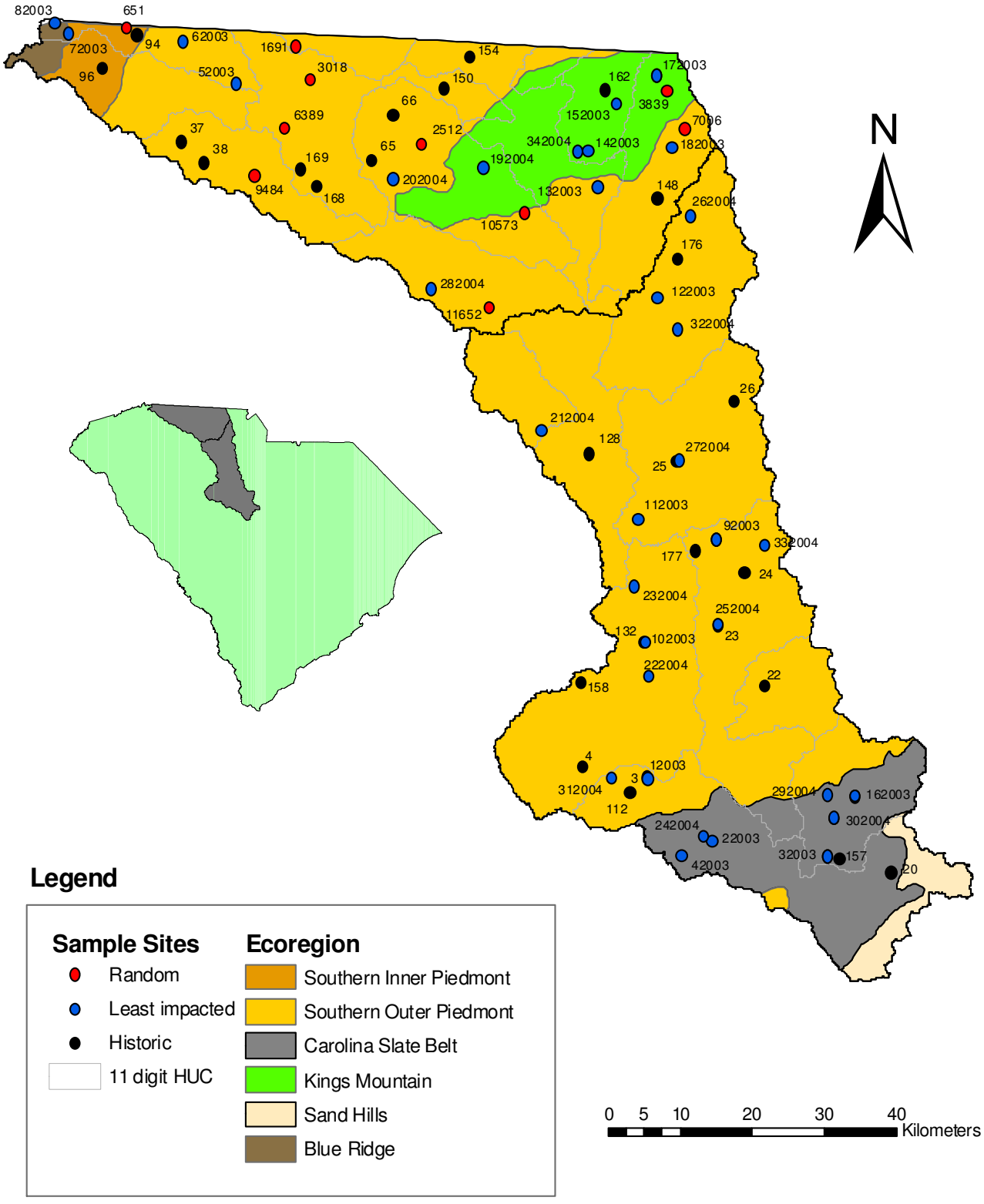

Figure 1. Random and least impacted sites sampled during 2003 and 2004 and historic sites sampled from 1993 – 2001 by the SCDNR in the Broad River drainage.

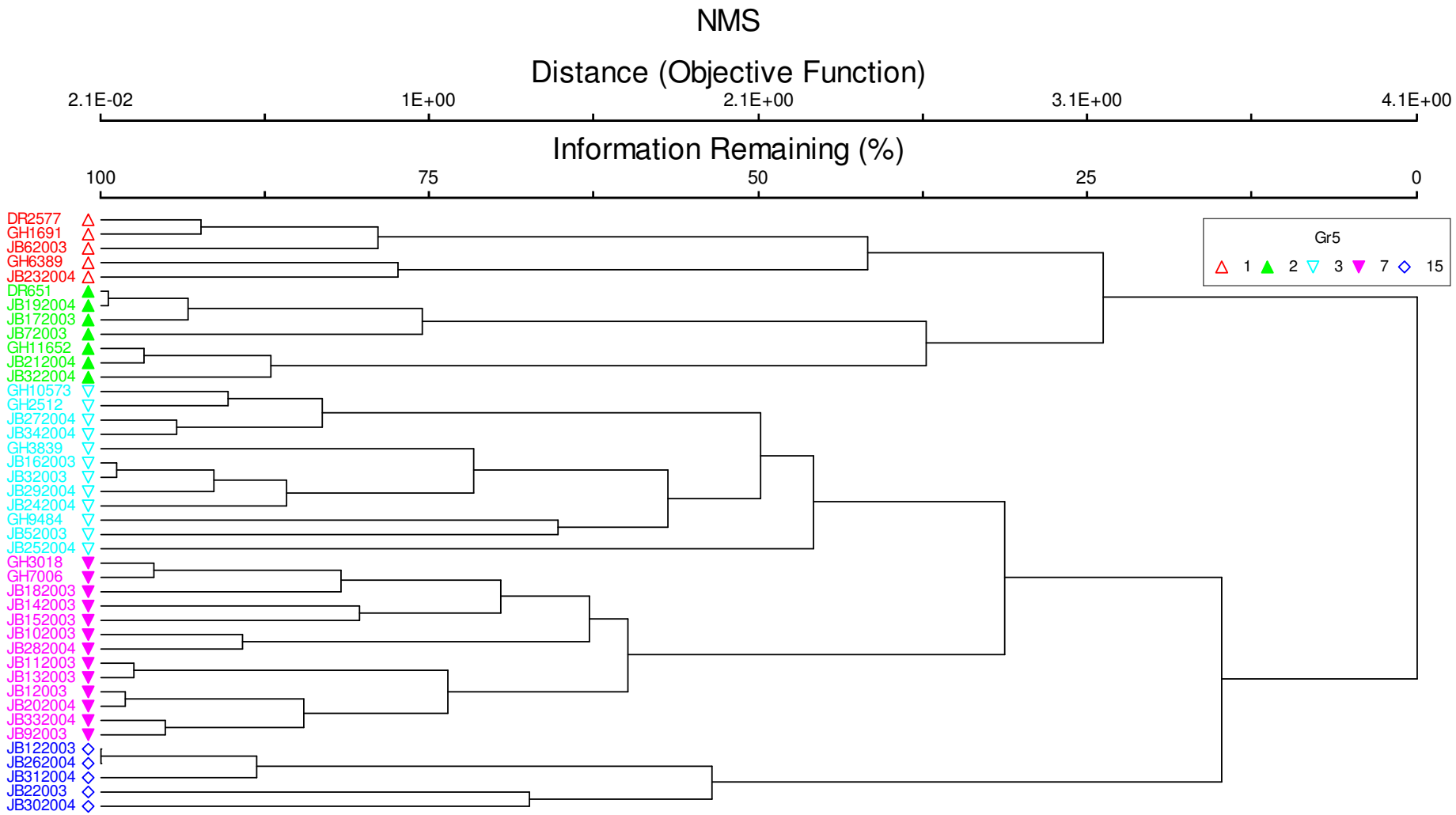

Figure 2. Similarity of fish communities sampled from the Broad River drainage during 2003 and 2004.

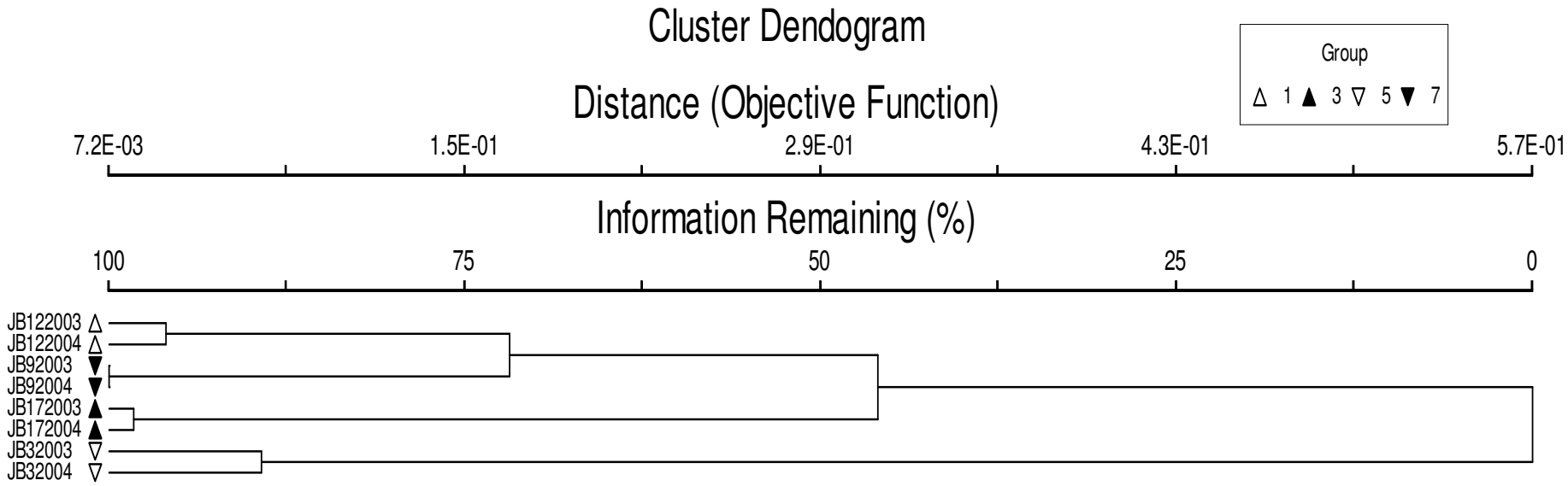

Figure 3. Similarity of fish communities at sites sampled during both 2003 and 2004 in Broad River drainage.

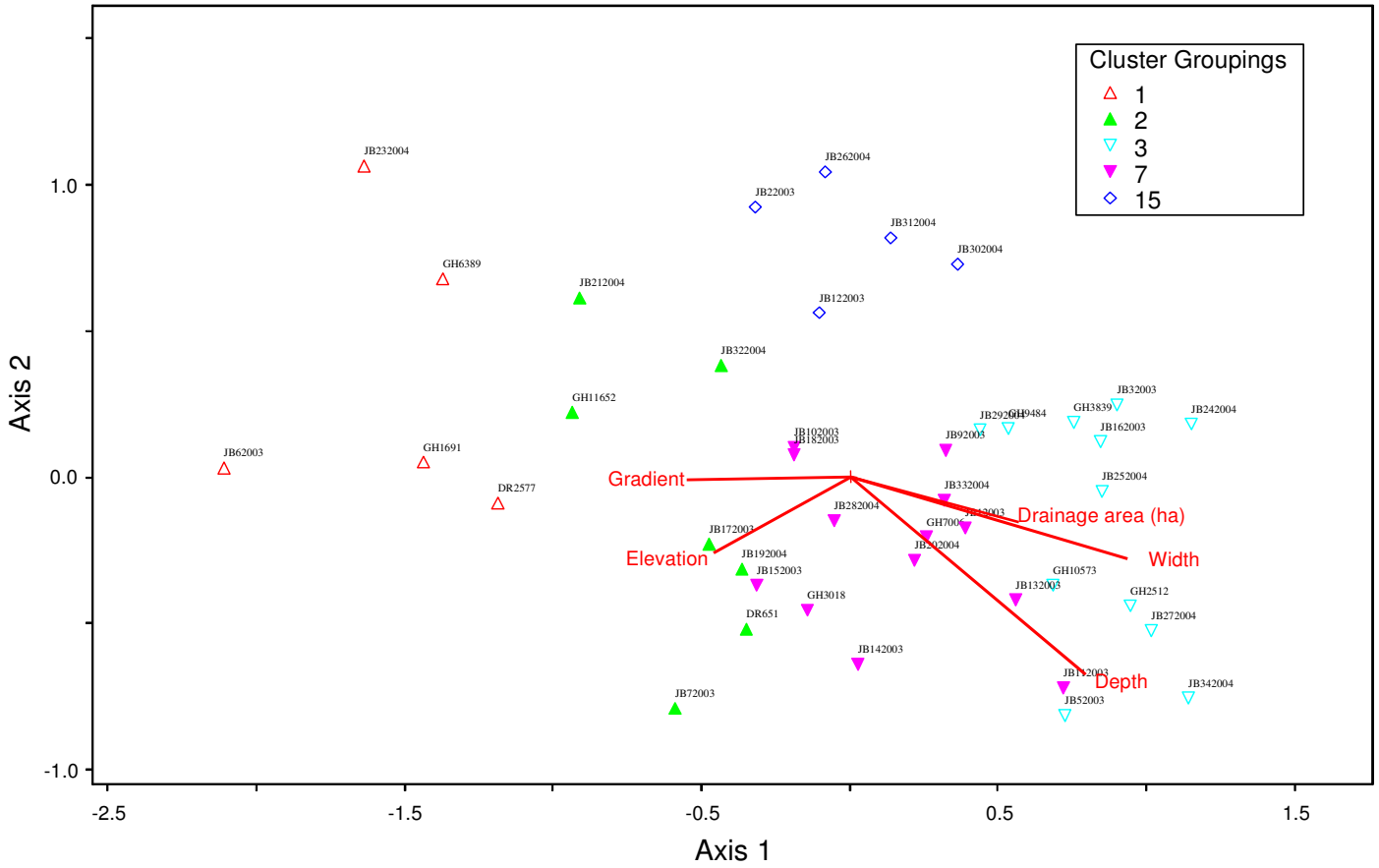

Figure 4. NMS ordination of fish communities sampled from the Broad River drainage during 2003 and 2004. Sites in close proximity to each other have similar fish communities. Habitat variables that were most strongly correlated to the axes are overlaid.

