

BASINWIDE ASSESSMENT REPORT

NEW RIVER BASIN



NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT
AND NATURAL RESOURCES
Division of Water Quality
Environmental Sciences Section



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INTRODUCTION TO PROGRAM METHODS

The Division of Water Quality uses a basinwide approach to water quality management. Activities within the Division, including permitting, monitoring, modeling, nonpoint source assessments, and planning are coordinated and integrated for each of the 17 major river basins within the state. All basins are reassessed every five years. The New River basin has been sampled by the Environmental Sciences Section (ESS) four times for basinwide monitoring: 1993, 1998, 2003, and 2008.

The ESS collects a variety of biological, chemical, and physical data that can be used in a myriad of ways within the basinwide-planning program. In some program areas there may be adequate data from several program areas to allow a fairly comprehensive analysis of ecological integrity or water quality. In other areas, data may be limited to one program area, such as only benthic macroinvertebrate data or only fisheries data, with no other information available. Such data may or may not be adequate to provide a definitive assessment of water quality, but can provide general indications of water quality. The primary program areas from which data were drawn for this assessment of the New River basin include benthic macroinvertebrates, fish community, ambient monitoring, and aquatic toxicity monitoring for the period 2003-2008. Details of biological sampling methods (including habitat evaluation) and rating criteria can be found in the appendices of this report. Technical terms are defined in the Glossary.

This document is structured with physical, geographical, and biological data discussions presented in hydrologic units (HUCs). General water quality conditions are given in an upstream to downstream format. Lakes data, ambient chemistry data and aquatic toxicity data, with summaries, are presented in separate reports.

BASIN DESCRIPTION

The New River Basin is located within the Blue Ridge Province of the Appalachian Mountains in the northwest corner of the state in Watauga, Ashe and Alleghany counties (Figure 1). It is the state's 4th smallest river basin, and encompasses a 765 square-mile watershed drained by approximately 825 miles of streams. The New River originates at the confluence of the North Fork New River and South Fork New River in northeastern Ashe County, and then flows northeast into Virginia before eventually flowing into the Kanawha River (Figure 1). The New River meanders across the North Carolina-Virginia state line four times before the confluence of the Little River, the only other major tributary originating in North Carolina, which also flows north into Virginia. The New River is part of the oldest river system in North America. South Fork New River is classified as High Quality Waters (HQW) from Elk Creek near the Watauga-Ashe County line to Dog Creek and is classified as Outstanding Resource Waters (ORW) from Dog Creek to the New River. All North Carolina segments of the New River are classified as ORW. Other HQW waters in the New River basin are: upper segments of Flattop Branch; most of Winkler Creek; Flannery Fork; most of the Howard Creek drainage; a portion of Big Horse Creek and three of its tributaries; and the lowermost segment of Little River. The only other stream segments classified as ORW are Call Creek and the lowermost segment of Old Field Creek. Overall, more than half of the land in the New River basin is forested, with pastureland as the next largest land use. The steep slopes found in the basin limit much of the development and agriculture to the river valleys. Christmas tree farming is a rapidly expanding business in the basin.

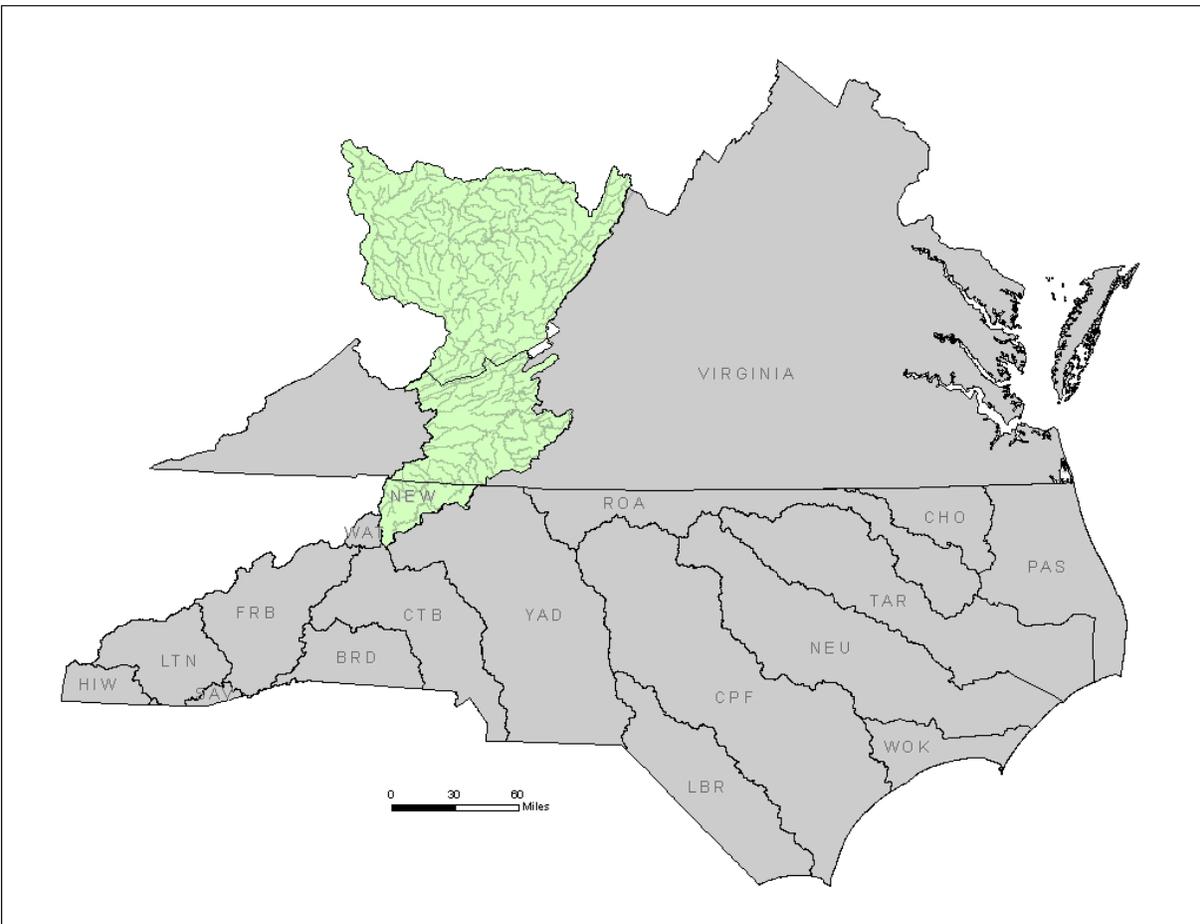


Figure 1. Geographical Relationships of the New River Basin.

NEW RIVER HUC 05050001 – UPPER NEW RIVER

Description

The North Carolina portion of HUC 05050001 includes the entire New River basin in the state. Most of the counties of Ashe and Alleghany are included, as is a central-to-northeast portion of Watauga. The towns of Sparta (population 1,817; all populations are from year 2000 U.S. Census Bureau data), Jefferson (1,422), West Jefferson (1,081), Boone (13,472), and most of Blowing Rock (1,418) are contained in the HUC. There are two active NPDES dischargers in the HUC with permitted flows of over one million gallons per day (MGD): the Town of Boone's Jimmy Smith WWTP (permit NC0020621) with permitted flow of 4.82 MGD and discharge to South Fork New River; and United Chemi-Con, Incorporated (permit NC0000019) with permitted flow of 1.018 MGD and discharge to North Fork New River.

Four Level IV ecoregions are represented by significant areas within the HUC (Figure 2): New River Plateau, Amphibolite Mountains, Southern Crystalline Ridges and Mountains, and Southern Metasedimentary Mountains.¹

- About one-half of the HUC is within the **New River Plateau** ecoregion, a hilly, high-elevation area used for "pasture, orchards, cropland, livestock and dairy farms, and Christmas tree production."¹ This area has the lowest relief of the four ecoregions in the HUC, with elevations from 2300 feet on the New River floodplain to 4175 feet at Peach Bottom Mountain west-southwest of Sparta.
- A western portion of the HUC is within the **Amphibolite Mountains**. This area is characterized by steep mountains of gneiss and amphibolite (composed mainly of hornblende, a form of amphibole) and by its high plant diversity (driven in part by disjunct populations of more northern species and by the presence of remnant species). Streams in this area tend toward less acidity relative to streams in surrounding areas due to higher concentrations of calcium and magnesium in the soils. Elevations are from 2700 feet on tributaries to North Fork New River to nearly 5600 feet along the Tennessee Valley Divide.
- Southern and northwestern portions of the HUC are within the **Southern Crystalline Ridges and Mountains** ecoregion, an area of high relief and little area dedicated to agriculture. Schist and gneiss are the dominant rock types. Soils are loamy and acidic. Elevations are from about 2700 feet on Little Horse Creek to over 4900 feet along Pond Mountain in the northwest part of the HUC.
- A small southwestern portion of the HUC of about nine square miles is in the **Southern Metasedimentary Mountains**, described as "steep, dissected, biologically-diverse mountains that are densely forested."¹ The schists and gneisses in this area have not undergone as much metamorphosis as in the adjacent Southern Crystalline Ridges and Mountains region. Elevations range from about 3100 feet on Middle Fork South Fork New River near Boone to over 4500 feet at Flat Top Mountain.

Data from the 2001 National Land Cover Database show roughly two-thirds of the area within the North Carolina portion of the HUC is forest, wetlands, and open water, about one-quarter pasture and grassland, six percent suburban, and the remainder crops and urban or barren (Figure 3).