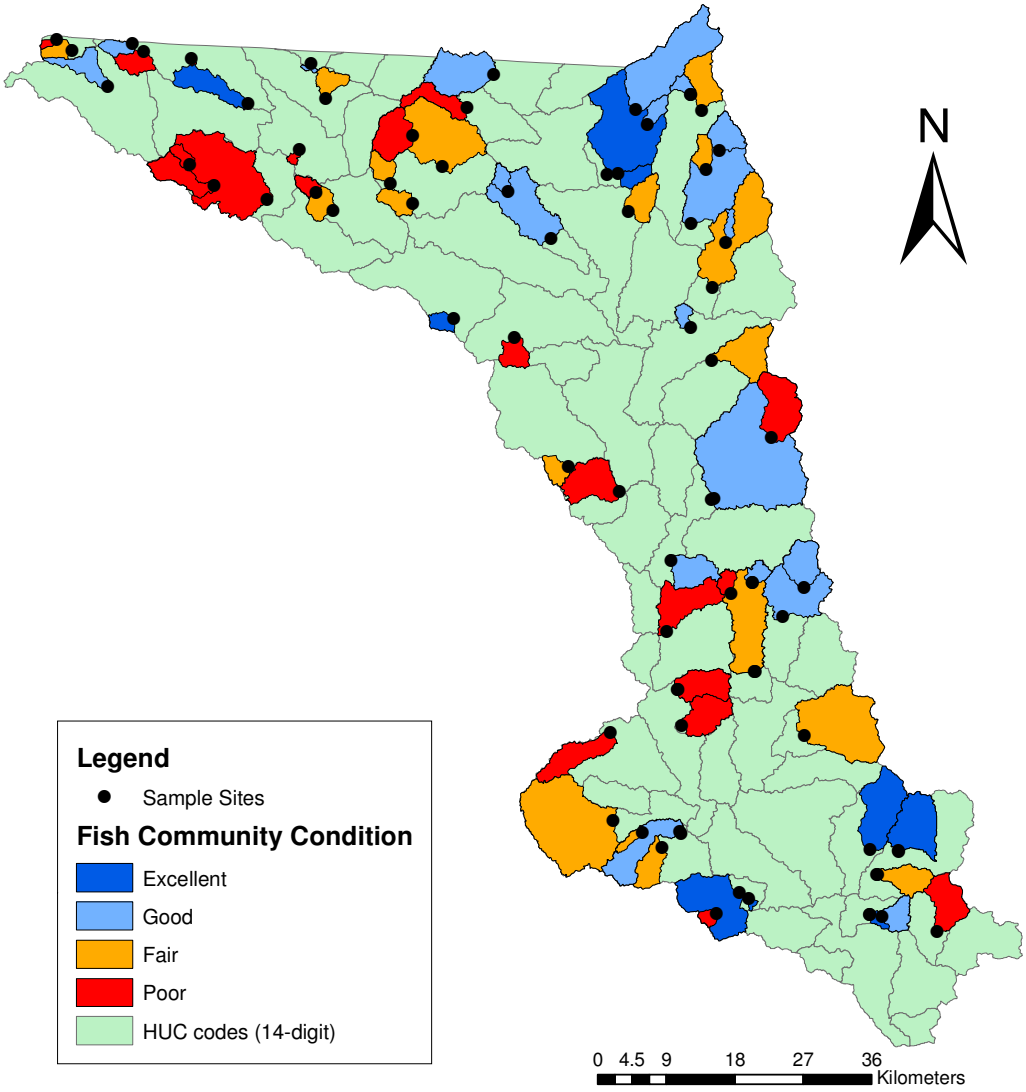

Figure 5. Fish Community Condition Index for sites sampled during the current study, as well as 28 historic sites sampled from 1993 – 2001 in the Broad River drainage by the SCDNR.

APPENDIX 1

MACROINVERTEBRATE ASSESSMENT OF WADEABLE STREAMS IN THE BROAD RIVER DRAINAGE SOUTH CAROLINA

AUGUST 2005

Submitted To:

SOUTH CAROLINA
DEPARTMENT OF NATURAL RESOURCES
Eastover, South Carolina

Submitted by:

SHEALY ENVIRONMENTAL SERVICES, INC.
106 Vantage Point Drive
Cayce, South Carolina
(803)791-9700

SCDHEC Laboratory Certification No. 32010

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I. SUMMARY

From 13 July 2005 to 19 August 2005, personnel from SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES conducted a benthic macroinvertebrate community assessment on various creeks in the Broad River drainage, South Carolina. These samples were then sorted and identified by personnel at SHEALY ENVIRONMENTAL SERVICES, INC. The objective of this assessment was to determine the condition of the river's macroinvertebrate community throughout the drainage.

II. INTRODUCTION

From 13 July 2005 to 19 August 2005, a benthic macroinvertebrate community assessment was conducted in various creeks in the Broad River drainage, South Carolina by personnel of South Carolina Department of Natural Resources (SCDNR). The objective of this assessment was to determine the conditions of aquatic macroinvertebrate communities throughout the drainage.

III. DESCRIPTION OF STUDY AREA

Collections of aquatic macroinvertebrates were made from thirty seven sampling locations in the Broad River drainage. The SCDNR sample numbers, the creek from which the samples were taken, and the dates on which they were collected are found in Table 1.

IV. METHODS

A. Sample Processing

At the SHEALY ENVIRONMENTAL SERVICES, INC. laboratory, macroinvertebrates were sorted from debris with the aid of an Aus Jena GSZ stereomicroscope. The macroinvertebrates were enumerated and identified to the lowest positive taxonomic level with the aide of appropriate microscopic techniques and taxonomic keys. All specimens will be maintained in SHEALY ENVIRONMENTAL SERVICES, INC. voucher collection for five years.

B. Data Analysis

Comparisons of the macroinvertebrate communities were based on the known tolerance levels and life history strategies of the organisms encountered and on changes in taxonomic composition between sampling stations. Changes in taxonomic composition were determined using metrics outlined in Rapid Bioassessment Protocol III of the US EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers* (Plafkin *et al.* 1989) and other works. These metrics included the following:

1) Taxa richness - The number of different taxa found at a particular location is an indication of diversity. Reductions in community diversity have been positively associated with various forms of environmental pollution, including nutrient loading, toxic substances, and sedimentation (Barbour *et al*., 1996; Fore *et al*., 1996; Rosenberg and Resh, 1993; Shackleford, 1988).

Table 1. SCDNR sample numbers, sampled creeks, and the dates on which they were sampled.

SCDNR Sample #	Creek	Date Collected
2005001	Harmon Creek	13 July 2005
2005002	Horse Creek	13 July 2005
2005003	Big Cedar Creek	19 July 2005
2005004	Little Cedar Creek	19 July 2005
2005005	Big Creek	19 July 2005
2005006	Weir Creek	19 July 2005
2005007	Terrible Creek	20 July 2005
2005008	Rocky Creek	20 July 2005
2005009	McClures Creek	20 July 2005
2005010	Johns Creek	20 July 2005
2005011	Crooked Creek	27 July 2005
2005012	Sites Creek	27 July 2005
2005013	Wateree Creek	27 July 2005
2005014	West Fork Little River	28 July 2005
2005015	Sandy River	28 July 2005
2005016	Blue Branch	28 July 2005
2005017	Susybole Creek	28 July 2005
2005018	Guyonmoore Creek	04 Aug 2005
2005019	Wolf Creek	04 Aug 2005
2005020	Kings Creek	04 Aug 2005
2005021	Rocky Branch	04 Aug 2005
2005022	Dry Fork	10 Aug 2005
2005023	Garner Branch	10 Aug 2005
2005024	Clark Fork	10 Aug 2005
2005025	Long Branch	10 Aug 2005
2005026	Peter Hawks Creek	12 Aug 2005
2005027	Jumping Run Creek	12 Aug 2005
2005028	Gregorys Creek	12 Aug 2005
2005029	Obed Creek	17 Aug 2005
2005030	Cowpens Creek	17 Aug 2005
2005031	Gilkey Creek	17 Aug 2005
2005032	Green Creek	18 Aug 2005
2005033	Vaughn Creek	18 Aug 2005
2005034	Tributary to Vaughn Creek	18 Aug 2005
2005035	Crims Creek	19 Aug 2005
2005036	Tributary to Crims Creek	19 Aug 2005
2005037	Tributary to the Pacolet River	17 Aug 2005

2) EPT Index - EPT Index is the number of taxa from the insect orders Ephemeroptera, Plecoptera and Trichoptera found at a station. These three insect orders are considered to be intolerant of adverse changes in water quality, especially temperature and dissolved oxygen, and therefore, a reduction in these taxa is indicative of reduced water quality (Barbour *et al*., 1996; Lenat, 1988).

3) Chironomidae taxa and abundance - The Chironomidae are a taxonomically and ecologically diverse group with many taxa which are tolerant of various forms of pollution. The chironomids are often the dominant group encountered at impacted or stressed sites (Rosenberg and Resh, 1993).

4) Ratio of EPT and Chironomidae abundance - The relative abundance of these four indicator groups is a measure of community balance. When compared to a reference site, good biotic conditions are reflected in a fairly even distribution among these four groups (Plafkin *et al*., 1989). The value of this ratio is reduced by impact due to the general reduction of the more sensitive EPT taxa and an increase in the more tolerant chironomid taxa.

5) Ratio of scraper/scraper and filtering collectors - When compared to a reference site, shifts in the dominance of a particular feeding type may indicate a community responding to an over-abundance of a particular food source or toxicants bound to a particular food source (Rosenberg and Resh, 1993).

6) Shredder/total number of specimens collected - When compared to a reference site, reductions in the relative abundance of shredders can indicate changes in the quality or quantity of riparian zone vegetation or the presence of toxic substances bound to organic carbon contained in the leaf and woody material which comprises their food source (Plafkin *et al*., 1989).

7) Percent contribution of dominant taxon - This measures the redundancy and evenness of the community structure. It assumes a highly redundant community reflects an impaired community because as the more sensitive taxa are eliminated, there is often a significant increase in the remaining tolerant forms (Barbour *et al*., 1996; Shackleford, 1988).

8) Dominant taxa in common - When compared to a reference site, major shifts in the composition and abundance of dominant taxa can indicate environmental stress (Barbour *et al*., 1996; Shackleford, 1988).

11) Community loss index (Table 6) - This index measures the loss of taxa between a reference or control station and a study site. It is an index of dissimilarity, with values

increasing as the degree of dissimilarity from the reference station increases (Courtemanch and Davies, 1987; Plafkin *et al*., 1989).

12) Jaccard coefficient of community similarity (Table 7) - This coefficient represents the degree of similarity in taxonomic composition between two stations in terms of taxon presence or absence. Values range from 0 to 1.0, increasing as the degree of similarity increases (Jaccard, 1912; Plafkin *et al*., 1989).

13) Sörensen coefficient (Table 8) - This coefficient represents the degree of similarity in taxonomic composition between two stations in terms of taxon presence or absence. Values range from 0 to 1.0, increasing as the degree of similarity increases (Breitenmoser-Würsten and Satori, 1995).

Table 2. Procedures used in the calculation of selected metrics used in this report.

Metric	Procedure
Community Loss Index	CLI = d-a/e Where: a = number of taxa common to both samples. d = total number of taxa present in sample A. e = total number of taxa present in sample B.
Jaccard Coefficient of Similarity	JCS = a/a+b+c Where: a = number of taxa common to both samples. b = number of taxa present in sample B but not A. c = number of taxa present in sample A but not B.
Sörensen Coefficient	C_S= 2a/(d+e) Where: a = number of taxa common to both samples. d = the number of taxa present in sample A. e = the number of taxa present in sample B.

V. RESULTS-Macroinvertebrate Community Analysis

A total of 11,306 specimens representing 309 taxa were collected from the Broad River drainage during this assessment. The taxa list, number of specimens, and relative abundance for each taxon are presented in Table 3. Table 4 lists the dominant taxa for each sampling station. Bioassessment metrics for each sampling station are presented in Tables 5-7.

The sampling effort at Harmon Creek (2005001) yielded 338 specimens representing 55 taxa (Table 3). An EPT index of 10 was calculated for this station (Table 5). The Chironomidae were represented by 16 taxa and contributed 38% of the total specimens collected. The SCDHEC bioclassification value of 3.0 resulted in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the collector-gatherers, contributing 47% of the collection. The dominant taxon was *Caenis* sp., which contributed 18% of the collection (Table 4).

Horse Creek (2005002) yielded 447 specimens representing 65 taxa (Table 3). An EPT index of 16 was calculated for this station (Table 5). The Chironomidae were represented by 18 taxa and contributed 17% of the total specimens collected. The SCDHEC bioclassification value of 3.3 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the collector-filterers, which contributed 38% of the collection. The dominant taxon was *Chimarra* sp., which contributed 18% of the specimens collected (Table 4).

Big Cedar Creek (2005003) yielded 422 specimens representing 62 taxa (Table 3). An EPT index of 15 was calculated for this station (Table 5). The Chironomidae were represented by 13 taxa and contributed 12% of the total specimens collected. The SCDHEC bioclassification value of 3.2 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the scrapers, which contributed 26% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 15% of the specimens collected (Table 4).

Little Cedar Creek (2005004) yielded 317 specimens representing 49 taxa (Table 3). An EPT index of 19 was calculated for this station (Table 5). The Chironomidae were represented by 13 taxa and contributed 16% of the total specimens collected. The SCDHEC bioclassification value of 4.0 results in a water quality rating of "good" for this station. The dominant functional feeding group was the collector-filterers, which contributed 35% of the collection. The dominant taxon was *Cheumatopsyche* sp., which contributed 21% of the specimens collected (Table 4).

Big Creek (2005005) yielded 340 specimens representing 62 taxa (Table 3). An EPT index of 23 was calculated for this station (Table 5). The Chironomidae were represented by 14 taxa and contributed 16% of the total specimens collected. The SCDHEC bioclassification value of 3.7 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 34% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 18% of the specimens collected (Table 4).

Weir Creek (2005006) yielded 403 specimens representing 70 taxa (Table 3). An EPT index of 21 was calculated for this station (Table 5). The Chironomidae were represented by 26 taxa and contributed 20% of the total specimens collected. The SCDHEC bioclassification value of 3.5 results in a water quality rating of "good" for this station. The dominant functional feeding group was the collector-filterers, which contributed 32% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 10% of the specimens collected (Table 4).

Terrible Creek (2005007) yielded 273 specimens representing 51 taxa (Table 3). An EPT index of 7 was calculated for this station (Table 5). The Chironomidae were represented by 20 taxa and contributed 31% of the total specimens collected. The SCDHEC bioclassification value of 2.2 results in a water quality rating of "fair" for this station. The

dominant functional feeding group was the predators, which contributed 37% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 26% of the specimens collected (Table 4).

Rocky Creek (2005008) yielded 425 specimens representing 57 taxa (Table 3). An EPT index of 20 was calculated for this station (Table 5). The Chironomidae were represented by 20 taxa and contributed 19% of the total specimens collected. The SCDHEC bioclassification value of 3.5 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 27% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 23% of the specimens collected (Table 4).

McClures Creek (2005009) yielded 209 specimens representing 50 taxa (Table 3). An EPT index of 9 was calculated for this station (Table 5). The Chironomidae were represented by 17 taxa and contributed 27% of the total specimens collected. The SCDHEC bioclassification value of 2.3 results in a water quality rating of "fair" for this station. The dominant functional feeding group was the scrapers, which contributed 31% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 25% of the specimens collected (Table 4).

Johns Creek (2005010) yielded 338 specimens representing 56 taxa (Table 3). An EPT index of 14 was calculated for this station (Table 5). The Chironomidae were represented by 18 taxa and contributed 18% of the total specimens collected. The SCDHEC bioclassification value of 3.2 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the scrapers, which contributed 34% of the collection. The dominant taxon was *Stenacron interpunctatum*, which contributed 12% of the specimens collected (Table 4).

Crooked Creek (2005011) yielded 307 specimens representing 46 taxa (Table 3). An EPT index of 11 was calculated for this station (Table 5). The Chironomidae were represented by 10 taxa and contributed 8% of the total specimens collected. The SCDHEC bioclassification value of 3.0 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the scrapers, which contributed 42% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 21% of the specimens collected (Table 4).

Sites Creek (2005012) yielded 271 specimens representing 48 taxa (Table 3). An EPT index of 12 was calculated for this station (Table 5). The Chironomidae were represented by 15 taxa and contributed 20% of the total specimens collected. The SCDHEC bioclassification value of 3.0 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the scrapers, which contributed 37% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 30% of the specimens collected (Table 4).

Wateree Creek (2005013) yielded 400 specimens representing 56 taxa (Table 3). An EPT index of 21 was calculated for this station (Table 5). The Chironomidae were represented by 15 taxa and contributed 8% of the total specimens collected. The SCDHEC bioclassification value of 3.0 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the scrapers, which contributed 38% of the collection. The dominant taxon was *Stenacron interpunctatum*, which contributed 15% of the specimens collected (Table 4).

The West Fork of Little River (2005014) yielded 353 specimens representing 57 taxa (Table 3). An EPT index of 12 was calculated for this station (Table 5). The Chironomidae were represented by 16 taxa and contributed 19% of the total specimens collected. The SCDHEC bioclassification value of 2.5 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the scrapers, which contributed 31% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 14% of the specimens collected (Table 4).

Sandy River (2005015) yielded 332 specimens representing 47 taxa (Table 3). An EPT index of 18 was calculated for this station (Table 5). The Chironomidae were represented by 8 taxa and contributed 6% of the total specimens collected. The SCDHEC bioclassification value of 3.5 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 34% of the collection. The dominant taxon was *Stenacron interpunctatum*, which contributed 15% of the specimens collected (Table 4).

Blue Branch (2005016) yielded 346 specimens representing 55 taxa (Table 3). An EPT index of 18 was calculated for this station (Table 5). The Chironomidae were represented by 19 taxa and contributed 20% of the total specimens collected. The SCDHEC bioclassification value of 3.5 results in a water quality rating of "good" for this station. The

dominant functional feeding group was the scrapers, which contributed 53% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 15% of the specimens collected (Table 4).

Susybole Creek (2005017) yielded 238 specimens representing 38 taxa (Table 3). An EPT index of 16 was calculated for this station (Table 5). The Chironomidae were represented by 6 taxa and contributed 5% of the total specimens collected. The SCDHEC bioclassification value of 3.8 results in a water quality rating of "good" for this station. The dominant functional feeding group was the predators, which contributed 31% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 17% of the specimens collected (Table 4).

Guyonmoore Creek (2005018) yielded 348 specimens representing 54 taxa (Table 3). An EPT index of 19 was calculated for this station (Table 5). The Chironomidae were represented by 11 taxa and contributed 3% of the total specimens collected. The SCDHEC bioclassification value of 4.0 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 40% of the collection. The dominant taxon was *Chimarra* sp., which contributed 12% of the specimens collected (Table 4).

Wolf Creek (2005019) yielded 173 specimens representing 45 taxa (Table 3). An EPT index of 19 was calculated for this station (Table 5). The Chironomidae were represented by 7 taxa and contributed 10% of the total specimens collected. The SCDHEC bioclassification value of 4.0 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 44% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 12% of the specimens collected (Table 4).

Kings Creek (2005020) yielded 202 specimens representing 52 taxa (Table 3). An EPT index of 24 was calculated for this station (Table 5). The Chironomidae were represented by 10 taxa and contributed 12% of the total specimens collected. The SCDHEC bioclassification value of 4.3 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 29% of the collection. The dominant taxon was *Corydalus cornutus*, which contributed 12% of the specimens collected (Table 4).

Rocky Branch (2005021) yielded 316 specimens representing 50 taxa (Table 3). An EPT index of 18 was calculated for this station (Table 5). The Chironomidae were represented by 12 taxa and contributed 11% of the total specimens collected. The SCDHEC bioclassification value of 3.7 results in a water quality rating of "good" for this station. The dominant functional feeding group was the collector-filterers, which contributed 37% of the collection. The dominant taxon was *Chimarra* sp., which contributed 16% of the specimens collected (Table 4).

Dry Fork (2005022) yielded 179 specimens representing 41 taxa (Table 3). An EPT index of 14 was calculated for this station (Table 5). The Chironomidae were represented by 7 taxa and contributed 7% of the total specimens collected. The SCDHEC bioclassification value of 2.7 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the scrapers, which contributed 40% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 22% of the specimens collected (Table 4).

Garner Branch (2005023) yielded 232 specimens representing 51 taxa (Table 3). An EPT index of 21 was calculated for this station (Table 5). The Chironomidae were represented by 11 taxa and contributed 13% of the total specimens collected. The SCDHEC bioclassification value of 3.7 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 42% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 21% of the specimens collected (Table 4).

Clark Fork (2005024) yielded 299 specimens representing 42 taxa (Table 3). An EPT index of 14 was calculated for this station (Table 5). The Chironomidae were represented by 9 taxa and contributed 5% of the total specimens collected. The SCDHEC bioclassification value of 4.0 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 55% of the collection. The dominant taxon was *Leucrocuta* sp., which contributed 16% of the specimens collected (Table 4).

Long Branch (2005025) yielded 230 specimens representing 48 taxa (Table 3). An EPT index of 21 was calculated for this station (Table 5). The Chironomidae were represented by 7 taxa and contributed 9% of the total specimens collected. The SCDHEC bioclassification value of 4.0 results in a water quality rating of "good" for this station. The

dominant functional feeding group was the scrapers, which contributed 45% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 15% of the specimens collected (Table 4).

Peter Hawks Creek (2005026) yielded 159 specimens representing 39 taxa (Table 3). An EPT index of 12 was calculated for this station (Table 5). The Chironomidae were represented by 13 taxa and contributed 15% of the total specimens collected. The SCDHEC bioclassification value of 3.0 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the predators, which contributed 38% of the collection. The dominant taxon was *Cheumatopsyche* sp., which contributed 12% of the specimens collected (Table 4).

Jumping Run Creek (2005027) yielded 428 specimens representing 49 taxa (Table 3). An EPT index of 16 was calculated for this station (Table 5). The Chironomidae were represented by 11 taxa and contributed 10% of the total specimens collected. The SCDHEC bioclassification value of 3.3 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the collector-filterers, which contributed 52% of the collection. The dominant taxon was *Isonychia* sp., which contributed 27% of the specimens collected (Table 4).

Gregorys Creek (2005028) yielded 319 specimens representing 52 taxa (Table 3). An EPT index of 14 was calculated for this station (Table 5). The Chironomidae were represented by 12 taxa and contributed 14% of the total specimens collected. The SCDHEC bioclassification value of 3.0 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the predators, which contributed 41% of the collection. The dominant taxon was *Beloneuria* sp., which contributed 17% of the specimens collected (Table 4).

Obed Creek (2005029) yielded 390 specimens representing 51 taxa (Table 3). An EPT index of 22 was calculated for this station (Table 5). The Chironomidae were represented by 12 taxa and contributed 7% of the total specimens collected. The SCDHEC bioclassification value of 4.2 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 38% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 17% of the specimens collected (Table 4).

Cowpens Creek (2005030) yielded 290 specimens representing 53 taxa (Table 3). An EPT index of 19 was calculated for this station (Table 5). The Chironomidae were represented by 12 taxa and contributed 8% of the total specimens collected. The SCDHEC bioclassification value of 4.0 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 43% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 16% of the specimens collected (Table 4).

Gilkey Creek (2005031) yielded 366 specimens representing 48 taxa (Table 3). An EPT index of 19 was calculated for this station (Table 5). The Chironomidae were represented by 9 taxa and contributed 11% of the total specimens collected. The SCDHEC bioclassification value of 4.0 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 55% of the collection. The dominant taxon was *Elimia* sp., which contributed 19% of the specimens collected (Table 4).

Green Creek (2005032) yielded 158 specimens representing 40 taxa (Table 3). An EPT index of 20 was calculated for this station (Table 5). The Chironomidae were represented by 4 taxa and contributed 3% of the total specimens collected. The SCDHEC bioclassification value of 4.0 results in a water quality rating of "good" for this station. The dominant functional feeding group was the predators, which contributed 35% of the collection. The dominant taxon was *Beloneuria* sp., which contributed 12% of the specimens collected (Table 4).

Vaughns Creek (2005033) yielded 241 specimens representing 41 taxa (Table 3). An EPT index of 25 was calculated for this station (Table 5). The Chironomidae were represented by 2 taxa and contributed 1% of the total specimens collected. The SCDHEC bioclassification value of 4.3 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 24% of the collection. The dominant taxon was *Epeorus* sp., which contributed 10% of the specimens collected (Table 4).

Tributary to Vaughns Creek (2005034) yielded 284 specimens representing 28 taxa (Table 3). An EPT index of 19 was calculated for this station (Table 5). The Chironomidae were represented by 1 taxa and contributed 1% of the total specimens collected. The SCDHEC bioclassification value of 4.0 results in a water quality rating of "good" for this station. The

dominant functional feeding group was the shredders, which contributed 28% of the collection. The dominant taxon was *Tallaperla* sp., which contributed 24% of the specimens collected (Table 4).

Crims Creek (2005035) yielded 279 specimens representing 42 taxa (Table 3). An EPT index of 11 was calculated for this station (Table 5). The Chironomidae were represented by 12 taxa and contributed 10% of the total specimens collected. The SCDHEC bioclassification value of 3.0 results in a water quality rating of "good-fair" for this station. The dominant functional feeding group was the scrapers, which contributed 38% of the collection. The dominant taxon was *Stenonema modestum*, which contributed 33% of the specimens collected (Table 4).

Tributary to Crims Creek (2005036) yielded 340 specimens representing 53 taxa (Table 3). An EPT index of 18 was calculated for this station (Table 5). The Chironomidae were represented by 10 taxa and contributed 13% of the total specimens collected. The SCDHEC bioclassification value of 3.5 results in a water quality rating of "good" for this station. The dominant functional feeding group was the collector-filterers, which contributed 40% of the collection. The dominant taxon was *Chimarra* sp., which contributed 24% of the specimens collected (Table 4).

Tributary of the Pacolet River (2005037) yielded 314 specimens representing 44 taxa (Table 3). An EPT index of 17 was calculated for this station (Table 5). The Chironomidae were represented by 11 taxa and contributed 9% of the total specimens collected. The SCDHEC bioclassification value of 3.8 results in a water quality rating of "good" for this station. The dominant functional feeding group was the scrapers, which contributed 31% of the collection. The dominant taxon was *Tallaperla* sp., which contributed 16% of the specimens collected (Table 4).

VI. REFERENCES

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Table 3. Macroinvertebrates, their North Carolina biotic index tolerance values (TV), functional feeding groups (FG), and abundance collected from the Broad River drainage, South Carolina, 13 July-19 August 2005.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Annelida																						
Hirudinea																						
Rhynchobdellida																						
Glossiphoniidae																						
1	Placobdella papillifera	8.96	P		1																	1
Oligochaeta																						
Haplotaxida																						
Haplotaxidae																						
2	Haplotaxidae cf. Haplotaxis sp.		SC											1								
Lumbricidae																						
3	Oligochaeta cf. Enchytraeidae Genus species		SC											1								
Lumbriculida																						
Branchiobdellidae																						
4	Branchiobdellidae Genus species		P						28				1						6			
Lumbriculidae																						
5	Lumbriculidae Genus species	7.03	SC				3									5			1			
6	Pristinella sp.	7.03	SC												2							
Tubificida																						
Naididae																						
7	Naididae cf. Pristina sp.		SC		1																	
8	Naididae cf. Slavina sp.		SC										2									
9	Naididae Genus species		SC		1	7		1											1			
10	Pristina sp.		SC					2			5			1	1			1				
11	Slavina appendiculata	7.06	CG											2								
12	Stylaria sp.		SC																			
Tubificidae																						
13	Tubificidae Genus species	7.11	SC																			1

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Annelida																					
Hirudinea																					
Rhynchobdellida																					
Glossiphoniidae																					
1	Placobdella papillifera	8.96	P																		
Oligochaeta																					
Haplotaxida																					
Haplotaxidae																					
2	Haplotaxidae cf. Haplotaxis sp.		SC																		
Lumbricidae																					
3	Oligochaeta cf. Enchytraeidae Genus species		SC																		
Lumbriculida																					
Branchiobdellidae																					
4	Branchiobdellidae Genus species		P				6		4			1		28	32		5	29		1	8
Lumbriculidae																					
5	Lumbriculidae Genus species	7.03	SC			1		3	3		1	2	2		2				3		
6	Pristinella sp.	7.03	SC																		
Tubificida																					
Naididae																					
7	Naididae cf. Pristina sp.		SC																		
8	Naididae cf. Slavina sp.		SC																		
9	Naididae Genus species		SC		4	4				1											
10	Pristina sp.		SC																		
11	Slavina appendiculata	7.06	CG																		
12	Stylaria sp.		SC																		1
Tubificidae																					
13	Tubificidae Genus species	7.11	SC																1	1	

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Arthropoda																						
Arachnoidea																						
Acariformes																						
14	Acariformes Genus species	5.53	P	2				5	1									1	1			
Arrenuridae																						
15	Arrenurus sp.	5.53	P		1	1							1									
Aturidae																						
16	Aturus sp.	5.53	P						1													
Hydrachnidae																						
17	Hydrachna sp.	5.53	P												10	2	5		4			6
Hygrobatidae																						
18	Hygrobates sp.	5.53	P		1						2		1									
Krendowskiidae																						
19	Geayia sp.	5.53	P			2										2						2
Lebertiidae																						
20	Lebertia sp.	5.53	P	7		3		4		15	1		9				1	1				
Limnesiidae																						
21	Limnesia sp.	5.53	P	2													1					
Mideopsidae																						
22	Mideopsis sp.	5.53	P		3	9																
Sperchonidae																						
23	Sperchon sp.	5.53	P		1																	
Torrenticolidae																						
24	Torrenticola sp.	5.53	P					1														
Unionicolidae																						
25	Neumania sp.	5.53	P		1			1		1												

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Arthropoda																					
Arachnoidea																					
Acariformes																					
14	Acariformes Genus species	5.53	P																		
Arrenuridae																					
15	Arrenurus sp.	5.53	P	1			1														
Aturidae																					
16	Aturus sp.	5.53	P																		
Hydrachnidae																					
17	Hydrachna sp.	5.53	P	1	1				2					1							
Hygrobatidae																					
18	Hygrobates sp.	5.53	P																		
Krendowskiidae																					
19	Geayia sp.	5.53	P																		
Lebertiidae																					
20	Lebertia sp.	5.53	P																		
Limnesiidae																					
21	Limnesia sp.	5.53	P																		
Mideopsidae																					
22	Mideopsis sp.	5.53	P																		
Sperchonidae																					
23	Sperchon sp.	5.53	P																		
Torrenticolidae																					
24	Torrenticola sp.	5.53	P																		
Unionicolidae																					
25	Neumania sp.	5.53	P																		

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Crustacea																						
Amphipoda																						
Talitridae																						
26	Hyalella azteca	7.75	OM										10			10			9		1	
27	Hyalella sp.		OM	2		8				10												
Cladocera																						
Daphnidae																						
28	Ceriodaphnia sp.		CF														4					
Decapoda																						
Cambaridae																						
29	Cambaridae Genus species		OM				1						2	1	3					3		
30	Cambarus asperimanus	7.62	OM																			
31	Cambarus robustus	7.62	OM																			
Eucopepoida																						
Cyclopidae																						
32	Eucyclops agilis		OM														2					
Isopoda																						
Asellidae																						
33	Lirceus sp.	7.85	SC												1							
Hexapoda																						
Coleoptera																						
34	Coleoptera Genus species		CG					1														
Carabidae																						
35	Carabidae Genus species		P														1					

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Crustacea																					
Amphipoda																					
Talitridae																					
26	Hyalella azteca	7.75	OM					1													
27	Hyalella sp.		OM																		
Cladocera																					
Daphnidae																					
28	Ceriodaphnia sp.		CF																		
Decapoda																					
Cambaridae																					
29	Cambaridae Genus species		OM		3	1	9	1	2				2	5	10	1	7	2	1	2	9
30	Cambarus asperimanus	7.62	OM																	3	9
31	Cambarus robustus	7.62	OM												4						
Eucopepoida																					
Cyclopidae																					
32	Eucyclops agilis		OM																		
Isopoda																					
Asellidae																					
33	Lirceus sp.	7.85	SC																		
Hexapoda																					
Coleoptera																					
34	Coleoptera Genus species		CG																		
Carabidae																					
35	Carabidae Genus species		P						1												