¹ Griffith, G.E., Omernik, J.M., Comstock, J.A. Schafale, M.P., McNab, W.H., Lenat, D.R., MacPherson, T.F., Glover, J.B. and Shelburne, V.B. 2002. Ecoregions of North Carolina and South Carolina. (color poster with map, descriptive text, summary tables and photographs): Reston, VA, U.S. Geological Survey (map scale 1:1,500,000).

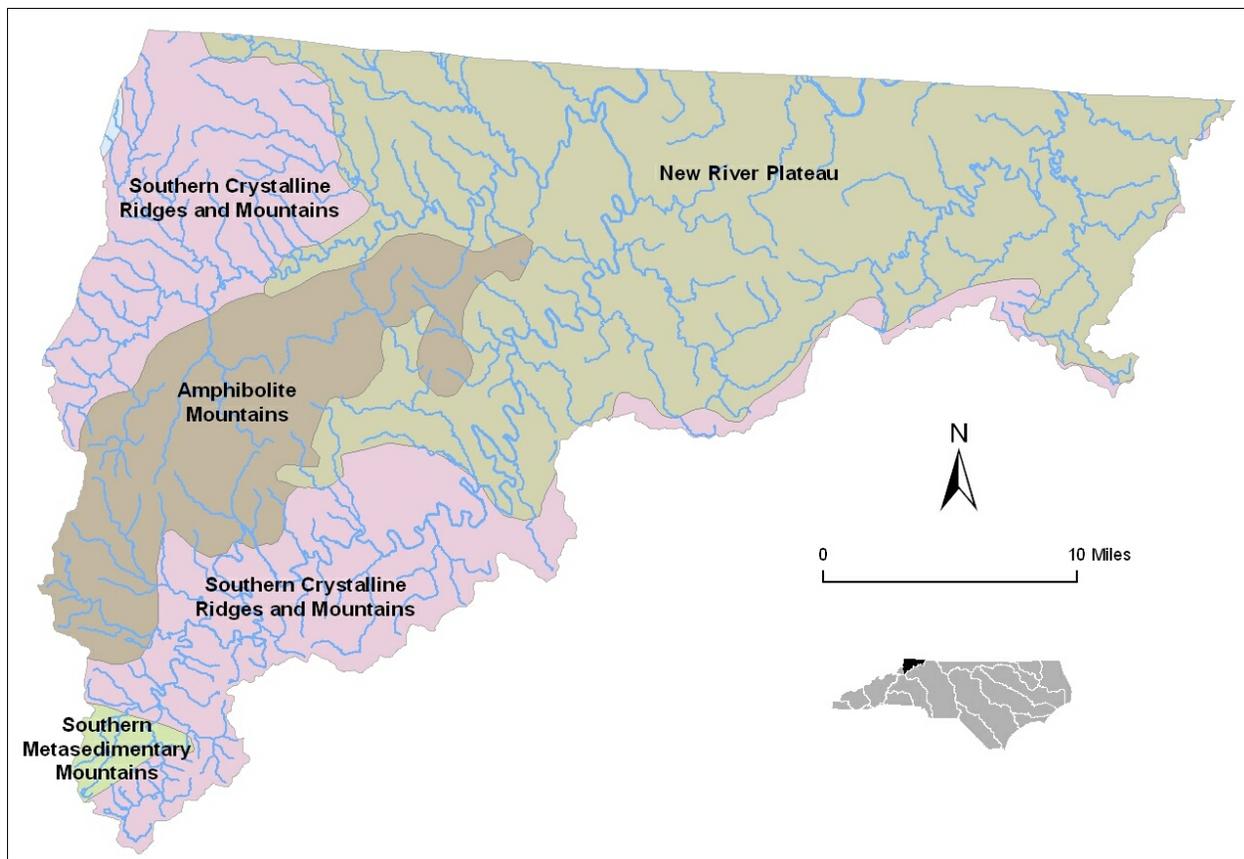


Figure 2. Level IV Ecoregions of the New River Basin.

Fish and benthic samples were collected from streams in the North Fork New River, South Fork New River, and Little River catchments, from two smaller tributaries to New River (Grassy Creek and Elk Creek), and from the mainstem New River (Figure 4). The headwater of North Fork New River is in Elk Knob State Park in Watauga County, just over one mile east of the Tennessee Valley Divide. From there the stream flows north for roughly five miles, then east-northeast to a point about two miles south of the North Carolina-Virginia border. The town of Jefferson is within the North Fork catchment. The headwater of South Fork New River is Middle Fork South Fork New River, originating in Blowing Rock. South Fork New River flows generally northeast until it meets North Fork New River to form New River; it receives runoff from the towns of Boone, Jefferson, and most of Blowing Rock. From the confluence of North and South Forks, New River flows about 4.5 stream-miles before entering Virginia, then meanders back and forth across the North Carolina-Virginia border for about 17 stream-miles before heading back into Virginia for one last time. Another nine miles downstream Little River joins New River. The town of Sparta is within the Little River catchment. New River continues flowing through Virginia and into West Virginia where it meets Gauley River to form Kanawha River, a tributary of Ohio River.

New River has received national recognition. In 1998 the river was one of 14 in the nation designated as an American Heritage River. The lower section of South Fork New River—from the mouth of Dog Creek east of Jefferson downstream to the confluence with North Fork New River—and the first 4.5 stream-miles of New River to the North Carolina-Virginia border are designated as a National Wild and Scenic River.

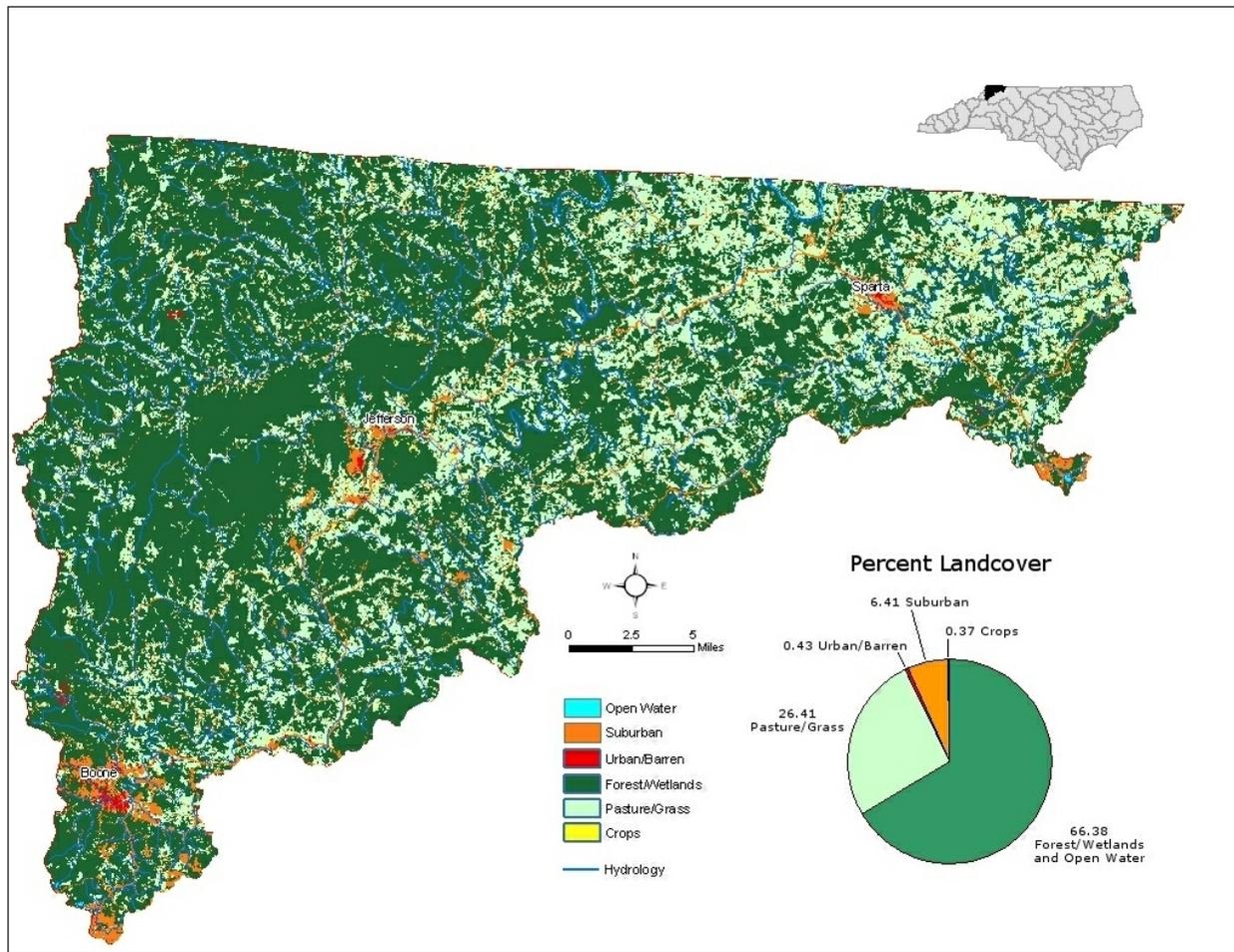


Figure 3. Land cover in HUC 05050001 in the New River basin (data from the 2001 National Land Cover Database).