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Dryopidae																						
36	Helichus basalis	4.63	SC													5				3		
37	Helichus fastigiatus	4.63	SC	1	4		1	6	3	5	4	4	3	5			5	1	3		1	
38	Helichus lithophilus	4.63	SC									2										
Dytiscidae																						
39	Coptotomus sp.	9.26	P	1						1												
40	Dytiscidae cf. Hydrocolus sp.		P	2	5	1			1	3		1		2								
41	Dytiscidae cf. Lioporeus sp.		P	3	2	2									4			1				
42	Hydroporini Genus species		P					2														
Elmidae																						
43	Ancyronyx variegatus	6.49	CG		1	15					1	3				4	2	9			2	
44	Dubiraphia sp.	5.93	CG	6		33	3	5	4	1		1	1	1		8	3				2	2
45	Macronychus glabratus	4.58	CG			11	5	2	1	1		1			1	25	16	33		4	2	
46	Stenelmis sp.	5.1	SC	4	3	1			1				4	30	3	29		2			15	1
Gyrinidae																						
47	Dineutus ciliatus	5.54	P																			
48	Dineutus discolor	5.54	P		1																	
49	Dineutus sp.	5.54	P			4	3	3				3					4			1		
50	Gyrinus sp.	6.17	P							2												
Hydrophilidae																						
51	Cymbiodyta sp.		CG						5													
52	Sperchopsis tessellatus	6.13	CG							1												
Noteridae																						
53	Suphisellus sp.		P																			
Psephenidae																						
54	Ectopria sp.		SC		1									1	3	2						
55	Psephenus herricki	2.35	SC	2		1			1					11					24		7	

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Dryopidae																					
36	Helichus basalis	4.63	SC									6									
37	Helichus fastigiatus	4.63	SC	1		2	3			6	11				1	5	2		2	5	2
38	Helichus lithophilus	4.63	SC																		
Dytiscidae																					
39	Coptotomus sp.	9.26	P																		
40	Dytiscidae cf. Hydrocolus sp.		P																		
41	Dytiscidae cf. Lioporeus sp.		P																		
42	Hydroporini Genus species		P																		
Elmidae																					
43	Ancyronyx variegatus	6.49	CG	2	1		2	1	1		5		1			1			3		
44	Dubiraphia sp.	5.93	CG	2	5	2	1	1	1		6								8	1	
45	Macronychus glabratus	4.58	CG	8			3	16		2	6	1	11	3		5	4		12	2	
46	Stenelmis sp.	5.1	SC	2		1	1	41	2			1	3	1		1	1				
Gyrinidae																					
47	Dineutus ciliatus	5.54	P									1									
48	Dineutus discolor	5.54	P																		
49	Dineutus sp.	5.54	P	1	1						1	3	1	1		1					
50	Gyrinus sp.	6.17	P																		
Hydrophilidae																					
51	Cymbiodyta sp.		CG																		
52	Sperchopsis tessellatus	6.13	CG				1					1									
Noteridae																					
53	Suphisellus sp.		P									1									
Psephenidae																					
54	Ectopria sp.		SC				1		1											2	
55	Psephenus herricki	2.35	SC		3				3					8	4		15				

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Ptilodactylidae																						
56	Anchytarsus bicolor	3.64	SH											1								
Scirtidae																						
57	Scirtes sp.		SC								1											
Staphylinidae																						
58	Staphylinidae Genus species		P																			
Collembola																						
59	Collembola Genus species		CG	1																		
Entomobryidae																						
60	Entomobryidae Genus species		CG		1																	
Isotomidae																						
61	Isotomidae cf. Semicerura sp.		CG								1	1										
Diptera																						
Athericidae																						
62	Atherix lantha	2.07	P																			
Ceratopogonidae																						
63	Atrichopogon sp.	6.49	CG			5																
64	Bezzia/Palpomyia sp.	6.86	P	1		1	1	1		1				1			2		1		1	1
65	Dasyhelea sp.	6.76	CG														1					
66	Probezzia sp.	6.76	P											1								
Chironomidae																						
67	Ablabesmyia janta	7.2	P														3					
68	Ablabesmyia mallochi	7.19	P	2	1			1	3	3	3		3		2		1		1			
69	Ablabesmyia peleensis	9.67	P																			
70	Ablabesmyia rhamphe gr.	7.2	P	4	1	1			1		1	1					1					
71	Brillia flavifrons	5.18	SH																			
72	Brillia sp.	5.18	SH				5									1						
73	Chironomidae cf. Diplocladius sp.		CG					1														
74	Chironomidae cf. Phaenopsectra punctipes gr.		SC		4		1		1		2	5										
75	Chironomidae cf. Polypedilum scalanum gr.		SH			1																

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Ptilodactylidae																					
56	Anchytarsus bicolor	3.64	SH											2	5					1	
Scirtidae																					
57	Scirtes sp.		SC																		
Staphylinidae																					
58	Staphylinidae Genus species		P												1	1					
Collembola																					
59	Collembola Genus species		CG																		
Entomobryidae																					
60	Entomobryidae Genus species		CG																		
Isotomidae																					
61	Isotomidae cf. Semicerura sp.		CG																		
Diptera																					
Athericidae																					
62	Atherix lantha	2.07	P															5			
Ceratopogonidae																					
63	Atrichopogon sp.	6.49	CG																		
64	Bezzia/Palpomyia sp.	6.86	P	1	2	1		1	1												1
65	Dasyhelea sp.	6.76	CG																		
66	Probezzia sp.	6.76	P																		
Chironomidae																					
67	Ablabesmyia janta	7.2	P					3			2	1							2	1	
68	Ablabesmyia mallochi	7.19	P						1	1		1	1		1					2	
69	Ablabesmyia peleensis	9.67	P	1															1		
70	Ablabesmyia rhamphe gr.	7.2	P										1		1						
71	Brillia flavifrons	5.18	SH																		1
72	Brillia sp.	5.18	SH																		
73	Chironomidae cf. Diplocladius sp.		CG																		
74	Chironomidae cf. Phaenopsectra punctipes gr.		SC																		
75	Chironomidae cf. Polypedilum scalanum gr.		SH																		

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Chironomidae cont.																						
76	Chironomidae cf. Saetheria sp.		CG							2												
77	Chironomidae cf. Zavrelia sp.		P	1	1			1	2	3	1			1								
78	Chironomidae cf. Zavrelimyia sp.		P								2											
79	Chironomidae Genus species					1	2	4	15	8	9	7	5	1	2		3	2	2			
80	Chironomus sp.	9.63	CG												1				2			
81	Cladotanytarsus sp.	4.09	CG			1			1				1									
82	Corynoneura sp.	6.01	CG	1	1	3	1		1	2	2	4		1		4	2			2	1	
83	Cryptochironomus sp.	6.4	P			1	1			5			1									
84	Cryptotendipes sp.	6.19	CG							5												
85	Demicryptochironomus sp. A	2.12	CG							1												
86	Dicrotendipes neomodestus	8.1	CG										5									1
87	Dicrotendipes sp.	8.1	CG												2							
88	Krenosmittia sp.	10	CG					1														
89	Labrundinia pilosella	5.91	P					1	1	1												
90	Microtendipes pedellus gr.	5.53	CF	23	7	12		25	11	1			18	1	12	2			28		1	5
91	Microtendipes sp.	5.53	CF				1															
92	Nanocladius sp.	7.07	CG						1	1						2						
93	Natarsia sp. A	9.95	P												1	1						
94	Nilotanypus fimbriatus	3.9	P										1									
95	Nilotanypus sp.	3.9	P			1	1		1	1							2				1	
96	Omisus sp.		CG													1			2			
97	Orthocladius sp.	5.94	SH																			
98	Paracladopelma sp.	5.51	P	1																		
99	Paracladopelma undine	4.93	CG								1											
100	Parakiefferiella sp.	5.4	CG						2													
101	Paralauterborniella nigrohalterale	4.77	CG								1						2					
102	Paramerina sp.	4.29	P						1													
103	Parametriocnemus sp.		CG	1	1				3		2		1								1	
104	Paratanytarsus dissimilis	8.45	CF					1	2	22												

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Chironomidae cont.																					
76	Chironomidae cf. Saetheria sp.		CG																		
77	Chironomidae cf. Zavrelia sp.		P																		
78	Chironomidae cf. Zavrelimyia sp.		P																		
79	Chironomidae Genus species																				
80	Chironomus sp.	9.63	CG	2		1		1													
81	Cladotanytarsus sp.	4.09	CG																		
82	Corynoneura sp.	6.01	CG		1				1			1					1			1	3
83	Cryptochironomus sp.	6.4	P	1						1			1	1					1		1
84	Cryptotendipes sp.	6.19	CG																		
85	Demicryptochironomus sp. A	2.12	CG																		
86	Dicrotendipes neomodestus	8.1	CG		1																
87	Dicrotendipes sp.	8.1	CG																		
88	Krenosmittia sp.	10	CG																		
89	Labrundinia pilosella	5.91	P																		
90	Microtendipes pedellus gr.	5.53	CF			7	1	1	13				3	2	13					9	1
91	Microtendipes sp.	5.53	CF																	1	
92	Nanocladius sp.	7.07	CG	7			1	1	2												
93	Natarsia sp. A	9.95	P																		
94	Nilotanypus fimbriatus	3.9	P																		
95	Nilotanypus sp.	3.9	P																		
96	Omisus sp.		CG																1		1
97	Orthocladius sp.	5.94	SH	1	1								5	1	1	1					
98	Paracladopelma sp.	5.51	P																		
99	Paracladopelma undine	4.93	CG																		
100	Parakiefferiella sp.	5.4	CG																		
101	Paralauterborniella nigrohalterale	4.77	CG																		
102	Paramerina sp.	4.29	P																		
103	Parametriocnemus sp.		CG				1		1	2		1									2
104	Paratanytarsus dissimilis	8.45	CF										1								

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Chironomidae cont.																						
105	Paratanytarsus sp.	8.45	CF						4			1										
106	Paratendipes albimanus	5.11	CG	14			1					2	1		11							
107	Paratendipes dissimilis	5.11	CG												2							
108	Paratendipes sp.	5.11	CG		3	1					5								1			
109	Phaenopsectra obediens gr.	6.5	SC	4				1			3	2	3		4	1	28	6	11		1	8
110	Phaenopsectra punctipes gr.	6.5	SC										8		1						1	1
111	Polypedilum aviceps	3.65	SH																			
112	Polypedilum fallax gr.	6.39	SH		3				2		4	13	1		4						1	
113	Polypedilum flavum	5.78	SH	1	2		5		11	2	7	1	6	9		4	10	2	1	4		1
114	Polypedilum halterale gr.	7.31	SH															2	2			
115	Polypedilum illinoense gr.	9	SH		5				1					5	1		1	1	2		2	
116	Polypedilum scalaenum gr.	8.4	SH		2		1	1	4	1	4	1	2	1		1			1		1	
117	Polypedilum sp.	5.78	SH					2														
118	Procladius sp.	9.1	P																1			
119	Pseudochironomus sp.	5.36	CG	1												1		1	1			
120	Rheocricotopus robacki	7.28	CG													1	1			1		
121	Rheotanytarsus exiguus gr.	5.89	CF			3	3	10	3	10	12	3		3		1	1			1		
122	Rheotanytarsus sp.	5.89	CF										1									
123	Saetheria sp.		CG																			
124	Stenochironomus sp.	6.45	CG		1											1						
125	Stictochironomus sp.	6.52	CG	5	1	3						1							1			
126	Sublettia coffmani	1.6	CG										2									
127	Synorthocladius sp.	4.36	CG						1													
128	Tanypodinae Genus species		P	1	1																	
129	Tanytarsus sp.	6.76	CF	7	3	2		2	4	11	2	1	1				1		2			1
130	Thienemanniella sp.	5.86	CG	2						1	4	1										
131	Thienemanniella xena	5.86	CG																			
132	Thienemannimyia gr.	8.42	P				2	2	2	3	13	1	2	1	5	9	7		1		1	1
133	Tribelos jacundum	6.3	CG	59	36	22	26		1	1	1	8			6		1	3	6	1		

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Chironomidae cont.																					
105	Paratanytarsus sp.	8.45	CF																		
106	Paratendipes albimanus	5.11	CG																		
107	Paratendipes dissimilis	5.11	CG																		
108	Paratendipes sp.	5.11	CG		1					1					2						7
109	Phaenopsectra obediens gr.	6.5	SC	1	11	1	6			5	8	2	1	1	14		1		7	18	4
110	Phaenopsectra punctipes gr.	6.5	SC		4		3				1	1		4	3				1		
111	Polypedilum aviceps	3.65	SH										2							1	
112	Polypedilum fallax gr.	6.39	SH	1	1		5			5	13	6	2	6	1				3		
113	Polypedilum flavum	5.78	SH				2			1	1	8		1					3		3
114	Polypedilum halterale gr.	7.31	SH																		
115	Polypedilum illinoense gr.	9	SH	6			3	2		1	12	1									
116	Polypedilum scalaenum gr.	8.4	SH			1				3				1							
117	Polypedilum sp.	5.78	SH																		
118	Procladius sp.	9.1	P	1																	
119	Pseudochironomus sp.	5.36	CG																		
120	Rheocricotopus robacki	7.28	CG							1	1	1				2					
121	Rheotanytarsus exiguus gr.	5.89	CF	3			2	2		1	1			1				3	7	6	
122	Rheotanytarsus sp.	5.89	CF																		
123	Saetheria sp.		CG						1												
124	Stenochironomus sp.	6.45	CG																		
125	Stictochironomus sp.	6.52	CG																		
126	Sublettia coffmani	1.6	CG																		
127	Synorthocladius sp.	4.36	CG					2													
128	Tanypodinae Genus species		P																		
129	Tanytarsus sp.	6.76	CF		2	1	1				1		3								2
130	Thienemanniella sp.	5.86	CG																		
131	Thienemanniella xena	5.86	CG		1				1	1				1							
132	Thienemannimyia gr.	8.42	P		1		4				1	2	1	3					1	2	2
133	Tribelos jacundum	6.3	CG		3	1		1			3			1		1			1	2	

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Chironomidae cont.																						
134	Xylotopus par	5.99	CG		4				1			4		1			4	3	3	2	1	
135	Zavrelimyia sp.	9.11	P												1	2			1			
Culicidae																						
136	Anopheles sp.	8.58	CF	1	4	2						1					3					1
137	Culicidae Genus species		CF	1																		
Dixidae																						
138	Dixa sp.	2.55	CG						1		1											
139	Dixella sp.		CG	4	11			2	3	1	1	5	5	1	5		5	6	1		8	4
Empididae																						
140	Empididae Genus species		P					2	1		2											
141	Hemerodromia sp.	7.57	P											1								
Simuliidae																						
142	Simulium sp.	4	CF		1	2	4	1				3	3	8		2				3		1
Syrphidae																						
143	Syrphidae Genus species		CG																			
Tipulidae																						
144	Antocha sp.	4.25	CG										1				1					1
145	Dicranota sp.		SH																			
146	Hexatoma sp.	4.31	P															4	1	4	1	
147	Limonia sp.	9.64	SH																			
148	Pseudolimnophila sp.	7.22	SH									1										
149	Tipula sp.	7.33	SH		2		1							1			2					
150	Tipulidae cf. Hexatoma sp.		P					3		1												
Ephemeroptera																						
151	Ephemeroptera Genus species							2														
Baetidae																						
152	Acentrella ampla	3.61	CG																			
153	Acerpenna macdunnoughi		CG								1											
154	Baetidae Genus species		CG	4		2	1	3		6						1					2	2