The North Carolina Natural Heritage Program has completed Significant Natural Area inventories for the counties of Ashe and Watauga.^{2, 3} The inventories include:

- the **Potato Hill/Rich Mountain Bald/Harmon Knob** area, which includes the amphibolite peaks of 5194-foot Potato Hill and 5372-foot Rich Mountain Bald along the Tennessee Valley Divide. The area provides examples of several natural plant communities (High Elevation Rocky Summit, Montane Oak-Hickory Forest, Northern Hardwood Forest, High Elevation Seep, Acidic Cove Forest, and Rich Cove Forest) and is home to several rare species (including spreading avens and Roan Mountain bluet).
- the **Long Hope Valley/Elk Knob/The Peak** area, which is significant as containing “the best example in North Carolina of a rare hanging valley.”² Many natural plant communities are represented in the area, including: Southern Appalachian Bog, Swamp Forest-Bog Complex, High Elevation Rocky Summit, High Elevation Seep, Montane Mafic Cliff, Rich Cove Forest, Northern Hardwood Forest, Montane Oak-Hickory Forest, and High Elevation Red Oak Forest. Rock gnome lichen, an extremely rare lichen federally listed as Endangered, occurs in the area.

² Anonymous. 1999. *Executive Summary: An Inventory of the Significant Natural Areas of Ashe County, North Carolina*. North Carolina Natural Heritage Program.

³ Anonymous. 2000. *Executive Summary: An Inventory of the Significant Natural Areas of Watauga County, North Carolina*. North Carolina Natural Heritage Program.

- **Bluff Mountain**, which includes a couple of very significant plant communities: Southern Appalachian Fen, the only known well-developed example of the community; High Elevation Mafic Glade, the only known representative of the community in North Carolina. Other plant communities present in the area are: High Elevation Rocky Summit, Carolina Hemlock Bluff, Montane White Oak Forest, Northern Hardwood Forest, High Elevation Seep, and Rich Cove Forest. Roan Mountain bluet and rock gnome lichen both occur here.
- **Three Top Mountain**, which includes examples of Rich Cove Forest, Montane Oak-Hickory Forest, Northern Hardwood Forest, and High Elevation Red Oak Forest natural plant communities. Roan Mountain bluet occurs here.
- **North Fork New River, South Fork New River, and New River Aquatic Habitats**, which are recognized in part for the presence of rare fishes, amphibians, and mussels. The rivers are home to several endemic fish species, including: tonguetied minnow (*Exoglossum laurae*); sharpnose darter (*Percina oxyrhynchus*); Kanawha minnow (*Phenacobius teretulus*), which is listed as Vulnerable⁴ by the International Union for Conservation of Nature (IUCN); and Kanawha darter (*Etheostoma kanawhae*), listed as Near Threatened⁵ by the IUCN.

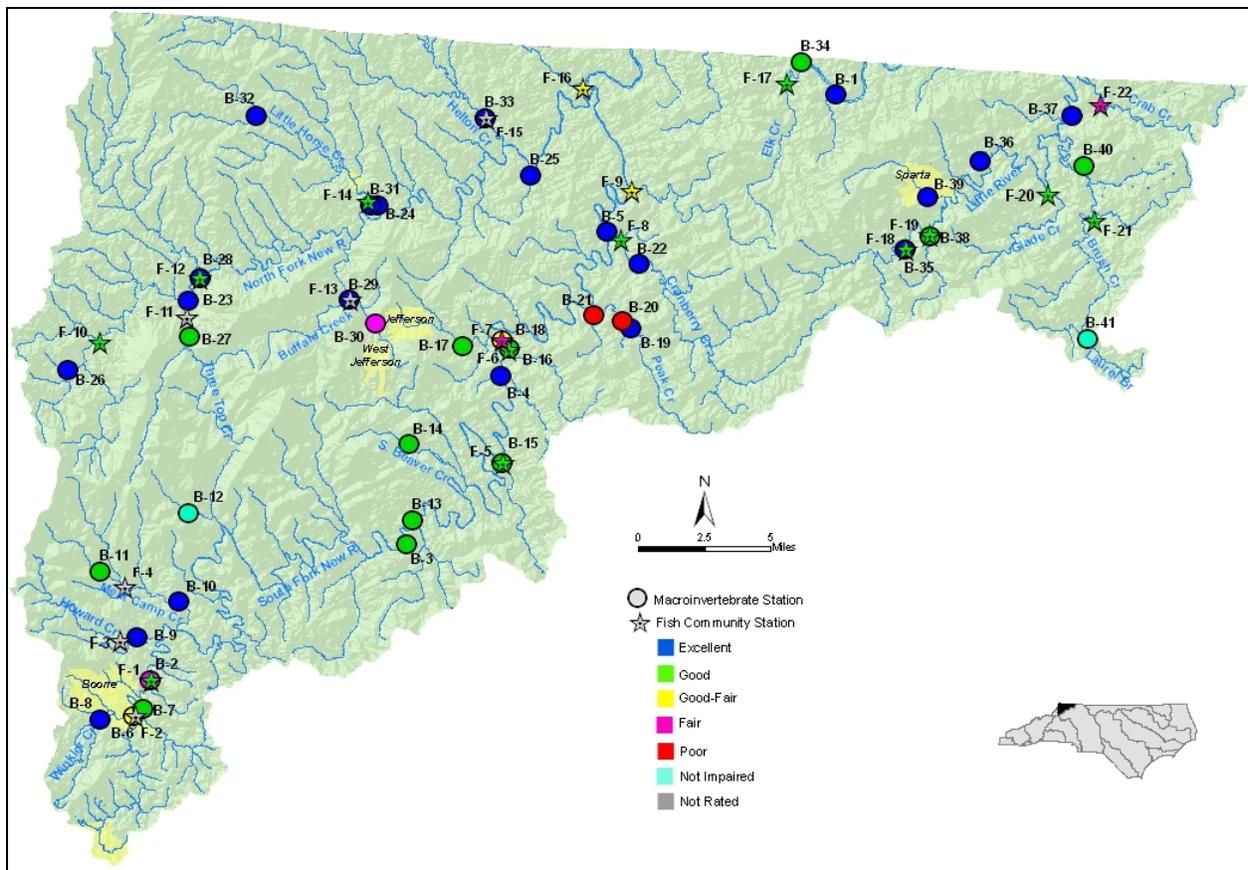


Figure 4. Sampling sites in HUC 05050001 in the New River basin. Monitoring sites are listed in Table 1.

⁴ Gimenez Dixon, M. 1996. *Phenacobius teretulus*. In: IUCN 2008. 2008 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 07 February 2009.

⁵ Gimenez Dixon, M. 1996. *Etheostoma kanawhae*. In: IUCN 2008. 2008 IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 07 February 2009.

Overview of Water Quality

The following stream segments within HUC 05050001 are on the final 303(d) impaired waters list for 2006:

Waterbody / Description	Assessment Unit	Class	Reason for Listing
• Little Peak Creek <i>from source to Peak Creek</i>	10-1-35-4	B;Tr:+	standard violation for pH; action level violation for copper; impaired biological integrity
• Ore Knob Branch <i>from source to Peak Creek</i>	10-1-35-3	B;Tr:+	standard violation for pH; action level violations for iron, copper, and zinc; impaired biological integrity
• Peak Creek <i>from Ore Knob Branch to South Fork New River</i>	10-1-35-(2)b	B;Tr:+	standard violation for pH; impaired biological integrity
• South Fork New River <i>from Obids Creek to point 0.6 miles upstream of Roan Creek</i>	10-1-(26)b	WS-IV; HQW	standard violation for pH
• Little Buffalo Creek <i>from source to Buffalo Creek</i>	10-2-20-1	C;Tr:+	impaired biological integrity; historical listing decision for nutrients

Sixty-three basinwide collections were made in late 2007 (one benthic sample) and 2008 in the HUC (Table 1). Twelve sites were sampled for fish only, 31 for macroinvertebrates only, and 10 sites were sampled for both macroinvertebrates and fish; two of the unshared fish sites were within a mile of benthic sites on the same stream, close enough that the site-pairs can be considered as shared. For fish sites, 12 were rated as Good, two as Good-Fair, two as Fair, and six were assigned a classification of Not Rated. For benthic sites, 21 were rated as Excellent, 12 as Good, two as Good-Fair, two as Fair, two as Poor, and two were assigned a classification of Not Impaired. Of the shared fish/benthic sites for which a fish classification was assigned, three received the same classification following both fish and benthic sampling (Good in all cases), four differed by a single classification (either fish Good and benthic Excellent or fish Fair and benthic Good-Fair), and one differed by two classification levels (South Fork New River at US 421 in Watauga County received a Good following fish sampling and Fair after benthic sampling).

Table 1. Waterbodies monitored in HUC 05050001 in the New River basin for basinwide assessment, 2003 and 2008.

Map #¹	Waterbody	County	Location	2003 (1998)²	2008
B-1	New R	Alleghany	SR 1345	Excellent	Excellent
B-2	S Fk New R	Watauga	US 421	Good-Fair	Fair
B-3	S Fk New R	Ashe	SR 1169	Excellent	Good
B-4	S Fk New R	Ashe	NC 16/18	Excellent	Excellent
B-5	S Fk New R	Ashe	US 221 below Cranberry Cr	Excellent	Excellent
B-6	M Fk S Fk New R	Watauga	SR 1522	Good-Fair	Good-Fair
B-7	E Fk S Fk New R	Watauga	SR 1522	Good	Good
B-8	Winkler Cr	Watauga	SR 1549	Excellent	Excellent
B-9	Howard Cr	Watauga	SR 1328	Good	Excellent
B-10	Meat Camp Cr	Watauga	SR 1333	Good	Excellent
B-11	Norris Fk	Watauga	SR 1337	Excellent	Good
B-12	Pine Orchard Cr	Watauga	SR 1369	Excellent	Not Impaired
B-13	Pine Swamp Cr	Ashe	off SR 1179 at mouth	Good	Good
B-14	S Beaver Cr	Ashe	SR 1147	Good	Good
B-15	Obids Cr	Ashe	SR 1192	Good	Good
B-16	Roan Cr	Ashe	SR 1588	Excellent	Good
B-17	Naked Cr	Ashe	NC 16/88	Good-Fair	Good

¹B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.

²Fish community samples were last collected in 1998.

Table 1. (continued)

Map # ¹	Waterbody	County	Location	2003 (1998) ²	2008
B-18	Naked Cr	Ashe	off SR 1589	---	Good-Fair
B-19	Peak Cr	Ashe	off SR 1599 upstream of Ore Knob Br	Good	Excellent
B-20	Peak Cr	Ashe	SR 1599 downstream of Ore Knob Br	Poor	Poor
B-21	L Peak Cr	Ashe	SR 1595	Poor	Poor
B-22	Cranberry Cr	Ashe	SR 1603	Excellent	Excellent
B-23	N Fk New R	Ashe	SR 1100	Excellent	Excellent
B-24	N Fk New R	Ashe	SR 1644	Excellent	Excellent
B-25	N Fk New R	Ashe	Old NC 16	---	Excellent
B-26	Hoskin Fk	Ashe	off NC 88 below Wilson Br	Excellent	Excellent
B-27	Three Top Cr	Ashe	off SR 1100 below Long Hope Cr	---	Good
B-28	Big Laurel Cr	Ashe	NC 88	Excellent	Excellent
B-29	Buffalo Cr	Ashe	NC 88/194 above L Buffalo Cr	---	Excellent
B-30	L Buffalo Cr	Ashe	off SR 1153	Poor	Fair
B-31	Big Horse Cr	Ashe	NC 194	Excellent	Excellent
B-32	L Horse Cr	Ashe	SR 1334	Good	Excellent
B-33	Helton Cr	Ashe	SR 1536	Excellent	Excellent
B-34	Elk Cr	Alleghany	SR 1344	Good	Good
B-35	Little R	Alleghany	SR 1128	Good	Excellent
B-36	Little R	Alleghany	SR 1424	Excellent	Excellent
B-37	Little R	Alleghany	NC 18	Excellent	Excellent
B-38	Pine Swamp Cr	Alleghany	SR 1128	Good-Fair	Good
B-39	Bledsoe Cr	Alleghany	SR 1172	Good	Excellent
B-40	Brush Cr	Alleghany	SR 1422	Excellent	Good (2007)
B-41	Laurel Br	Alleghany	SR 1105	Good	Not Impaired
F-1	S Fk New R	Watauga	US 421	Good	Good
F-2	M Fk S Fk New R	Watauga	SR 1522	Excellent	Not Rated
F-3	Howard Cr	Watauga	SR 1306	Not Rated	Not Rated
F-4	Meat Camp Cr	Watauga	SR 1335	Not Rated	Not Rated
F-5	Obids Cr	Ashe	SR 1192	---	Good
F-6	Roan Cr	Ashe	SR 1588	---	Good
F-7	Naked Cr	Ashe	off SR 1589	Fair (NC 16/88)	Fair
F-8	Cranberry Cr	Ashe	SR 1600	Excellent	Good
F-9	Prathers Cr	Alleghany	off SR 1302	---	Good-Fair
F-10	N Fk New R	Ashe	SR 1119	Good	Good
F-11	Three Top Cr	Ashe	SR 1123	---	Not Rated
F-12	Big Laurel Cr	Ashe	NC 88	---	Good
F-13	Buffalo Cr	Ashe	NC 88/194	---	Not Rated
F-14	Big Horse Cr	Ashe	SR 1350	Good	Good
F-15	Helton Cr	Ashe	SR 1536	Good	Not Rated
F-16	Grassy Cr	Ashe	SR 1549	---	Good-Fair
F-17	Elk Cr	Alleghany	SR 1341	Good	Good
F-18	Little R	Alleghany	SR 1128	Good-Fair	Good
F-19	Pine Swamp Cr	Alleghany	SR 1128	---	Good
F-20	Glade Cr	Alleghany	SR 1422	Good	Good
F-21	Brush Cr	Alleghany	SR 1433	---	Good
F-22	Crab Cr	Alleghany	NC 18	---	Fair

¹B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.

²Fish community samples were last collected in 1998.

A total of six samples were collected from four sites within the town limits of Boone. The only site of the four attaining a classification of Excellent, the benthic site on Winkler Creek at SR 1549/Watauga County, is on the edge of town and receives very little urban influence. Two sites are near the confluence of Middle Fork South Fork New River and East Fork South Fork New River; both sites are adjacent to the same golf course. Middle Fork South Fork New River at SR 1522/Watauga County is a shared fish/benthic site; the site was assigned a classification of Not Rated following fish sampling and received a Good-Fair after benthic sampling. East Fork South Fork New River at SR 1522/Watauga County received a classification of Good following benthic sampling; the benthic community has recovered fairly

well from an unknown event that severely reduced the community sometime in late 2003. The shared fish/benthic site on South Fork New River at US 421 is downstream of the Town of Boone Jimmy Smith WWTP (permit NC0020621; permitted discharge of 4.82 million gallons per day); the site received a Good following fish sampling and Fair after benthic work.

Six sites are located north of Boone and within eight miles of the town. Rated sites received either an Excellent (benthic sites on Howard Creek at SR 1328/Watauga County and Meat Camp Creek at SR 1333/Watauga County) or Good (the benthic site on Norris Fork at SR 1337/Watauga County). Other sites were either assigned Not Impaired (benthic site on Pine Orchard Creek at SR 1369/Watauga County) or Not Rated (fish sites on Howard Creek at SR 1306/Watauga County and Meat Camp Creek at SR 1335/Watauga County).

Five sampling events at the four sites south to south-southeast of Jefferson in the South Fork New River catchment all resulted in classifications of Good: benthic sites at South Fork New River at SR 1169/Ashe County, Pine Swamp Creek off SR 1179/Ashe County, South Beaver Creek at SR 1147/Ashe County; and the shared fish/benthic site on Obids Creek at SR 1192/Ashe County.

There is a cluster of four sites southeast to east of Jefferson and within five miles of the town. A classification of Excellent resulted from benthic sampling on South Fork New River at NC 16/18, the same classification received during each prior sampling event at the site. The shared fish/benthic site on Roan Creek at SR 1588/Ashe County attained a Good following both sampling events. This was the first time the Roan Creek site had been sampled for fish; EPT richness at the site showed a marked drop in 2008 from the prior sampling events in 1993, 1998, and 2003. Naked Creek flows through the center of Jefferson; both sites on the stream are downstream of the town. The upper site on Naked Creek at NC 16/18 received a classification of Good following benthic sampling. The lower site on Naked Creek off SR 1589/Ashe County received a classification of Fair following fish sampling and Good-Fair after benthic sampling. Two minor dischargers (Town of Jefferson WTP, permit NC0083470; Town of Jefferson WWTP, permit NC0021709) are located between the upstream and downstream sites on Naked Creek and may be affecting water quality at the lower site.

The abandoned mine site at Ore Knob Hill is continuing to greatly impact the fauna in Peak Creek below Ore Knob Branch and in Little Peak Creek. Benthic summer sampling events on Little Peak Creek at SR 1595/Ashe County have produced either six or seven EPT taxa, resulting in a classification of Poor each time. The latest benthic sampling event on Peak Creek at SR 1599/Ashe County downstream of Ore Knob Branch produced the lowest number of EPT taxa for any sampling event; three EPT taxa were collected. It appears that rain events may dilute the effects of mine drainage at the this lower Peak Creek site, as sampling in 1998 following a rain event resulted in 23 EPT taxa collected; other historic sampling events at the site using EPT collection methods produced either four or six EPT taxa. In sharp contrast to the lower site, the upper benthic basinwide site on Peak Creek off SR 1599/Ashe County produced the greatest number of EPT taxa for any sampling event at the site using EPT collection methods; forty-four EPT taxa were collected resulting in a classification of Excellent.

Four basinwide sites are present in the lowermost portion of the South Fork New River catchment. Cranberry Creek at SR 1603/Ashe County received a classification of Excellent after benthic sampling in summer 2008 (as it has following the prior two sampling events in 1998 and 2003). Further downstream on Cranberry Creek, the fish basinwide site at SR 1600/Ashe County received a classification of Good; the site received an Excellent following the only other fish sampling event at the site in 1998. The benthic site on South Fork New River at US 221 below Cranberry Creek was classified as Excellent, the same classification the site has received each time before (in 1993, 1998, and 2003). Prathers Creek off SR 1302/Alleghany County was sampled for the first time for fish, and received a rating of Good-Fair.

Sampling events in the upper portion of the North Fork New River catchment, if rated, resulted in classifications of either Excellent or Good; the new fish site on Three Top Creek at SR 1123/Ashe County was assigned a Not Rated. The sites receiving classifications of Excellent include: the benthic site on Hoskin Fork off NC 88 (as it did in 2003); and the benthic site on North Fork New River at SR 1100/Ashe County (as it has following each prior sampling event back to 1993). The sites rated as Good include: the

fish site on North Fork New River at SR 1119/Ashe County (as it did following the only other sampling event in 1998); and the new benthic basinwide site on Three Top Creek off SR 1100/Ashe County. The shared fish/benthic site on Big Laurel Creek at NC 88 received a classification of Excellent following benthic sampling (as it has following each sampling event back to 1993) and Good following fish sampling at the site for the first time.