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Chironomidae cont.																					
134	Xylotopus par	5.99	CG		9	1		3		1		20	5		3	1			1		
135	Zavrelimyia sp.	9.11	P																		
Culicidae																					
136	Anopheles sp.	8.58	CF			2														1	
137	Culicidae Genus species		CF																		
Dixidae																					
138	Dixa sp.	2.55	CG									1	1	2							
139	Dixella sp.		CG			3					4			1	2				1	1	
Empididae																					
140	Empididae Genus species		P																		
141	Hemerodromia sp.	7.57	P									2									
Simuliidae																					
142	Simulium sp.	4	CF	3						11	2	3	20	1		2	17	3		1	
Syrphidae																					
143	Syrphidae Genus species		CG								9	1									
Tipulidae																					
144	Antocha sp.	4.25	CG	1	1									1							
145	Dicranota sp.		SH									1						1			
146	Hexatoma sp.	4.31	P	1	1		4	1	3	2	1	3		1	8						1
147	Limonia sp.	9.64	SH															1			
148	Pseudolimnophila sp.	7.22	SH																		
149	Tipula sp.	7.33	SH							1	1	6		2	1	1		1			3
150	Tipulidae cf. Hexatoma sp.		P																		
Ephemeroptera																					
151	Ephemeroptera Genus species																				
Baetidae																					
152	Acentrella ampla	3.61	CG	1									2								
153	Acerpenna macdunnoughi		CG																		
154	Baetidae Genus species		CG				2													1	

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Baetidae cont.																						
155	Baetis brunneicolor		CG																			
156	Baetis intercalaris	4.99	CG				2		1		6	1	11		4	1					5	
157	Baetis pluto	4.28	CG		4	13	3		2		4		5	4	3	4		5		2	3	16
158	Baetis sp.	4.71	CG				4														4	
159	Centroptilum sp.	6.6	CG							1												
160	Labiobaetis frondalis	7.46	CG																			
161	Labiobaetis propinquus	5.77	CG					1			3	9			2	1	1					
162	Procloeon sp.	5	OM					1	2				3				4					2
163	Pseudocloeon sp.	4.02	SC																			
Baetiscidae																						
164	Baetisca gibbera	1.43	CG																			
165	Baetisca sp.		CG					1														
Caenidae																						
166	Brachycercus sp.		CG								1						4					
167	Caenidae cf. Brachycercus sp.		CG					2														
168	Caenis sp.	7.41	CG	60	30	59		3	1		6	3	6	1	38	22	19	11	27	3	14	2
Ephemerellidae																						
169	Drunella tuberculata		CG																			
170	Serratella deficiens	2.75	CG					1			1									9	3	
171	Serratella sp.		CG						8													
172	Timpanoga simplex	3.61	CG													1						
Ephemeridae																						
173	Hexagenia limbata	4.9	CG				5															5
Heptageniidae																						
174	Epeorus sp.	1.27	CG			4									2						1	
175	Heptagenia marginalis	2.26	SC			16									1	1					4	
176	Heptagenia sp.	2.57	SC																			
177	Heptageniidae Genus species		SC	19	11				2						1	2	5	1	1	2	4	3

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Baetidae cont.																					
155	Baetis brunneicolor		CG															3			
156	Baetis intercalaris	4.99	CG	1	1		2			1	2		1		4	1	3				3
157	Baetis pluto	4.28	CG	3	7	1			9	4	9	1	23	3	1	2	12		2	3	2
158	Baetis sp.	4.71	CG																		
159	Centroptilum sp.	6.6	CG																		
160	Labiobaetis frondalis	7.46	CG	1	1																
161	Labiobaetis propinquus	5.77	CG									14	1	4		3	3				
162	Procloeon sp.	5	OM	1					1		1				1						
163	Pseudocloeon sp.	4.02	SC							1		2									
Baetiscidae																					
164	Baetisca gibbera	1.43	CG						2												
165	Baetisca sp.		CG																		
Caenidae																					
166	Brachycercus sp.		CG	1	1														2	1	
167	Caenidae cf. Brachycercus sp.		CG																		
168	Caenis sp.	7.41	CG		10	32	6	1	1	2	3	5		2			1				
Ephemerellidae																					
169	Drunella tuberculata		CG															2			
170	Serratella deficiens	2.75	CG		5		2	1	2		17	6		6	1	5					
171	Serratella sp.		CG																		
172	Timpanoga simplex	3.61	CG																		
Ephemeridae																					
173	Hexagenia limbata	4.9	CG	4		1		1							1						1
Heptageniidae																					
174	Epeorus sp.	1.27	CG														23	4			
175	Heptagenia marginalis	2.26	SC											1	3						
176	Heptagenia sp.	2.57	SC	1								1	7	7							
177	Heptageniidae Genus species		SC		2	1			2				4	1	2	1				1	

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Heptageniidae cont.																						
178	Leucrocuta sp.	2.4	SC	6	10	6			1				30			2					35	2
179	Stenacron interpunctatum	6.87	SC	23	46	14	2	43	20				42	12	1	59	17	51	37		31	10
180	Stenacron pallidum	2.72	SC																			
181	Stenacron sp.		SC							2								1	3		3	
182	Stenonema femoratum	7.18	SC		15									4		2					1	
183	Stenonema modestum	5.5	SC	1	12	63	39	62	41	71	99	52	22	63	81	39	51	49	52	41	24	21
184	Stenonema sp.	3.45	SC	20	14		19									1	5		6		1	
Isonychiidae																						
185	Isonychia sp.	3.45	CF	3	11		11	12	34		26	2	23			6		10	1	22	23	4
Leptohyphidae																						
186	Tricorythodes sp.	5.06	CG			3	2	14			32	3	7				13	5		2	1	
Leptophlebiidae																						
187	Habrophlebiodes sp.		CG					4	5		4			8								
188	Leptophlebiidae Genus species		CG						1								2					
189	Paraleptophlebia moerens	0.94	CG																			
Neoephemeridae																						
190	Neoephemera purpurea	1.57	CG																			
Heteroptera																						
Belostomatidae																						
191	Belostoma sp.	9.8	P							1												
Gelastocoridae																						
192	Gelastocoris oculatus		P									1										
Gerridae																						
193	Gerris sp.		P												1							
194	Trepobates sp.		P																			
Notonectidae																						
195	Notonecta irrorata	8.71	P														2					

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Heptageniidae cont.																					
178	Leucrocuta sp.	2.4	SC	7	11	1	4	47	31				1								
179	Stenacron interpunctatum	6.87	SC	22	30	22	26	25	18		9		64	26	39				2	30	1
180	Stenacron pallidum	2.72	SC						7												
181	Stenacron sp.		SC								1										
182	Stenonema femoratum	7.18	SC				1					1					1			4	2
183	Stenonema modestum	5.5	SC	21	39	39	48	20	35	19	14	25	68	45	52	11	14	13	91	39	15
184	Stenonema sp.	3.45	SC																		
Isonychiidae																					
185	Isonychia sp.	3.45	CF	16	17		12	18	13		117		22		1	1	2	2	2	10	15
Leptohyphidae																					
186	Tricorythodes sp.	5.06	CG	9		1								1					15		
Leptophlebiidae																					
187	Habrophlebiodes sp.		CG																		1
188	Leptophlebiidae Genus species		CG																		
189	Paraleptophlebia moerens	0.94	CG														1			2	
Neoephemeridae																					
190	Neoephemera purpurea	1.57	CG													1	4				
Heteroptera																					
Belostomatidae																					
191	Belostoma sp.	9.8	P																		
Gelastocoridae																					
192	Gelastocoris oculatus		P																		
Gerridae																					
193	Gerris sp.		P																		
194	Trepobates sp.		P																	1	
Notonectidae																					
195	Notonecta irrorata	8.71	P																		

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Veliidae																						
196	Microvelia sp.		P						1						3							
197	Rhagovelia obesa		P											3		1			2		1	
Lepidoptera																						
Cossidae																						
198	Cossidae cf. Prionoxystus sp.		SH		1																	
Megaloptera																						
Corydalidae																						
199	Corydalus cornutus	5.16	P	1	1	3	1	1	2				4	1		8	2	4		2	3	
200	Nigronia serricornis	4.95	P	1	11	3	14	1	14	4	11	6	3	1		2	2	4	10	5	8	2
Sialidae																						
201	Sialis sp.	7.17	P	2						1							1					
Odonata																						
Aeshnidae																						
202	Basiaeschna janata	7.35	P	2		6																
203	Boyeria vinosa	5.89	P	1	2	7	7	10	6	15	2	11	2			7	6	20	1	23	6	1
204	Gomphaeschna cf. furcillata	6	P												1							
Calopterygidae																						
205	Calopterygidae Genus species		P					6														
206	Calopteryx maculata	7.78	P			3					8	4	1	16	5							
207	Calopteryx sp.	7.78	P		1		1					7				11	1	15	1	1	7	
Coenagrionidae																						
208	Argia bipunctulata	8.17	P			2																
209	Argia sp.	8.17	P															4				
210	Coenagrionidae Genus species		P												1							
211	Enallagma sp.	8.91	P												1			2				
Cordulegastridae																						
212	Cordulegaster erronea	5.73	P														1			1		
213	Cordulegaster maculata	5.7	P										1									
214	Cordulegaster sp.	5.73	P						4	3	1	2								3		

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Veliidae																					
196	Microvelia sp.		P						1	1	3	1	1						2		
197	Rhagovelia obesa		P			1	1		1										10		
Lepidoptera																					
Cossidae																					
198	Cossidae cf. Prionoxystus sp.		SH																		
Megaloptera																					
Corydalidae																					
199	Corydalus cornutus	5.16	P	24				13			3		5	3	5		5		1		
200	Nigronia serricornis	4.95	P	3	5	2	7	10	4	5	9	6	6	11			3		3	30	4
Sialidae																					
201	Sialis sp.	7.17	P		1		3														
Odonata																					
Aeshnidae																					
202	Basiaeschna janata	7.35	P																		
203	Boyeria vinosa	5.89	P	1	3	7	4	16	6	9	4	4	10	9	2	11	4		7	4	3
204	Gomphaeschna cf. furcillata	6	P																		
Calopterygidae																					
205	Calopterygidae Genus species		P																		
206	Calopteryx maculata	7.78	P																		
207	Calopteryx sp.	7.78	P		2	3	1	1	1	12	9	3	3	4	7	1			3	4	
Coenagrionidae																					
208	Argia bipunctulata	8.17	P					9													
209	Argia sp.	8.17	P																2		
210	Coenagrionidae Genus species		P					1													
211	Enallagma sp.	8.91	P																		
Cordulegastridae																					
212	Cordulegaster erronea	5.73	P																		
213	Cordulegaster maculata	5.7	P		2	3	1			7	3	4	1			1	1			7	6
214	Cordulegaster sp.	5.73	P			6						35			4						3

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Gomphidae																						
215	Gomphidae Genus species		P	1	1	1	5			1	4	3			1							
216	Gomphus lividus	5.8	P						1													
217	Gomphus sp.	5.8	P			1	3			2						1	5	3		2	1	3
218	Hagenius brevistylus	3.99	P						1							1		1			1	
219	Ophiogomphus mainensis		P			7	2		4								9			4		2
220	Ophiogomphus sp.	5.54	P					6		4	14	2	6						3	2		
221	Progomphus cf. obscurus		P							29	12											
222	Progomphus obscurus	8.22	P									7	10				16	4		4	1	
223	Progomphus sp.		P					4										4	2			
224	Stylogomphus albistylus	4.72	P						12			2	2								5	
Libellulidae																						
225	Libellula semifasciata	9.64	P																			
226	Libellulidae cf. Neurocordulia sp.		P	3																		
227	Libellulidae Genus species.		P	5		1									1							
228	Macromia alleghaniensis	6.16	P																			1
229	Macromia margarita	6.16	P									1										
230	Macromia sp.	6.16	P																			
231	Macromiinae Genus species		P	3	2	4						1										
232	Perithemis sp.	9.85	P												1		1					1
Plecoptera																						
233	Plecoptera Genus species						1															
Chloroperlidae																						
234	Haploperla brevis	0.98	SC																			
Leuctridae																						
235	Leuctra sp.	0.67	SH																			1
236	Leuctridae cf. Leuctra sp.		SH					3				1										
237	Plecoptera cf. Leuctridae Genus species		SH						17		4											

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Gomphidae																					
215	Gomphidae Genus species		P		1																
216	Gomphus lividus	5.8	P																		
217	Gomphus sp.	5.8	P	2		2		3	1	3	12		2	1	6	1	1			3	
218	Hagenius brevistylus	3.99	P										1								
219	Ophiogomphus mainensis		P		7		1					6	1	4	4	2	2			1	8
220	Ophiogomphus sp.	5.54	P																		1
221	Progomphus cf. obscurus		P																		
222	Progomphus obscurus	8.22	P			1				1	5	2			2				7	3	
223	Progomphus sp.		P																		
224	Stylogomphus albistylus	4.72	P		3	3		2	3	2	1	1		1		1			2	2	6
Libellulidae																					
225	Libellula semifasciata	9.64	P			1															
226	Libellulidae cf. Neurocordulia sp.		P																		
227	Libellulidae Genus species.		P																		
228	Macromia alleghaniensis	6.16	P																		
229	Macromia margarita	6.16	P																		
230	Macromia sp.	6.16	P	1							1	1							1		
231	Macromiinae Genus species		P																		
232	Perithemis sp.	9.85	P																		
Plecoptera																					
233	Plecoptera Genus species																				
Chloroperlidae																					
234	Haploperla brevis	0.98	SC													1					
Leuctridae																					
235	Leuctra sp.	0.67	SH						4	1	2	1	30	1		2	7	3			9
236	Leuctridae cf. Leuctra sp.		SH																		
237	Plecoptera cf. Leuctridae Genus species		SH																		

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Peltoperlidae																						
238	Peltoperla sp.		SH																			
239	Tallaperla sp.	1.19	SH																			
Perlidae																						
240	Acroneuria abnormis	2.06	P																			
241	Acroneuria carolinensis		P																			
242	Agnetina sp.		P		1		3													7		1
243	Attaneuria ruralis		P																			
244	Beloneuria sp.		P																	13	11	1
245	Neoperla sp.	1.49	P															3		1		
246	Paragnetina fumosa	3.36	P															1				
247	Paragnetina immarginata	1.38	P															4				
248	Paragnetina kansensis	1.99	P															1				
249	Perlesta sp.	4.7	P						1		7									1		
250	Perlidae cf. Acroneuria sp.		P					2			23											
251	Perlidae cf. Perlinella sp.		P					4														
252	Perlidae Genus species		P		2		8															
253	Perlinella sp.		P																3			1
Perlodidae																						
254	Malirekus hastatus	1.15	P																			
Pteronarcyidae																						
255	Pteronarcys sp.	1.67	SH				13				1	2								14		
Trichoptera																						
Brachycentridae																						
256	Brachycentrus sp.	2.08	CF																			
Calamoceratidae																						
257	Heteroplectron americanum	3.23	SH																			
Glossosomatidae																						
258	Glossosoma sp.	1.55	SC																			