The benthic basinwide site on Buffalo Creek was moved upstream to above the mouth of Little Buffalo Creek to provide monitoring of conditions in the stream without the influence of West Jefferson WWTP. The new site at the crossing of NC 88/194 just above Little Buffalo Creek received a classification of Excellent following benthic sampling; fish were sampled for the first time from the site and was assigned a classification of Not Rated. The benthic site on Little Buffalo Creek below the West Jefferson WWTP (permit NC0020451) has alternated between Poor and Fair for basinwide sampling since 1993; in 2008 it received a classification of Fair.

All benthic basinwide sampling events for sites in the lowermost portion of North Fork New River catchment resulted in classifications of Excellent (Little Horse Creek at SR 1334/Ashe County, Big Horse Creek at NC 194, Helton Creek at SR 1536/Ashe County, North Fork New River at SR 1644/Ashe County, and North Fork New River at Old NC 16). The fish site on Big Horse Creek at SR 1350/Ashe County is very close to the benthic site on that stream; the fish sampling event resulted in a classification of Good, the same rating following fish sampling in 1998. Fish sampling on Helton Creek at SR 1536/Ashe County (a shared fish/benthic site) was assigned a classification of Not Rated.

Four sites were sampled in the New River basin between the confluence of North Fork New River and South Fork New River (to form the New River) and the mouth of Little River. Grassy Creek at SR 1549/Ashe County received a classification of Good-Fair following fish sampling. Both the fish community sampling event on Elk Creek (at SR 1341/Alleghany County) and the benthic event (at SR 1344/Alleghany County) resulted in classifications of Good. The only basinwide site on New River proper is the benthic site at SR 1345/Alleghany County; the site received a classification of Excellent in 2008, as it did following the prior sampling event in 2003.

All of the seven sampling events in the upper portion of the Little River catchment above the confluence of Brush Creek resulted in classifications of either Excellent (benthic events at the shared fish/benthic site on Little River at SR 1128/Alleghany County and downstream at SR 1424/Alleghany County, and the benthic event on Bledsoe Creek at SR 1172/Alleghany County in the town of Sparta) or Good (fish event at the shared site on Little River at SR 1128/Alleghany County, both fish and benthic events on Pine Swamp Creek at SR 1128/Alleghany County, and the fish event on Glade Creek at SR 1422/Alleghany County). There was either no change or a better classification following sampling at these sites in 2008 compared to the results of 2003 (benthic) or 1998 (fish) basinwide sampling.

The remaining sites in the HUC are in the lower portion of the Little River catchment, either in the Brush Creek drainage or below it. The benthic site on Laurel Branch at SR 1105/Alleghany County has received classifications of Good following sampling events in 1998, 2003, and 2006 though by current criteria sites with small drainage areas (such as for the site on Laurel Branch) are assigned either a Not Rated or Not Impaired; following benthic sampling in 2008 the site received a rating of Not Impaired. Both sites on Brush Creek (fish site at SR 1433/Alleghany County and benthic site at SR 1422/Alleghany County) received classifications of Good. Little River at NC 18 received a classification of Excellent following benthic sampling, the same for each of the eight prior sampling events at the site except summer 1986 when it received a classification of Good. Crab Creek at NC 18 was sampled for the first time for fish; the site received a classification of Fair.

Prior to 2008, the latest basinwide data for fish communities in the HUC are from 1998. Seven sites were collected for fish in both years. Of those sites, five had the same classification between the two years, one site increased a level in classification (Little River at SR 1128/Alleghany County increased from Good-Fair to Good), and one decreased by one level (Cranberry Creek at SR 1600/Ashe County dropped from Excellent to Good).

Thirty-four benthic sites had comparable data from summer 2003 and summer 2008. Of those, four sites dropped a classification level; all were in South Fork New River catchment. Three of the four sites dropped from Excellent to Good, though South Fork New River at US 421 dropped from Good-Fair to Fair. Nine sites improved by a single classification level; such improving sites were scattered across the HUC. Six of the nine sites improved from Good to Excellent, two from Good-Fair to Good, and one (Little Buffalo Creek off SR 1153/Ashe County) from Poor to Fair. The site on Brush Creek at SR 1422/Alleghany County was sampled in summer 2003 and fall 2007; seasonal differences in the benthic community are very likely contributing to the drop in classification from Excellent to Good at that site.

Three basinwide sampling events in 2008 returned classifications of Fair on stream segments not on the final 303(d) impaired waters list for 2006: 1) the benthic event on South Fork New River at US 421, AU designation 10-1-(3.5)b (though the fish community event resulted in a classification of Good in 2008 for the site); 2) the fish event on Naked Creek off SR 1589/Ashe County, AU designation 10-1-32b (though the benthic event resulted in a classification of Good-Fair in 2008); 3) the fish event on Crab Creek at NC 18, AU designation 10-9-12 (there are no benthic data for the stream from 2008).

River and Stream Assessment

One benthic basinwide site, first sampled in 2003, was not sampled in 2008: Meat Camp Creek at SR 1340/Watauga County. Four benthic basinwide sites were moved in 2008: Naked Creek at Old SR 1585/Ashe County was moved downstream about one stream-mile to off of SR 1589/Ashe County; North Fork New River at NC 16 was moved downstream about two stream-miles to Old NC16; Three Top Creek at SR 1100/Ashe County was moved 1.3 stream-miles upstream to off SR 1100/Ashe County; Buffalo Creek at NC 88/194 was moved upstream 0.4 stream-miles to another site off of the same highway. One fish site was moved: Naked Creek at NC 16/88 was moved about 2.2 miles downstream to off of SR 1589/Ashe County.

Specific summaries of the 41 benthic macroinvertebrate and 22 fish community basinwide sampling events may be found in **Appendix S-1**.

SPECIAL STUDIES

2003 sodium hydroxide spill into Middle Fork South Fork New River

Following a spill of approximately 3000 gallons of sodium hydroxide from the Blowing Rock Water Treatment Plant (permit NC0027286) into the Middle Fork South Fork New River on 14 October 2003, benthic samples were collected from five sites to help assess impacts (BAU memorandum B-20031113). The benthic community showed no effects from the spill when sampling was performed 21 days after the spill. However, a site in an adjacent drainage (included in the study as a reference site) did indicate a "toxic event" apparently unrelated to the Blowing Rock WTP spill; the basinwide site on East Fork South Fork New River at SR 1522 declined from Good in August 2003 to Poor in November, with a drop from 31 EPT taxa collected in August to three in November. It is still unknown as to the source of impact to the East Fork South Fork New River site.

2003 study for the Wetlands Restoration Program, Little River watershed

Data from seven basinwide sites (sampled in August 2003) and two additional sites (one sampled in August and November 2003, the other only in November) were presented to the Wetlands Restoration Program to assist with local watershed planning in the Little River watershed (BAU memorandum B-20040203). Except for a site on Pine Swamp Creek, which received a classification of Good-Fair, all sites were classified as either Good or Excellent. However, most sites suffered from reduced riparian zones on one or both banks, which could lead to bank instability and increased erosion.

2006 study for the Ecosystem Enhancement Program, Little River watershed

Eleven sites were sampled for benthic invertebrates in April 2006 to support local watershed planning conducted by the Ecosystem Enhancement Program (formerly the Wetlands Restoration Program) in the Little River watershed (BAU memorandum B-20060815). Except for two sites on Bledsoe Creek within the city limits of Sparta that received classifications of Good-Fair (likely due to urban runoff and possibly also to the presence of toxins), results from the large-stream sites in the study showed high water-quality as reflected by classifications of either Good or Excellent. Two small-stream sites (for which there are currently no assessment criteria) were assigned values of Not Impaired, though both had “diverse and intolerant benthic communities.”

2007 Rockwater Farms study, UT South Fork New River

Three sites in the South Fork New River watershed were sampled for benthic invertebrates to assess a possible water-quality impact from Rockwater Farms to an unnamed tributary to South Fork New River (BAU memorandum B-20070309); two sites were located on the unnamed tributary to South Fork New River upstream and downstream of the potential source of impact, the third site was on an unnamed tributary to Mill Creek to serve as a control. All three sites had drainage areas of less than 0.1 square miles. The benthic community showed no evidence of impact downstream of Rockwater Farms.

2007 Shatley Farm study, UT Little Phoenix Creek

Following land clearing of 85 acres in the headwater area of an unnamed tributary to Little Phoenix Creek, benthic invertebrates were collected to help assess impacts on the stream from the activity (BAU memorandum B-20070904). Sampling was done in August 2007 at a site downstream of the farm and at a second site (to serve as a control) on another unnamed tributary to Little Phoenix Creek. The difference in the number of EPT taxa collected was marked; six taxa were collected from the site downstream of the farm and 21 from the control.

2007 study for the Ecosystem Enhancement Program, Little River watershed

Benthic invertebrates were sampled in October 2007 from five sites in the Little River watershed to assess pre-restoration conditions to an unnamed tributary to Crab Creek (BAU memorandum B-20080129). There were no prior data for the three sites with the smallest drainages, which are located upstream and downstream of the restoration area and on a tributary entering roughly midway along the restoration reach. A site on Crab Creek below the unnamed tributary had been sampled previously in November 2003; there was a notable decline in EPT richness between the two sampling events, from 33 taxa in 2003 to 20 in 2007. The fifth site was collected on Brush Creek away from the influence of the restoration project to help assess the effects of seasonality on the study sites; results were similar to those following prior sampling events in summer 1993, 1998, and 2003.