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Peltoperlidae																					
238	Peltoperla sp.		SH													5					
239	Tallaperla sp.	1.19	SH		1		4		13						1	16	5	68			50
Perlidae																					
240	Acroneuria abnormis	2.06	P	3			2	1	4						15	9	17	15			
241	Acroneuria carolinensis		P						1												
242	Agnetina sp.		P		5																
243	Attaneuria ruralis		P													7					
244	Beloneuria sp.		P		5		4	1	6	16	7	54	3	4	4	19	8	9		1	19
245	Neoperla sp.	1.49	P																		
246	Paragnetina fumosa	3.36	P																		
247	Paragnetina immarginata	1.38	P																		
248	Paragnetina kansensis	1.99	P	3																	
249	Perlesta sp.	4.7	P										1								
250	Perlidae cf. Acroneuria sp.		P																		
251	Perlidae cf. Perlinella sp.		P																		
252	Perlidae Genus species		P																		
253	Perlinella sp.		P																		
Perlodidae																					
254	Malirekus hastatus	1.15	P															3			
Pteronarcyidae																					
255	Pteronarcys sp.	1.67	SH							5				1		5	6	3			
Trichoptera																					
Brachycentridae																					
256	Brachycentrus sp.	2.08	CF	1																	
Calamoceratidae																					
257	Heteroplectron americanum	3.23	SH				1														
Glossosomatidae																					
258	Glossosoma sp.	1.55	SC														3	14			1

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Goeridae																						
259	Goera calcarata	0.13	SC																			
Helicopsychidae																						
260	Helicopsyche borealis		SC						4							1			1			
Hydropsychidae																						
261	Arctopsyche irrorata		CF																			
262	Ceratopsyche sparna	2.72	CF																			8
263	Cheumatopsyche sp.	6.22	CF	7	38	24	65	23	34	2	39	7	21	52		19	48	28	9	35	37	11
264	Diplectrona modesta	2.21	CF						2		1			2	6							
265	Hydropsyche betteni	7.78	CF		24	4	7	3	4		9		7	1		9			4	2		
266	Hydropsyche sp.	4.26	CF													4					3	2
267	Hydropsychidae Genus species		CF				17												2			
Hydroptilidae																						
268	Hydroptilidae Genus species				1	1																
Lepidostomatidae																						
269	Lepidostoma sp.	0.9	SH					2														
Leptoceridae																						
270	Ceraclea sp.	2.01	CG																			
271	Leptoceridae Genus species				1																	
272	Nectopsyche exquisita	4.1	SH										1			1		1	1			
273	Nectopsyche pavida	4.14	SH					1										1				
274	Nectopsyche sp.	2.94	SH																			
275	Oecetis avara	4.7	P			2		5									2	1	1			
276	Oecetis sp.	4.7	P								1											
277	Triaenodes ignitus	4.58	SH			4	7	3										12		1		
278	Triaenodes sp.	4.46	SH											1		1						
Limnephilidae																						
279	Pycnopsyche gentilis	0.57	SH																			
280	Pycnopsyche luculenta \ sonso	2.5	SH																			
281	Pycnopsyche sp.	2.52	SH	3					1	1									2			

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Goeridae																					
259	Goera calcarata	0.13	SC						1												
Helicopsychidae																					
260	Helicopsyche borealis		SC																		
Hydropsychidae																					
261	Arctopsyche irrorata		CF															13			
262	Ceratopsyche sparna	2.72	CF	4									32				7				
263	Cheumatopsyche sp.	6.22	CF	8	34	2	11	5	14	19	44	45	17	39	6	16	14		43	16	2
264	Diplectrona modesta	2.21	CF									1	3					33			10
265	Hydropsyche betteni	7.78	CF	1	9	2	3			2		17	6	2	6					9	
266	Hydropsyche sp.	4.26	CF	1	2					1			1	1							
267	Hydropsychidae Genus species		CF			1					1										
Hydroptilidae																					
268	Hydroptilidae Genus species																				
Lepidostomatidae																					
269	Lepidostoma sp.	0.9	SH									4				3					17
Leptoceridae																					
270	Ceraclea sp.	2.01	CG					1													
271	Leptoceridae Genus species																				
272	Nectopsyche exquisita	4.1	SH	5			3							1							
273	Nectopsyche pavida	4.14	SH																		
274	Nectopsyche sp.	2.94	SH			1															
275	Oecetis avara	4.7	P					1			1									1	
276	Oecetis sp.	4.7	P																		
277	Triaenodes ignitus	4.58	SH	1							2				1		5			3	
278	Triaenodes sp.	4.46	SH				2		1				1						2		
Limnephilidae																					
279	Pycnopsyche gentilis	0.57	SH						1												
280	Pycnopsyche luculenta \ sonso	2.5	SH										1	2	4		1	3		2	
281	Pycnopsyche sp.	2.52	SH																		

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Philopotamidae																						
282	Chimarra sp.	2.76	CF		79	1	1	13	29		7		18	39	26	57			10	7	41	3
283	Dolophilodes sp.	0.81	CF																			
284	Philopotamidae Genus species		CF												1				1			
Polycentropodidae																						
285	Neureclipsis crepuscularis	4.19	CF																			
286	Paranyctiophylax sp.	0.85	P															1				
287	Phylocentropus sp.	6.2	CF							1												
288	Polycentropus sp.	3.53	P										1									
Psychomyiidae																						
289	Lype diversa	4.05	SC																			
Rhyacophilidae																						
290	Rhyacophila fuscula	1.88	P																			
291	Rhyacophila sp.		P																			
292	Rhyacophila tuberculata		P																			
Uenoidae																						
293	Neophylax consimilis	2.2	SC																			
294	Neophylax mitchelli	2.2	SC						16													7
295	Neophylax oligius	2.2	SC																31			
296	Neophylax sp.	2.2	SC																			
Mollusca																						
Bivalvia																						
Unionoida																						
Corbiculidae																						
297	Corbicula sp.		CF	3		2	2	8					5	1		8	10	6			2	
Sphaeriidae																						
298	Sphaerium sp.		CF			3								1								

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Philopotamidae																					
282	Chimarra sp.	2.76	CF		49	13	14		2	1	56		4		2		5		7	81	
283	Dolophilodes sp.	0.81	CF														9	16			
284	Philopotamidae Genus species		CF																		
Polycentropodidae																					
285	Neureclipsis crepuscularis	4.19	CF	1		1		3													2
286	Paranyctiophylax sp.	0.85	P				1												2		
287	Phylocentropus sp.	6.2	CF																		
288	Polycentropus sp.	3.53	P										1						3	1	
Psychomyiidae																					
289	Lype diversa	4.05	SC				1									2	2	3			
Rhyacophilidae																					
290	Rhyacophila fuscula	1.88	P													2					
291	Rhyacophila sp.		P															4			
292	Rhyacophila tuberculata		P														1				
Uenoidae																					
293	Neophylax consimilis	2.2	SC																		28
294	Neophylax mitchelli	2.2	SC					1						13	13		10	6		7	
295	Neophylax oligius	2.2	SC																		
296	Neophylax sp.	2.2	SC	3			3														
Mollusca																					
Bivalvia																					
Unionoida																					
Corbiculidae																					
297	Corbicula sp.		CF	4	1			9	1						2				10	3	
Sphaeriidae																					
298	Sphaerium sp.		CF																		

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005001	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
Gastropoda																						
Limnophila																						
Ancylidae																						
299	Ancylidae Genus species		SC	1	1	1		1					1		1							
300	Ferrissia sp.	6.55	SC																			1
Lymnaeidae																						
301	Lymnaeidae Genus species		SC																		2	
Physidae																						
302	Physa sp.	8.84	SC	1	3	1			1	1						1						
Planorbidae																						
303	Gyraulus sp.	4.23	SC																			
304	Planorbidae Genus species		SC	1	1					1												
Mesogastropoda																						
Pleuroceridae																						
305	Elimia sp.	2.46	SC																		8	21
Viviparidae																						
306	Mesogastropoda cf. Viviparidae Genus sp.		SC			1																
307	Viviparidae Genus species		SC																14			
Platyhelminthes																						
Turbellaria																						
Tricladida																						
Planariidae																						
308	Cura formanii	4.97	OM										1	3	1							
309	Tricladida Genus species		OM		1																	

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 3. Continued.

Seq	Taxon	TV	FG	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
Gastropoda																					
Limnophila																					
Ancylidae																					
299	Ancylidae Genus species		SC																		
300	Ferrissia sp.	6.55	SC				1				1									1	
Lymnaeidae																					
301	Lymnaeidae Genus species		SC																		
Physidae																					
302	Physa sp.	8.84	SC																	3	
Planorbidae																					
303	Gyraulus sp.	4.23	SC																	2	
304	Planorbidae Genus species		SC																		
Mesogastropoda																					
Pleuroceridae																					
305	Elimia sp.	2.46	SC		4			27						17	68	6	8	22			44
Viviparidae																					
306	Mesogastropoda cf. Viviparidae Genus sp.		SC																		
307	Viviparidae Genus species		SC																		
Platyhelminthes																					
Turbellaria																					
Tricladida																					
Planariidae																					
308	Cura formanii	4.97	OM			2															
309	Tricladida Genus species		OM																		

* CG = collector-gatherer, CF = collector-filterer, OM = omnivore, P = predator, SH = shredder, SC = scraper

Table 4. Dominant taxa (>5% of the collection) for the sampling locations in the Broad River drainage South Carolina, 13 July-19 August 2005.

2005001			**2005002**			**2005003**		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Caenis sp.	60	17.75	Chimarra sp.	79	17.67	Stenonema modestum	63	14.93
Tribelos jacundum	59	17.46	Stenacron interpunctatum	46	10.29	Caenis sp.	59	13.98
Microtendipes pedellus gr.	23	6.80	Cheumatopsyche sp.	38	8.50	Dubiraphia sp.	33	7.82
Stenacron interpunctatum	23	6.80	Tribelos jacundum	36	8.05	Cheumatopsyche sp.	24	5.69
Stenonema sp.	20	5.92	Caenis sp.	30	6.71	Tribelos jacundum	22	5.21
Heptageniidae Genus species	19	5.62	Hydropsyche betteni	24	5.37			
2005004			**2005005**			**2005006**		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Cheumatopsyche sp.	65	20.50	Stenonema modestum	62	18.24	Stenonema modestum	41	10.17
Stenonema modestum	39	12.30	Stenacron interpunctatum	43	12.65	Cheumatopsyche sp.	34	8.44
Tribelos jacundum	26	8.20	Microtendipes pedellus gr.	25	7.35	Isonychia sp.	34	8.44
Stenonema sp.	19	5.99	Cheumatopsyche sp.	23	6.76	Chimarra sp.	29	7.20
Hydropsychidae Genus species	17	5.36				Branchiobdellidae Genus species	28	6.95
2005007			**2005008**			**2005009**		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Stenonema modestum	71	26.01	Stenonema modestum	99	23.29	Stenonema modestum	52	24.88
Progomphus cf. obscurus	29	10.62	Cheumatopsyche sp.	39	9.18	Polypedilum fallax gr.	13	6.22
Paratanytarsus dissimilis	22	8.06	Tricorythodes sp.	32	7.53	Boyeria vinosa	11	5.26
Lebertia sp.	15	5.49	Isonychia sp.	26	6.12			
Boyeria vinosa	15	5.49	Perlidae cf. Acroneuria sp.	23	5.41			

Table 4. Continued..

2005010			2005011			2005012		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Stenacron interpunctatum	42	12.43	Stenonema modestum	63	20.52	Stenonema modestum	81	29.89
Leucrocuta sp.	30	8.88	Cheumatopsyche sp.	52	16.94	Caenis sp.	38	14.02
Isonychia sp.	23	6.80	Chimarra sp.	39	12.70	Chimarra sp.	26	9.59
Stenonema modestum	22	6.51	Stenelmis sp.	30	9.77			
Cheumatopsyche sp.	21	6.21	Calopteryx maculata	16	5.21			
Microtendipes pedellus gr.	18	5.33						
Chimarra sp.	18	5.33						
2005013			**2005014**			**2005015**		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Stenacron interpunctatum	59	14.75	Stenonema modestum	51	14.45	Stenacron interpunctatum	51	15.36
Chimarra sp.	57	14.25	Cheumatopsyche sp.	48	13.60	Stenonema modestum	49	14.76
Stenonema modestum	39	9.75	Phaenopsectra obediens gr.	28	7.93	Macronychus glabratus	33	9.94
Stenelmis sp.	29	7.25	Caenis sp.	19	5.38	Cheumatopsyche sp.	28	8.43
Macronychus glabratus	25	6.25				Boyeria vinosa	20	6.02
Caenis sp.	22	5.5						
2005016			**2005017**			**20050018**		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Stenonema modestum	52	15.03	Stenonema modestum	41	17.23	Chimarra sp.	41	11.78
Stenacron interpunctatum	37	10.69	Cheumatopsyche sp.	35	14.71	Cheumatopsyche sp.	37	10.63
Neophylax oligius	31	8.96	Boyeria vinosa	23	9.66	Leucrocuta sp.	35	10.06
Microtendipes pedellus gr.	28	8.09	Isonychia sp.	22	9.24	Stenacron interpunctatum	31	8.91
Caenis sp.	27	7.80	Pteronarcys sp.	14	5.88	Stenonema modestum	24	6.90
Psephenus herricki	24	6.94	Beloneuria sp.	13	5.46	Isonychia sp.	23	6.61

Table 4. Continued..

2005019			2005020			2005021		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Stenonema modestum	21	12.14	Corydalus cornutus	24	11.88	Chimarra sp.	49	15.51
Elimia sp.	21	12.14	Stenacron interpunctatum	22	10.89	Stenonema modestum	39	12.34
Baetis pluto	16	9.25	Stenonema modestum	21	10.40	Cheumatopsyche sp.	34	10.76
Cheumatopsyche sp.	11	6.36	Isonychia sp.	16	7.92	Stenacron interpunctatum	30	9.49
Stenacron interpunctatum	10	5.78				Isonychia sp.	17	5.38
2005022			**2005023**			**2005024**		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Stenonema modestum	39	21.79	Stenonema modestum	48	20.69	Leucrocuta sp.	47	15.72
Caenis sp.	32	17.88	Stenacron interpunctatum	26	11.21	Stenelmis sp.	41	13.71
Stenacron interpunctatum	22	12.29	Chimarra sp.	14	6.03	Elimia sp.	27	9.03
Chimarra sp.	13	7.26	Isonychia sp.	12	5.17	Stenacron interpunctatum	25	8.36
						Stenonema modestum	20	6.69
						Isonychia sp.	18	6.02
						Macronychus glabratus	16	5.35
						Boyeria vinosa	16	5.35
2005025			**2005026**			**20050027**		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Stenonema modestum	35	15.22	Cheumatopsyche sp.	19	11.95	Isonychia sp.	117	27.34
Leucrocuta sp.	31	13.48	Stenonema modestum	19	11.95	Chimarra sp.	56	13.08
Stenacron interpunctatum	18	7.83	Beloneuria sp.	16	10.06	Cheumatopsyche sp.	44	10.28
Cheumatopsyche sp.	14	6.09	Calopteryx sp.	12	7.55			
Microtendipes pedellus gr.	13	5.65	Simulium sp.	11	6.92			
Tallaperla sp.	13	5.65	Boyeria vinosa	9	5.66			
Isonychia sp.	13	5.65						

Table 4. Continued..

2005028			2005029			2005030		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Beloneuria sp.	54	16.93	Stenonema modestum	68	17.44	Stenonema modestum	45	15.52
Cheumatopsyche sp.	45	14.11	Stenacron interpunctatum	64	16.41	Cheumatopsyche sp.	39	13.45
Cordulegaster sp.	35	10.97	Ceratopsyche sparna	32	8.21	Branchiobdellidae Genus species	28	9.66
Stenonema modestum	25	7.84	Leuctra sp.	30	7.69	Stenacron interpunctatum	26	8.97
Xylotopus par	20	6.27	Baetis pluto	23	5.90	Elimia sp.	17	5.86
Hydropsyche betteni	17	5.33	Isonychia sp.	22	5.64			
			Simulium sp.	20	5.13			
2005031			**2005032**			**2005033**		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Elimia sp.	68	18.58	Beloneuria sp.	19	12.03	Epeorus sp.	23	9.54
Stenonema modestum	52	14.21	Cheumatopsyche sp.	16	10.13	Simulium sp.	17	7.05
Stenacron interpunctatum	39	10.66	Tallaperla sp.	16	10.13	Acroneuria abnormis	17	7.05
Branchiobdellidae Genus species	32	8.74	Stenonema modestum	11	6.96	Psephenus herricki	15	6.22
			Boyeria vinosa	11	6.96	Cheumatopsyche sp.	14	5.81
			Acroneuria abnormis	9	5.70	Stenonema modestum	14	5.81
2005034			**2005035**			**20050036**		
Taxon	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**	**Taxon**	**No.**	**Rel. Abd.**
Tallaperla sp.	68	23.94	Stenonema modestum	91	32.62	Chimarra sp.	81	23.82
Diplectrona modesta	33	11.62	Cheumatopsyche sp.	43	15.41	Stenonema modestum	39	11.47
Branchiobdellidae Genus species	29	10.21	Tricorythodes sp.	15	5.38	Stenacron interpunctatum	30	8.82
Elimia sp.	22	7.75				Nigronia serricornis	30	8.82
Dolophilodes sp.	16	5.63				Phaenopsectra obediens gr.	18	5.29
Acroneuria abnormis	15	5.28						

Table 4. Continued..

2005037		
Taxon	**No.**	**Rel. Abd.**
Tallaperla sp.	50	15.92
Elimia sp.	44	14.01
Neophylax consimilis	28	8.92
Beloneuria sp.	19	6.05
Lepidostoma sp.	17	5.41

Table 5. Rapid bioassessment metrics calculated for the sampling locations in the Broad River drainage, South Carolina 13 July-19 August 2005.

	Sample Location																		
Metric	**2005001**	**2005002**	**2005003**	**2005004**	**2005005**	**2005006**	**2005007**	**2005008**	**2005009**	**2005010**	**2005011**	**2005012**	**2005013**	**2005014**	**2005015**	**2005016**	**2005017**	**2005018**	**2005019**
Taxa Richness	55	65	62	49	62	70	51	57	50	56	46	48	56	57	47	55	38	54	45
Number of Specimens	338	447	422	317	340	403	273	425	209	338	307	271	400	353	332	346	238	348	173
EPT Index	10	16	15	19	23	21	7	20	9	14	11	12	21	12	18	18	16	21	19
EPT Abundance	146	299	216	210	208	226	84	275	80	197	187	166	234	171	186	192	162	251	102
Chironomidae Taxa	16	18	13	13	14	26	20	20	17	18	10	15	15	16	8	19	6	11	7
Chironomidae Abundance	127	77	52	50	53	80	84	79	56	62	24	55	32	68	20	69	11	12	18
EPT/Chironomidae Abundance	1.15	3.88	4.15	4.20	3.92	2.83	1.00	3.48	1.43	3.18	7.79	3.02	7.31	2.51	9.30	2.78	14.73	20.92	5.67
NCBI	5.70	5.66	5.57	5.01	5.43	5.25	6.26	5.66	6.04	5.51	5.49	5.70	5.89	6.21	5.58	5.36	4.88	4.96	5.11
SCDHEC Bioclassification	3.0	3.3	3.2	4.0	3.7	3.5	2.2	3.5	2.3	3.2	3.0	3.0	3.0	2.5	3.5	3.5	3.8	4.0	4.0
Percent Collector-Filterers	13.31	37.36	13.03	35.02	28.82	31.51	17.22	22.59	8.61	28.70	35.18	16.61	27.00	18.98	13.25	16.47	29.41	30.75	20.81
Percent Collector-Gatherers	46.75	21.03	41.47	16.72	12.06	10.67	8.79	18.35	22.49	13.61	6.19	28.41	19.25	21.81	22.89	12.72	10.92	14.37	19.08
Percent Omnivores	0.59	0.22	1.90	0.32	0.29	0.50	3.66	0.00	0.00	4.73	1.30	1.48	2.50	1.70	0.00	2.60	1.26	0.29	1.16
Percent Predators	13.61	9.17	15.64	16.40	19.41	22.08	36.63	25.41	25.36	14.50	9.12	14.02	11.75	21.53	23.80	11.56	31.09	13.79	13.87
Percent Scrapers	24.56	28.41	26.30	20.50	34.12	22.58	29.30	26.82	31.10	34.02	42.02	36.90	37.50	31.44	33.73	53.47	19.33	39.66	43.93
Percent Shredders	1.18	3.36	1.18	10.09	3.53	8.93	1.47	4.71	9.09	2.96	5.86	1.85	2.00	3.68	5.72	2.60	7.98	1.15	1.16
Scraper/Collector-Filterers	1.84	0.76	2.02	0.59	1.18	0.72	1.70	1.19	3.61	1.19	1.19	2.22	1.39	1.66	2.55	3.25	0.66	1.29	2.11
Shredders/Total	0.01	0.03	0.01	0.10	0.04	0.09	0.01	0.05	0.09	0.03	0.06	0.02	0.02	0.04	0.06	0.03	0.08	0.01	0.01
Percent Dominant Taxon	17.75	17.67	14.93	20.50	18.24	10.17	26.01	23.29	24.88	12.43	20.52	29.89	14.75	14.45	15.36	15.03	17.23	11.78	12.14
Number Of Dominant Taxa	6.00	6.00	5.00	5.00	4.00	5.00	5.00	5.00	3.00	7.00	5.00	3.00	6.00	4.00	5.00	6.00	6.00	6.00	5.00

Table 5. Continued..

	Sample Location																		
Metric	**2005019**	**2005020**	**2005021**	**2005022**	**2005023**	**2005024**	**2005025**	**2005026**	**2005027**	**2005028**	**2005029**	**2005030**	**2005031**	**2005032**	**2005033**	**2005034**	**2005035**	**2005036**	**2005037**
Taxa Richness	45	52	50	41	51	42	48	39	49	52	51	53	48	40	41	28	42	53	44
Number of Specimens	173	202	316	179	232	299	230	159	428	319	390	290	366	158	241	284	279	340	314
EPT Index	19	24	18	14	21	14	21	12	16	14	22	19	19	20	25	19	11	18	17
EPT Abundance	102	119	229	118	152	126	168	72	286	177	293	160	157	112	164	217	171	212	178
Chironomidae Taxa	7	10	12	7	11	9	7	13	11	12	12	12	9	4	2	1	12	10	11
Chironomidae Abundance	18	24	36	13	29	16	20	24	44	45	26	23	39	5	2	3	29	43	27
EPT/Chironomidae Abundance	5.67	4.96	6.36	9.08	5.24	7.88	8.40	3.00	6.50	3.93	11.27	6.96	4.03	22.40	82.00	72.33	5.90	4.93	6.59
NCBI	5.11	5.05	5.22	5.84	5.23	5.04	4.39	5.68	5.50	5.77	4.73	4.92	4.82	4.26	3.51	2.47	5.68	5.51	3.85
SCDHEC Bioclassification	4.0	4.3	3.7	2.7	3.7	3.7	4.0	3.0	3.3	3.0	4.2	4.0	4.0	4.0	4.3	4.0	3.0	3.5	3.8
Percent Collector-Filterers	20.81	20.79	36.08	16.20	18.97	12.71	18.70	22.01	51.87	20.69	28.72	15.86	8.20	12.03	22.41	24.65	24.73	40.29	10.19
Percent Collector-Gatherers	19.08	20.79	15.19	24.02	9.05	10.03	9.57	9.43	15.19	16.61	11.54	8.62	3.83	13.92	21.58	3.17	16.49	4.12	6.37
Percent Omnivores	1.16	0.50	0.95	1.68	3.88	0.67	1.30	0.00	0.23	0.00	0.51	1.72	4.10	0.63	2.90	0.70	0.36	1.47	5.73
Percent Predators	13.87	22.28	12.66	16.76	17.24	21.07	17.39	37.74	14.72	41.38	10.26	24.83	25.14	35.44	19.50	22.89	17.20	18.82	20.06
Percent Scrapers	43.93	28.71	34.18	40.22	42.24	54.85	44.78	20.13	10.75	12.85	38.46	42.76	54.92	17.09	23.65	20.42	38.35	33.24	31.21
Percent Shredders	1.16	6.93	0.95	1.12	8.62	0.67	8.26	10.69	7.24	8.46	10.51	6.21	3.83	20.89	9.96	28.17	2.87	2.06	26.43
Scraper/Collector-Filterers	2.11	1.38	0.95	2.48	2.23	4.32	2.40	0.91	0.21	0.62	1.34	2.70	6.70	1.42	1.06	0.83	1.55	0.82	3.06
Shredders/Total	0.01	0.07	0.01	0.01	0.09	0.01	0.08	0.11	0.07	0.08	0.11	0.06	0.04	0.21	0.10	0.28	0.03	0.02	0.26
Percent Dominant Taxon	12.14	11.88	15.51	21.79	20.69	15.72	15.22	11.95	27.34	16.93	17.44	15.52	18.58	12.03	9.54	23.94	32.62	23.82	15.92
Number Of Dominant Taxa	5.00	4.00	5.00	4.00	4.00	8.00	7.00	6.00	3.00	6.00	7.00	5.00	4.00	6.00	6.00	6.00	3.00	5.00	5.00

Table 6. Community Loss Index (CLI) calculated for the sampling locations in the Broad River drainage, South Carolina, 13 July-19 August 2005.

	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
2005001	0.34	0.39	0.76	0.53	0.39	0.57	0.61	0.66	0.57	0.80	0.83	0.61	0.53	0.74	0.58	1.16	0.59	0.80
2005002		0.53	0.86	0.71	0.47	0.90	0.68	0.80	0.70	0.89	1.00	0.70	0.74	0.96	0.73	1.24	0.72	1.00
2005003			0.71	0.58	0.50	0.78	0.74	0.78	0.66	0.87	0.94	0.66	0.63	0.89	0.80	1.13	0.69	0.93
2005004				0.42	0.36	0.57	0.49	0.50	0.46	0.61	0.77	0.41	0.42	0.66	0.55	0.66	0.44	0.69
2005005					0.49	0.75	0.61	0.80	0.63	0.87	1.00	0.73	0.65	0.85	0.69	1.18	0.74	0.98
2005006						0.84	0.65	0.86	0.71	0.93	1.06	0.77	0.75	1.04	0.78	1.32	0.74	1.09
2005007							0.51	0.60	0.61	0.76	0.88	0.63	0.53	0.81	0.60	1.03	0.63	0.84
2005008								0.52	0.55	0.80	0.83	0.70	0.60	0.85	0.67	1.00	0.69	0.98
2005009									0.46	0.72	0.75	0.55	0.42	0.68	0.56	0.79	0.52	0.80
2005010										0.72	0.75	0.57	0.60	0.77	0.60	1.05	0.52	0.73
2005011											0.60	0.41	0.47	0.64	0.49	0.84	0.43	0.69
2005012												0.54	0.58	0.70	0.56	1.05	0.56	0.76
2005013													0.58	0.74	0.55	0.95	0.43	0.73
2005014														0.68	0.62	0.95	0.57	0.80
2005015															0.40	0.71	0.39	0.73
2005016																1.05	0.56	0.82
2005017																	0.33	0.51
2005018																		0.67
2005019																		
2005020																		
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Table 6. Continued..

	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
2005001	0.79	0.72	0.90	0.73	0.95	0.77	1.15	0.82	0.85	0.78	0.75	0.83	1.18	1.05	1.89	0.98	0.68	0.93
2005002	0.92	0.84	1.05	0.82	1.17	0.96	1.13	0.90	0.88	0.84	0.85	0.94	1.28	1.24	2.18	1.14	0.81	1.11
2005003	0.75	0.78	1.02	0.84	1.00	0.92	1.21	0.86	0.94	0.80	0.75	0.94	1.25	1.10	2.07	1.10	0.74	1.11
2005004	0.50	0.54	0.71	0.59	0.74	0.69	0.77	0.49	0.63	0.55	0.47	0.60	0.80	0.76	1.50	0.64	0.45	0.70
2005005	0.81	0.88	1.07	0.84	1.10	0.98	1.21	0.80	0.90	0.84	0.79	0.94	1.28	1.17	2.07	1.07	0.75	1.07
2005006	0.96	0.94	1.17	0.86	1.17	0.98	1.26	0.92	0.88	0.80	0.83	0.96	1.40	1.27	2.29	1.17	0.85	1.11
2005007	0.75	0.78	0.90	0.69	0.93	0.83	1.00	0.73	0.77	0.76	0.70	0.88	1.10	1.05	1.75	0.90	0.64	0.84
2005008	0.81	0.72	1.00	0.75	1.12	0.92	0.97	0.76	0.73	0.73	0.70	0.83	1.13	1.05	1.86	0.93	0.75	0.86
2005009	0.65	0.60	0.76	0.63	0.86	0.81	0.79	0.53	0.60	0.63	0.55	0.75	0.85	0.88	1.61	0.69	0.58	0.80
2005010	0.62	0.64	0.78	0.57	0.95	0.75	0.90	0.63	0.69	0.63	0.57	0.71	1.10	0.95	1.82	0.76	0.60	0.80
2005011	0.60	0.60	0.66	0.51	0.74	0.58	0.79	0.59	0.56	0.59	0.49	0.63	0.93	0.78	1.43	0.67	0.49	0.68
2005012	0.71	0.66	0.83	0.65	0.88	0.73	0.95	0.67	0.65	0.61	0.57	0.71	0.98	0.90	1.57	0.83	0.64	0.89
2005013	0.62	0.68	0.88	0.55	0.83	0.65	0.95	0.67	0.69	0.57	0.57	0.79	1.03	0.93	1.86	0.81	0.58	0.93
2005014	0.67	0.66	0.90	0.75	0.88	0.81	1.00	0.59	0.69	0.73	0.62	0.79	1.03	1.07	1.93	0.81	0.60	0.98
2005015	0.50	0.62	0.71	0.57	0.67	0.67	0.79	0.47	0.62	0.59	0.51	0.60	0.83	0.80	1.61	0.60	0.53	0.82
2005016	0.75	0.66	0.76	0.67	0.88	0.75	0.95	0.67	0.75	0.75	0.64	0.73	1.15	1.07	1.86	0.88	0.68	0.84
2005017	0.42	0.34	0.51	0.41	0.50	0.46	0.46	0.31	0.31	0.35	0.26	0.38	0.48	0.49	1.11	0.50	0.32	0.55
2005018	0.58	0.48	0.71	0.49	0.67	0.56	0.79	0.51	0.60	0.57	0.47	0.56	0.90	0.80	1.75	0.69	0.55	0.77
2005019	0.48	0.40	0.61	0.47	0.67	0.52	0.79	0.47	0.58	0.45	0.38	0.54	0.80	0.66	1.36	0.71	0.42	0.61
2005020		0.56	0.83	0.55	0.69	0.69	0.87	0.57	0.69	0.53	0.51	0.67	0.93	0.85	1.68	0.74	0.64	0.84
2005021			0.68	0.45	0.69	0.50	0.74	0.51	0.56	0.47	0.40	0.50	0.73	0.78	1.57	0.69	0.51	0.64
2005022				0.43	0.48	0.44	0.59	0.41	0.48	0.41	0.40	0.44	0.68	0.68	1.39	0.50	0.36	0.55
2005023					0.69	0.52	0.79	0.49	0.52	0.53	0.51	0.60	0.83	0.73	1.50	0.69	0.49	0.66
2005024						0.38	0.72	0.39	0.50	0.47	0.40	0.46	0.63	0.66	1.21	0.55	0.42	0.61
2005025							0.79	0.55	0.56	0.51	0.49	0.52	0.78	0.73	1.43	0.71	0.51	0.68
2005026								0.24	0.23	0.33	0.26	0.42	0.53	0.54	1.14	0.50	0.38	0.48
2005027									0.37	0.47	0.42	0.52	0.70	0.73	1.50	0.50	0.42	0.68
2005028										0.51	0.45	0.67	0.80	0.83	1.57	0.79	0.58	0.68
2005029											0.40	0.54	0.73	0.71	1.54	0.69	0.49	0.73
2005030												0.50	0.75	0.73	1.46	0.76	0.51	0.75
2005031													0.68	0.63	1.32	0.69	0.42	0.61
2005032														0.41	1.00	0.64	0.43	0.52
2005033															0.86	0.69	0.34	0.48
2005034																0.57	0.36	0.39
2005035																	0.32	0.61
2005036																		0.75

Table 7. Jaccard Coefficient of Similarity (JCS) calculated for the sampling locations in the Broad River drainage, South Carolina, 13 July-19 August 2005.