2008 HQW/ORW assessment, North Fork New River watershed

Six sites were sampled for benthic invertebrates to help support potential reclassification to either HQW or ORW status; several basinwide sites and two other sites covered another study that were sampled in the watershed during summer 2008 will also be considered (report pending). All six sites sampled specifically for potential reclassification received classifications of Excellent following summer 2008 sampling.

2008 miscellaneous assessments

Benthic sampling was performed at four sites in the HUC at the request of either the Division of Water Quality Planning Section, Winston-Salem Regional Office, or Soil and Water Conservation in June 2008 (BAU memorandum B-20081007); none of the sites had been sampled previously. Two sites received classifications of Excellent (on Big Horse Creek and Little Phoenix Creek in the North Fork New River watershed). A small-stream site on Long Shoals Creek and also in the North Fork New River watershed

was assigned a classification of Not Impaired. A site on the Grassy Creek that is a tributary of New River received a classification of Good.

2008 Level IV Ecoregion Reference study, Glade Creek

A site on Glade Creek in the Little River watershed was sampled as part of a study to find reference conditions for streams in the different Level IV ecoregions⁶ in the state (report pending). The site had been sampled once before in summer 2003 at which time it received a classification of Good. The site received a classification of Excellent following summer 2008 sampling. The improved classification in 2008 was driven by a large increase in the number of EPT taxa collected, from 42 in 2003 to 56 in 2008.

2008 Shatley Farm follow-up study, UT Little Phoenix Creek

The site below Shatley Farm on UT Little Phoenix Creek was sampled again in summer 2008 to document differences in the benthic community following an effort to improve conditions upstream after the clearing of adjacent land that occurred prior to summer 2007 (BAU memorandum B-20080827). The change in the benthic community between summer 2007 and summer 2008 was striking in terms of both number of specimens and number of taxa collected; EPT richness increased from six to 17 taxa.

2008 Helton Creek study

Three sites on Helton Creek, a tributary to North Fork New River, were sampled to assess the effects of new channel cutting in the stream that is a source of increased sedimentation (BAU memorandum B-20081202). Both the upstream-most site and the site directly below the source of impact received classifications of Excellent following sampling in October 2008. The downstream-most site is a basinwide site; it received a classification of Good in October though it received an Excellent during summer basinwide sampling; seasonal effects are implicated in the difference in bioclassification at that site. Benthic sampling did not indicate degradation below the sediment source in this study.

⁶ Griffith, G.E., Omernik, J.M., Comstock, J.A. Schafale, M.P., McNab, W.H., Lenat, D.R., MacPherson, T.F., Glover, J.B. and Shelburne, V.B. 2002. Ecoregions of North Carolina and South Carolina. (color poster with map, descriptive text, summary tables and photographs): Reston, VA, U.S. Geological Survey (map scale 1:1,500,000).

GLOSSARY

BI or NCBI	The North Carolina Biotic Index. This is one of two metrics used extensively to evaluate the results of benthic sampling, and is the weighted sum of tolerance values for taxa found in the sample relative to their abundance.
Bioclassification	A classification assigned to a stream site following biological sampling of either fish or macroinvertebrates. Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each sample. For invertebrates the bioclassification is based on the number of taxa present in the intolerant groups (EPT) and the North Carolina Biotic Index (BI or NCBI) value. For fish the classification is based on abundance, condition of specimens, species richness, composition, pollution-tolerance, trophic composition, and reproductive function.
Ecoregion	An area of relatively homogeneous environmental conditions, usually defined by elevation, geology, vegetation, and soil type. Examples include Mountains, Piedmont, Coastal Plain, Sand Hills, and Carolina Slate Belt.
EPT	The insect orders Ephemeroptera, Plecoptera, and Trichoptera. As a whole, these are the most intolerant insects present in the benthic community. EPT also refers to taxa richness within the three insect orders, a metric used extensively to derive bioclassifications. Higher EPT taxa richness values are associated with better water quality.
EPT BI	North Carolina Biotic Index for the EPT portion of the benthic community. This is the weighted sum of the tolerance values of taxa in the insect orders Ephemeroptera, Plecoptera, and Trichoptera found in the sample, relative to their abundance.
HQW	High Quality Waters. Such waters are rated Excellent based on biological and physical/chemical characteristics through Division monitoring or special studies and have been approved for such designation by the state Environmental Management Commission; also, primary nursery areas designated by the Marine Fisheries Commission, and all Class SA waters.
MGD	Million gallons per day. This is generally the unit in which effluent discharge flow is measured.
NPDES	National Pollutant Discharge Elimination System.
NCIBI	North Carolina Index of Biotic Integrity (NCIBI); a summary measure of the effects of factors influencing the fish community.
ORW	Outstanding Resource Waters. These are unique and special waters of exceptional state or national recreational or ecological significance that require special protection to maintain existing uses and have been approved for such designation by the Environmental Management Commission.
Specific Conductance	The measure of the resistance of a solution to electrical flow. Resistance is reduced with increasing content of ionized salts. Reported in the units of $\mu\text{mhos/cm}$ at 25 °C.
ST	The total number of different taxa present in a Full Scale benthic macroinvertebrate sample.

GLOSSARY (continued)

UT	Unnamed tributary.
WTP	Water treatment plant.
WWTP	Wastewater treatment plant

Appendix B-1. Summary of benthic macroinvertebrate data, sampling methods and criteria.

New River Basin Summary

For 2008, 30 long-term benthic macroinvertebrate sites were sampled in the New River Basin as part of the Basinwide Assessment program; in this report, long-term sites are identified as basinwide samples assigned a classification in 2008 and with data from at least two prior basinwide sampling events. Graphical representations of bioclassification trends from 1993 to 2008 among these long-term basinwide benthos sites for the entire basin (Figure 1) can be found below. As can be seen from these data, the 2008 benthic macroinvertebrate community bioclassifications have generally improved from 1993, 1998, and 2003 levels. Indeed, the 2008 sampling period produced more Excellent bioclassifications (19 sites) than previously recorded for basinwide sampling in the New River Basin (previous high was 16 in 1993 and 2003). In general, the primary sources of pollution in this basin are non-point. The improvements seen in the benthic macroinvertebrate communities among most New River basinsites for 2008 support this conclusion. During drought conditions, less runoff from nonpoint sources is introduced from land into waterbodies and this typically results in the development of a more diverse and less pollution tolerant benthic macroinvertebrate community. This appears to have been the case among benthic macroinvertebrate basinsites in the New River basin in 2008. The only exceptions to this trend were found at South Fork New River (SR 1169, Ashe County) which declined from Excellent in 1998 and 2003 to Good in 2008, Roan Creek (SR 1588, Ashe County) which declined from Excellent in 1993, 1998, and 2003 to Good in 2008, and Brush Creek (SR 1422, Alleghany County) which declined from Excellent in 2003 to Good in 2008.

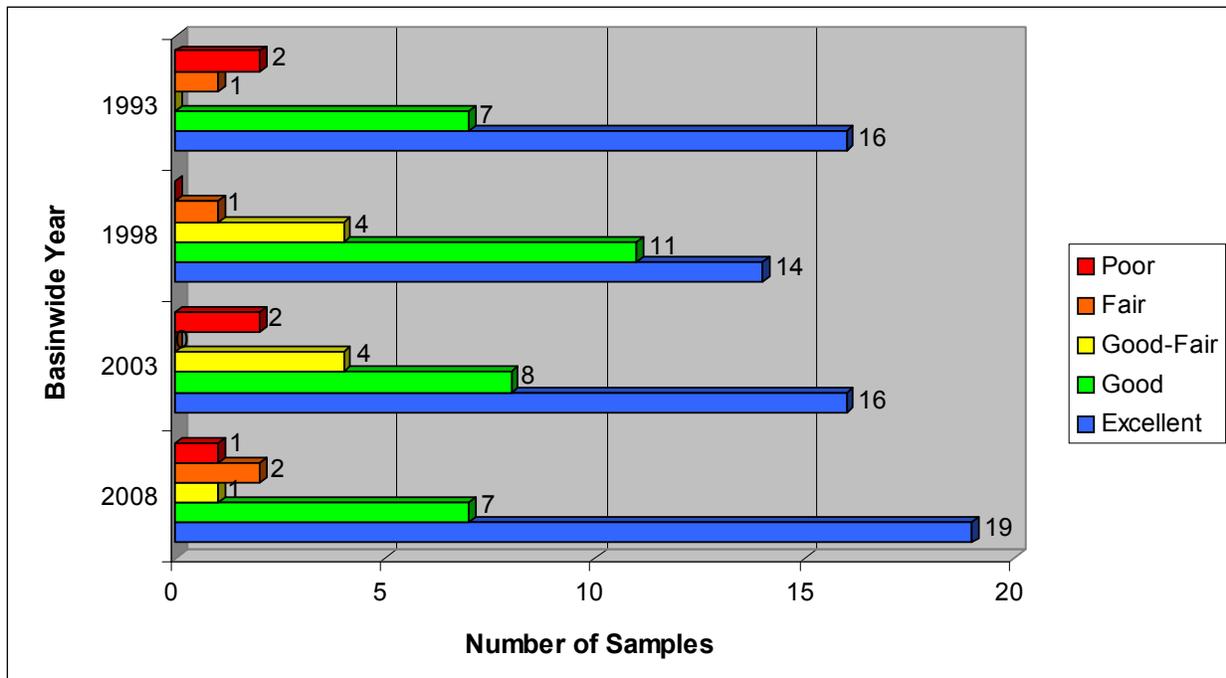


Figure B-1.1. New River Basin (HUC 05050001) Bioclassification Trends: 1993 to 2008.