	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
2005001	0.38	0.36	0.21	0.23	0.29	0.33	0.22	0.27	0.26	0.22	0.17	0.23	0.29	0.24	0.26	0.13	0.27	0.23
2005002		0.34	0.25	0.20	0.31	0.20	0.27	0.28	0.27	0.28	0.18	0.27	0.23	0.22	0.26	0.21	0.28	0.22
2005003			0.32	0.27	0.26	0.24	0.20	0.26	0.27	0.26	0.18	0.27	0.28	0.22	0.18	0.23	0.27	0.23
2005004				0.26	0.25	0.25	0.25	0.32	0.28	0.28	0.14	0.33	0.31	0.23	0.22	0.38	0.32	0.24
2005005					0.27	0.27	0.29	0.24	0.30	0.26	0.15	0.22	0.27	0.25	0.26	0.20	0.23	0.20
2005006						0.29	0.35	0.29	0.31	0.30	0.19	0.27	0.27	0.22	0.28	0.23	0.32	0.22
2005007							0.26	0.26	0.19	0.20	0.10	0.18	0.24	0.15	0.20	0.16	0.19	0.16
2005008								0.41	0.30	0.24	0.19	0.19	0.25	0.20	0.22	0.25	0.22	0.15
2005009									0.29	0.22	0.17	0.22	0.32	0.23	0.22	0.29	0.27	0.17
2005010										0.29	0.24	0.27	0.24	0.24	0.26	0.21	0.34	0.29
2005011											0.22	0.29	0.23	0.21	0.23	0.20	0.30	0.20
2005012												0.21	0.17	0.19	0.20	0.10	0.21	0.18
2005013													0.26	0.26	0.31	0.27	0.43	0.29
2005014														0.32	0.26	0.28	0.31	0.26
2005015															0.32	0.31	0.35	0.18
2005016																0.19	0.30	0.22
2005017																	0.28	0.22
2005018																		0.32
2005019																		
2005020																		
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Table 7. Continued..

	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
2005001	0.15	0.22	0.23	0.20	0.18	0.21	0.12	0.17	0.11	0.16	0.16	0.17	0.09	0.14	0.02	0.17	0.21	0.16
2005002	0.17	0.25	0.26	0.25	0.18	0.20	0.25	0.23	0.19	0.23	0.20	0.22	0.15	0.15	0.04	0.19	0.23	0.17
2005003	0.25	0.26	0.24	0.20	0.24	0.20	0.17	0.22	0.13	0.23	0.24	0.18	0.13	0.20	0.05	0.18	0.25	0.14
2005004	0.29	0.29	0.29	0.23	0.25	0.20	0.28	0.34	0.19	0.27	0.31	0.26	0.24	0.25	0.10	0.32	0.32	0.24
2005005	0.21	0.19	0.21	0.20	0.18	0.16	0.17	0.26	0.15	0.20	0.21	0.18	0.12	0.16	0.05	0.20	0.24	0.16
2005006	0.20	0.24	0.25	0.27	0.23	0.24	0.24	0.27	0.24	0.32	0.27	0.26	0.15	0.19	0.07	0.23	0.26	0.23
2005007	0.13	0.13	0.18	0.19	0.15	0.13	0.15	0.18	0.12	0.13	0.16	0.10	0.08	0.10	0.03	0.16	0.20	0.17
2005008	0.16	0.24	0.20	0.21	0.11	0.14	0.25	0.23	0.21	0.23	0.22	0.19	0.14	0.17	0.06	0.22	0.18	0.23
2005009	0.19	0.25	0.26	0.22	0.18	0.13	0.27	0.32	0.23	0.22	0.26	0.17	0.22	0.18	0.07	0.30	0.23	0.19
2005010	0.29	0.29	0.33	0.34	0.20	0.24	0.28	0.31	0.23	0.29	0.31	0.27	0.14	0.21	0.06	0.32	0.28	0.27
2005011	0.18	0.20	0.28	0.26	0.21	0.24	0.21	0.22	0.21	0.20	0.25	0.21	0.12	0.19	0.09	0.26	0.25	0.22
2005012	0.12	0.18	0.19	0.18	0.14	0.16	0.14	0.18	0.16	0.21	0.22	0.17	0.11	0.14	0.06	0.17	0.16	0.11
2005013	0.29	0.26	0.26	0.35	0.27	0.32	0.25	0.28	0.23	0.34	0.31	0.21	0.19	0.23	0.05	0.29	0.30	0.18
2005014	0.25	0.29	0.26	0.21	0.25	0.21	0.23	0.36	0.24	0.23	0.28	0.22	0.20	0.15	0.04	0.30	0.29	0.16
2005015	0.27	0.20	0.26	0.23	0.27	0.19	0.23	0.33	0.18	0.21	0.25	0.23	0.19	0.19	0.03	0.33	0.23	0.14
2005016	0.18	0.27	0.33	0.25	0.23	0.23	0.24	0.27	0.18	0.19	0.24	0.24	0.10	0.13	0.04	0.23	0.21	0.22
2005017	0.22	0.31	0.27	0.24	0.28	0.25	0.36	0.34	0.33	0.29	0.33	0.29	0.27	0.29	0.16	0.26	0.30	0.21
2005018	0.29	0.41	0.36	0.38	0.37	0.36	0.33	0.39	0.28	0.31	0.37	0.36	0.24	0.28	0.06	0.35	0.30	0.26
2005019	0.26	0.36	0.30	0.28	0.24	0.27	0.20	0.31	0.18	0.30	0.34	0.26	0.18	0.26	0.11	0.21	0.31	0.25
2005020		0.31	0.24	0.30	0.32	0.23	0.25	0.31	0.18	0.32	0.31	0.25	0.19	0.22	0.07	0.29	0.21	0.19
2005021			0.32	0.36	0.30	0.36	0.31	0.34	0.26	0.35	0.39	0.36	0.30	0.25	0.08	0.30	0.29	0.31
2005022				0.26	0.34	0.29	0.29	0.30	0.21	0.28	0.27	0.29	0.21	0.19	0.03	0.32	0.31	0.25
2005023					0.31	0.36	0.29	0.37	0.30	0.31	0.30	0.29	0.25	0.30	0.13	0.31	0.32	0.30
2005024						0.36	0.21	0.34	0.21	0.24	0.28	0.29	0.26	0.22	0.13	0.29	0.27	0.21
2005025							0.24	0.28	0.23	0.29	0.28	0.32	0.24	0.25	0.12	0.25	0.26	0.24
2005026								0.44	0.42	0.32	0.37	0.28	0.30	0.27	0.12	0.29	0.26	0.28
2005027									0.42	0.33	0.36	0.33	0.31	0.27	0.10	0.44	0.36	0.26
2005028										0.34	0.36	0.25	0.28	0.24	0.11	0.25	0.25	0.30
2005029											0.41	0.34	0.32	0.31	0.11	0.31	0.32	0.27
2005030												0.41	0.32	0.33	0.16	0.26	0.34	0.38
2005031													0.31	0.33	0.17	0.27	0.35	0.30
2005032														0.40	0.21	0.19	0.22	0.25
2005033															0.33	0.17	0.32	0.31
2005034																0.06	0.13	0.18
2005035																	0.36	0.21
2005036																		0.26

Table 8. Sörensen Coefficient (C_S) calculated for the sampling locations in the Broad River drainage, South Carolina, 13 July-19 August 2005.

	2005002	2005003	2005004	2005005	2005006	2005007	2005008	2005009	2005010	2005011	2005012	2005013	2005014	2005015	2005016	2005017	2005018	2005019
2005001	0.55	0.53	0.35	0.38	0.45	0.49	0.36	0.42	0.41	0.36	0.29	0.38	0.45	0.39	0.42	0.24	0.42	0.38
2005002		0.50	0.40	0.33	0.47	0.33	0.43	0.43	0.43	0.43	0.30	0.43	0.38	0.36	0.42	0.35	0.44	0.36
2005003			0.49	0.42	0.41	0.39	0.34	0.41	0.42	0.41	0.31	0.42	0.44	0.37	0.31	0.38	0.43	0.37
2005004				0.41	0.40	0.40	0.40	0.48	0.44	0.44	0.25	0.50	0.47	0.38	0.37	0.55	0.49	0.38
2005005					0.42	0.42	0.45	0.39	0.46	0.41	0.25	0.36	0.42	0.40	0.41	0.34	0.38	0.34

2005006						0.45	0.52	0.45	0.48	0.47	0.32	0.43	0.43	0.36	0.43	0.37	0.48	0.37
2005007							0.41	0.42	0.32	0.33	0.18	0.30	0.39	0.27	0.34	0.27	0.32	0.27
2005008								0.58	0.46	0.39	0.32	0.32	0.40	0.33	0.36	0.40	0.36	0.25
2005009									0.45	0.35	0.29	0.36	0.49	0.37	0.36	0.45	0.42	0.29
2005010										0.45	0.38	0.43	0.39	0.39	0.41	0.34	0.51	0.46
2005011											0.36	0.45	0.37	0.34	0.38	0.33	0.46	0.33
2005012												0.35	0.29	0.32	0.33	0.19	0.35	0.30
2005013													0.41	0.41	0.47	0.43	0.60	0.46
2005014														0.48	0.41	0.44	0.47	0.41
2005015															0.49	0.47	0.51	0.30
2005016																0.32	0.46	0.36
2005017																	0.43	0.36
2005018																		0.48
2005019																		
2005020																		
2005021																		
2005022																		
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2005036																		

Table 8. Continued..

	2005020	2005021	2005022	2005023	2005024	2005025	2005026	2005027	2005028	2005029	2005030	2005031	2005032	2005033	2005034	2005035	2005036	2005037
2005001	0.26	0.36	0.38	0.34	0.31	0.35	0.21	0.29	0.21	0.28	0.28	0.29	0.17	0.25	0.05	0.29	0.35	0.28
2005002	0.29	0.40	0.42	0.40	0.30	0.34	0.40	0.37	0.32	0.38	0.34	0.35	0.27	0.26	0.09	0.32	0.37	0.29
2005003	0.40	0.41	0.39	0.34	0.38	0.33	0.30	0.36	0.23	0.37	0.38	0.31	0.24	0.33	0.09	0.31	0.40	0.25
2005004	0.46	0.44	0.44	0.38	0.40	0.33	0.43	0.51	0.32	0.42	0.47	0.41	0.38	0.40	0.18	0.48	0.49	0.39
2005005	0.35	0.32	0.35	0.34	0.31	0.27	0.30	0.41	0.26	0.34	0.35	0.31	0.22	0.27	0.09	0.33	0.38	0.28
2005006	0.33	0.38	0.40	0.43	0.38	0.39	0.39	0.42	0.39	0.48	0.42	0.41	0.25	0.32	0.12	0.38	0.41	0.37
2005007	0.23	0.24	0.30	0.31	0.26	0.22	0.27	0.30	0.21	0.24	0.27	0.18	0.15	0.17	0.05	0.28	0.33	0.29
2005008	0.28	0.39	0.33	0.35	0.20	0.25	0.40	0.38	0.35	0.37	0.36	0.32	0.25	0.29	0.12	0.36	0.31	0.38
2005009	0.31	0.40	0.42	0.36	0.30	0.22	0.43	0.48	0.37	0.36	0.41	0.29	0.36	0.31	0.13	0.46	0.37	0.32
2005010	0.44	0.45	0.49	0.50	0.33	0.38	0.44	0.48	0.37	0.45	0.48	0.42	0.25	0.35	0.12	0.49	0.44	0.42
2005011	0.31	0.33	0.44	0.41	0.34	0.38	0.35	0.36	0.35	0.33	0.40	0.34	0.21	0.32	0.16	0.41	0.40	0.36
2005012	0.22	0.31	0.31	0.30	0.24	0.27	0.25	0.31	0.28	0.34	0.36	0.29	0.20	0.25	0.11	0.29	0.28	0.20
2005013	0.44	0.42	0.41	0.52	0.43	0.48	0.40	0.44	0.37	0.50	0.48	0.35	0.31	0.37	0.10	0.45	0.46	0.30
2005014	0.40	0.45	0.41	0.35	0.40	0.34	0.38	0.53	0.39	0.37	0.44	0.36	0.33	0.27	0.07	0.46	0.45	0.28
2005015	0.42	0.33	0.41	0.37	0.43	0.32	0.37	0.50	0.30	0.35	0.40	0.38	0.32	0.32	0.05	0.49	0.38	0.24
2005016	0.30	0.42	0.50	0.40	0.37	0.37	0.38	0.42	0.30	0.32	0.39	0.39	0.19	0.23	0.07	0.37	0.35	0.36
2005017	0.36	0.48	0.43	0.38	0.43	0.37	0.52	0.53	0.49	0.45	0.53	0.47	0.49	0.46	0.21	0.43	0.46	0.34
2005018	0.45	0.58	0.53	0.55	0.54	0.53	0.49	0.56	0.43	0.48	0.54	0.53	0.38	0.44	0.12	0.52	0.47	0.41
2005019	0.41	0.53	0.47	0.44	0.39	0.43	0.33	0.47	0.31	0.46	0.51	0.41	0.31	0.42	0.19	0.34	0.47	0.40
2005020		0.47	0.39	0.47	0.49	0.38	0.40	0.48	0.31	0.49	0.48	0.40	0.33	0.37	0.13	0.45	0.34	0.31
2005021			0.48	0.53	0.46	0.53	0.47	0.51	0.41	0.51	0.56	0.53	0.47	0.40	0.15	0.46	0.45	0.47
2005022				0.41	0.51	0.45	0.45	0.47	0.34	0.43	0.43	0.45	0.35	0.32	0.06	0.48	0.47	0.40
2005023					0.47	0.53	0.44	0.54	0.47	0.47	0.46	0.44	0.40	0.46	0.23	0.47	0.48	0.46
2005024						0.53	0.35	0.51	0.34	0.39	0.44	0.44	0.41	0.36	0.23	0.45	0.42	0.35
2005025							0.39	0.43	0.38	0.44	0.44	0.48	0.39	0.40	0.21	0.40	0.42	0.39
2005026								0.61	0.59	0.49	0.54	0.44	0.46	0.43	0.21	0.44	0.41	0.43
2005027									0.59	0.50	0.53	0.49	0.47	0.42	0.18	0.62	0.53	0.41
2005028										0.50	0.53	0.40	0.43	0.39	0.20	0.40	0.40	0.46
2005029											0.58	0.51	0.48	0.48	0.20	0.47	0.48	0.40
2005030												0.57	0.49	0.49	0.30	0.44	0.49	0.41
2005031													0.48	0.49	0.29	0.42	0.51	0.46
2005032														0.57	0.35	0.32	0.37	0.40
2005033															0.49	0.29	0.49	0.47
2005034																0.11	0.22	0.31
2005035																	0.53	0.35
2005036																		0.41