Numerous rare invertebrate taxa were collected in the New River basin in 2008-2003. These data are presented below in Table 1.

Table 1. Selected Rare Taxa Collected in the New River Basin between 2003 and 2008 (Rare Taxa Defined as <32 Observations: Equivalent to 0.5% of Approximately 6,300 NCDWQ Benthic Collections).

Taxon	North Carolina Natural Heritage (2008) Designated as <i>Significantly Rare</i> ?	Date	Collection Location(s)
Mayflies			
<i>Acerpenna macdunnoughi</i>	NO	8/18/2008	South Fork New River (SR 1169)
<i>Acerpenna macdunnoughi</i>	NO	8/22/2008	South Fork New River (US 221)
<i>Dannella provonshai</i>	NO	6/18/2008	Middle Fork Little Horse Creek (SR 1334)
<i>Neophemera youngi</i>	NO	8/19/2003	Big Laurel Creek (NC 88)
<i>Serratella spiculosa</i>	YES	8/18/2003	Cranberry Creek (SR 1603)
Stoneflies			
<i>Acroneuria evoluta</i>	NO	8/19/2008	New River (SR 1345)
<i>Agnentina annulipes</i>	NO	8/18/2008	South Fork New River (SR 1169)
<i>Agnentina annulipes</i>	NO	8/22/2008	South Fork New River (US 221)
<i>Isoperla lata</i>	YES	4/3/2006	Brush Creek (SR 1444)
<i>Isoperla lata</i>	YES	4/4/2006	Pine Swamp Creek (SR 1128, SR 1126), Wolf Branch (SR 1117)
<i>Isoperla lata</i>	YES	4/5/2006	Little River (SR 1128)
<i>Isoperla lata</i>	YES	4/6/2006	Waterfalls Creek (SR 1132), Bledsoe Creek (US 21)
<i>Isoperla lata</i>	YES	10/2/2007	Brush Creek (SR 1422)
<i>Isoperla lata</i>	YES	10/2/2007	UT Crab Creek (NC 18)
<i>Isoperla lata</i>	YES	10/13/2008	Helton Creek (SR 1526, Off SR 1370)
Caddisflies			
<i>Brachycentrus incanus</i>	NO	6/10/2008	Big Horse Creek (NC 194)
<i>Brachycentrus incanus</i>	NO	6/19/2008	Big Laurel Creek (NC 88)
<i>Ceraclea enodis</i>	NO	6/10/2008	Big Horse Creek (NC 194)
<i>Ceraclea menitea</i>	YES	8/21/2003	New River (SR 1345)
<i>Ceraclea menitea</i>	YES	8/22/2003	South Fork New River (NC 16-18)
<i>Ceraclea menitea</i>	YES	6/18/2008	North Fork New River (SR 1549)
<i>Ceraclea slossonae</i>	YES	6/10/2008	Big Horse Creek (NC 194)
<i>Ceraclea slossonae</i>	YES	8/18/2008	South Fork New River (SR 1169)
<i>Ceraclea slossonae</i>	YES	8/19/2008	New River (SR 1345)
<i>Ceraclea slossonae</i>	YES	8/20/2008	North Fork New River (Old NC 16, SR 1644)
<i>Ceraclea slossonae</i>	YES	8/22/2008	South Fork New River (US 221)
<i>Ceratopsyche walkeri</i>	YES	8/18/2008	Little River (SR 1424)
<i>Goera fuscula</i>	NO	8/19/2008	Howard Creek (SR 1328)
<i>Goera fuscula</i>	NO	8/20/2008	Meat Camp Creek (SR 1333)
<i>Goera fuscula</i>	NO	8/21/2008	Cranberry Creek (SR 1603), Little Horse Creek (SR 1334)
<i>Helicopsyche paralimnella</i>	NO	8/20/2008	North Fork New River (SR 1644)
Crustaceans			
<i>Cambarus chasmodactylus</i>	NO	8/19/2003	North Fork New River (SR 1100)
<i>Cambarus robustus</i>	NO	8/19/2003	North Fork New River (SR 1100)
<i>Cambarus robustus</i>	NO	8/20/2003	Little Buffalo Creek (Off SR 1153)
<i>Cambarus robustus</i>	NO	8/21/2003	Little River (SR 1424)
<i>Cambarus robustus</i>	NO	10/2/2007	Brush Creek (SR 1422), UT Crab Creek (NC 18)
<i>Orconectes cristavarius</i>	NO	8/21/2003	North Fork New River (SR 1644)
<i>Orconectes cristavarius</i>	NO	8/22/2003	South Fork New River (NC 16-18)
Hemiptera			
<i>Hydrometra sp</i>	NO	8/18/2008	South Fork New River (SR 1169)
Gastropods			
<i>Fossaria sp</i>	NO	8/19/2008	Little River (SR 1128)

Sampling Methods

Standard Qualitative (Full Scale) Method

Benthic macroinvertebrates can be collected from wadeable, freshwater, flowing streams and rivers using several sampling procedures, two of which are used for basinwide sampling in the mountainous region of western North Carolina. The Biological Assessment Unit's standard qualitative (Full Scale) sampling procedure comprises 10 components: two kick-net collections, three sweeps, two rock or log washes, one sand collection, one leaf-pack collection, and visual collections from large rocks and logs (NCDENR 2006). Invertebrates are removed from the matrix ("picked") on-site. The purpose of these collections is to inventory the aquatic fauna and produce an indication of relative abundance for each taxon. Organisms are classified as Rare (1 - 2 specimens), Common (3 - 9 specimens), or Abundant (≥ 10 specimens).

EPT Method

Benthic macroinvertebrates can also be collected using the EPT sampling procedure. Four, rather than 10, composite qualitative samples are taken at each site: one kick, one sweep, one leaf-pack, and visual collections (NCDENR 2006). Only EPT taxa are collected and identified and only EPT taxa richness is used to assign a bioclassification.

Habitat Evaluation

An assessment form has been developed by the Biological Assessment Unit to evaluate the physical habitat of a stream. The habitat score, which ranges between 1 and 100, is based on the evaluation of channel modification, amount of instream habitat, type of bottom substrate, pool variety, bank stability, light penetration, and riparian zone width. Higher numbers suggest better habitat quality, but no criteria have been developed to assign impairment ratings.

Data Analysis

Bioclassification criteria for standard qualitative samples in the mountain ecoregion are given below and in Table 2 and are based on EPT Richness and North Carolina Biotic Index (NCBI, sometimes just identified as BI) values. Tolerance values for individual taxa and community biotic index values have a range of zero through 10, with higher numbers indicating more tolerant taxa and more polluted conditions respectively. Water quality scores (5 = Excellent, 4 = Good, 3 = Good-Fair, 2 = Fair and 1 = Poor)—which are determined based upon NCBI values—are averaged with EPT taxa richness scores to produce a final bioclassification. Bioclassifications for the EPT sample method are based on the total number of EPT taxa present in the sample. Bioclassification thresholds for the EPT method are presented in Table 3. EPT abundance and overall taxa richness can also be used to help examine between-site differences in water quality.

EPT Richness and BI values are affected by seasonal changes. DWQ criteria for assigning bioclassifications are based on summer sampling, which occurs from June through September. For samples collected outside the summer sampling period, EPT Richness is often adjusted by removing the number of winter/spring Plecoptera taxa present to give a seasonally corrected value. Adjustments for seasonality may also be performed based upon site-specific differences between summer and non-summer samples if such data are available. The BI values also are seasonally adjusted for samples outside the summer season.

Table 2. Mountain Criteria for Standard Qualitative (Full Scale) Samples.

Score	NCBI Values	EPT Richness
5	<4.00	> 43
4.6	4.00—4.04	42-43
4.4	4.05—4.09	40-41
4	4.10—4.83	34-39
3.6	4.84—4.88	32-33
3.4	4.89—4.93	30-31
3	4.94—5.69	24-29
2.6	5.70—5.74	22-23
2.4	5.75—5.79	20-21
2	5.80—6.95	14-19
1.6	6.96—7.0	12-13
1.4	7.01-7.05	10-11
1	>7.05	0-9

Table 3. Mountain EPT Criteria for EPT samples.

Classification	EPT Values
Excellent	>35
Good	28-35
Good-Fair	19-27
Fair	11-18
Poor	0-10

Table 4. Benthic macroinvertebrate data collected from New River Basin, HUC 05050001, from 2003 through 2008. Basinwide sites sampled in 2008 are in bold font.

Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPT BI	BioClass
New R	SR 1345	Alleghany	10b	8/19/08	105	50	4.58	3.42	Excellent
				8/21/03	86	51	3.61	3.13	Excellent
S Fk New R	US 421	Watauga	10-1-(3.5)b	8/19/08	75	19	5.80	4.88	Fair
				11/4/03	---	11	---	4.25	Fair
				8/20/03	67	24	5.46	4.81	Good-Fair
S Fk New R	SR 1169	Ashe	10-1-(20.5)	8/18/08	99	38	4.84	3.78	Good
				8/21/03	98	45	4.19	3.33	Excellent
S Fk New R	NC 16/18	Ashe	10-1-(26)b	6/19/08	106	54	4.26	3.48	Excellent
				8/22/03	104	58	3.67	3.12	Excellent
S Fk New R	US 221 below Cranberry Cr	Ashe	10-1-(33.5)	8/22/08	101	48	4.40	3.24	Excellent
				8/23/03	112	47	4.62	3.43	Excellent
M Fk S Fk New R	US 321 ups Goldmine Br	Watauga	10-1-2-(6)	11/4/03	---	24	---	3.23	Good-Fair
M Fk S Fk New R	SR 1522	Watauga	10-1-2-(15)	8/19/08	---	27	---	4.19	Good-Fair
				11/4/03	---	33	---	2.99	Good
				8/20/03	---	24	---	3.26	Good-Fair
E Fk S Fk New R	SR 1524	Watauga	10-1-3-(1)	11/4/03	---	11	---	3.15	Fair
E Fk S Fk New R	SR 1522	Watauga	10-1-3-(8)	8/19/08	---	31	---	3.54	Good
				11/4/03	---	3	---	5.21	Poor
				8/20/03	---	31	---	3.06	Good
Winkler Cr	SR 1549	Watauga	10-1-4-(3.5)a	8/19/08	---	36	---	2.93	Excellent
				8/21/03	---	39	---	2.36	Excellent
Howard Cr	SR 1328	Watauga	10-1-9-(6)	8/19/08	---	44	---	2.19	Excellent
				8/20/03	---	35	---	2.35	Good
Meat Camp Cr	SR 1340	Watauga	10-1-10	8/21/03	---	32	---	1.86	Good
Meat Camp Cr	SR 1333	Watauga	10-1-10	8/20/08	---	39	---	2.80	Excellent
				7/31/08	---	46	---	2.84	Excellent
				8/20/03	---	35	---	2.81	Good
Norris Fk	SR 1337	Watauga	10-1-10-2	8/19/08	---	35	---	2.11	Good
				8/20/03	---	36	---	1.56	Excellent
Pine Orchard Cr	SR 1369	Watauga	10-1-15-1	8/20/08	---	36	---	2.09	Not Impaired
				8/21/03	---	33	---	1.64	Excellent
UT S Fk New R	ups SR 1353	Watauga	---	2/9/07	23	10	3.49	1.90	Not Rated
UT S Fk New R	dns SR 1353	Watauga	---	2/9/07	38	18	2.77	1.38	Not Rated
UT Mill Cr	SR 1111	Ashe	---	2/9/07	37	23	2.24	1.64	Not Impaired
Pine Swamp Cr	off SR 1179 at mouth	Ashe	10-1-24	8/18/08	---	34	---	3.82	Good
				8/19/03	---	30	---	3.14	Good
S Beaver Cr	SR 1147	Ashe	10-1-25-2a	8/18/08	---	35	---	2.83	Good
				8/21/03	---	31	---	2.68	Good
Obids Cr	SR 1192	Ashe	10-1-27-(2)	8/8/08	---	31	---	3.28	Good
				8/19/03	---	32	---	3.16	Good
Roan Cr	SR 1588	Ashe	10-1-31-(2)	8/20/08	---	32	---	3.18	Good
				8/18/03	---	44	---	3.03	Excellent
Naked Cr	NC 16/88	Ashe	10-1-32b	8/20/08	---	34	---	4.37	Good
				8/19/03	70	30	4.92	4.11	Good-Fair
Naked Cr	SR 1585	Ashe	10-1-32b	8/19/03	57	23	5.69	4.86	Good-Fair
Naked Cr	off SR 1589 140 meters ups of mouth	Ashe	10-1-32b	8/21/08	79	23	5.44	4.43	Good-Fair
Peak Cr	off SR 1599 350M ups of Ore Knob Br	Ashe	10-1-35-(2)a	6/19/08	---	44	---	2.32	Excellent

Table 4. (continued)

Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPT BI	BioClass
Peak Cr	SR 1599 dns of Ore Knob Br	Ashe	10-1-35-(2)b	8/21/08	---	3	---	2.62	Poor
				8/18/03	---	6	---	1.91	Poor
L Peak Cr	SR 1595	Ashe	10-1-35-4	8/21/08	---	7	---	2.12	Poor
				8/19/03	---	6	---	1.95	Poor
Cranberry Cr	SR 1603	Ashe	10-1-37	8/21/08	93	45	3.96	3.07	Excellent
				8/18/03	106	52	4.08	3.07	Excellent
N Fk New R	SR 1118	Ashe	10-2-(1)	6/17/08	---	41	---	2.03	Excellent
N Fk New R	SR 1100	Ashe	10-2-(12)	7/31/08	119	57	3.67	2.73	Excellent
				8/19/03	81	44	3.96	3.51	Excellent
N Fk New R	SR 1644	Ashe	10-2-(12)	8/20/08	99	49	3.93	3.31	Excellent
				8/21/03	72	45	3.66	3.31	Excellent
N Fk New R	NC 16	Ashe	10-2-(12)	8/21/03	80	48	3.75	3.43	Excellent
N Fk New R	Old NC 16	Ashe	10-2-(12)	8/20/08	108	55	4.08	3.07	Excellent
N Fk New R	SR 1549	Ashe	10-2-(12)	6/18/08	130	60	4.39	3.37	Excellent
Hoskin Fk	off NC 88 below Wilson Br	Ashe	10-2-7	7/31/08	---	38	---	3.18	Excellent
				8/19/03	---	37	---	2.92	Excellent
Brush Fk	NC 88	Ashe	10-2-8	6/17/08	---	40	---	2.79	Excellent
Roundabout Cr	SR 1308	Ashe	10-2-10	6/17/08	---	43	---	2.45	Excellent
Three Top Cr	off SR 1100 below Long Hope Cr	Ashe	10-2-13	8/21/08	---	35	---	2.60	Good
Three Top Cr	SR 1100	Ashe	10-2-13	8/19/03	---	35	---	2.90	Good
Big Laurel Cr	NC 88	Ashe	10-2-14	6/19/08	---	53	---	2.62	Excellent
				8/19/03	---	38	---	2.92	Excellent
Rich Hill Cr	NC 88	Ashe	10-2-15	6/17/08	---	38	---	2.00	Excellent
Buffalo Cr	NC 88/194 above L Buffalo Cr	Ashe	10-2-20	8/20/08	---	39	---	2.51	Excellent
Buffalo Cr	NC 88/194	Ashe	10-2-20	8/20/08	---	38	---	2.68	Excellent
				8/19/03	---	36	---	2.81	Excellent
L Buffalo Cr	off SR 1153	Ashe	10-2-20-1	8/21/08	63	13	6.00	5.00	Fair
				8/20/03	22	6	6.40	4.11	Poor
Big Horse Cr	SR 1362 ups of SR 1365	Ashe	10-2-21-(4.5)	6/18/08	---	43	---	2.80	Excellent
Big Horse Cr	NC 194	Ashe	10-2-21-(7)	6/10/08	123	60	4.33	2.84	Excellent
				8/19/03	89	50	3.95	3.42	Excellent
L Horse Cr	SR 1334	Ashe	10-2-21-8	8/21/08	---	38	---	2.92	Excellent
				8/19/03	---	33	---	3.03	Good
M Fk Little Horse Cr	SR 1334	Ashe	10-2-21-8-1	6/18/08	---	55	---	2.80	Excellent
L Phoenix Cr	off SR 1513	Ashe	10-2-23	6/18/08	---	40	---	2.17	Excellent
UT L Phoenix Cr	off Old NC 16	Ashe	---	8/20/08	---	17	---	1.45	Not Rated
				8/28/07	10	6	3.03	1.98	Not Rated
UT L Phoenix Cr	SR 1649	Ashe	---	8/28/07	36	21	2.76	2.49	Not Impaired
Long Shoals Cr	off SR 1574	Ashe	10-2-25	6/18/08	71	35	2.87	2.17	Not Impaired
Helton Cr	off SR 1370 0.8 miles ups of Jerd Br	Ashe	10-2-27	10/13/08	---	39	---	2.93	Excellent
Helton Cr	SR 1526	Ashe	10-2-27	10/13/08	---	41	---	2.90	Excellent
Helton Cr	SR 1536	Ashe	10-2-27	10/13/08	---	32	---	2.99	Good
Helton Cr	SR 1536	Ashe	10-2-27	8/20/08	---	37	---	2.93	Excellent
				8/18/03	---	40	---	3.12	Excellent
Grassy Cr	SR 1548	Ashe	10-3	6/18/08	---	31	---	3.33	Good
Elk Cr	SR 1344	Alleghany	10-6-(2)	8/19/08	---	30	---	3.14	Good
				8/18/03	---	34	---	3.52	Good

Table 4. (continued)

Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPT BI	BioClass
Little R	SR 1128	Alleghany	10-9-(1)a	8/19/08	102	42	3.73	3.27	Excellent
				4/5/06	103	50	3.55	2.32	Excellent
				8/18/03	75	36	4.03	3.53	Good
Little R	SR 1424	Alleghany	10-9-(6)	8/18/08	111	47	3.90	3.00	Excellent
				8/21/03	104	49	4.11	3.23	Excellent
				8/18/08	129	59	3.96	2.80	Excellent
Little R	NC 18	Alleghany	10-9-(6)	8/20/03	89	47	3.96	3.40	Excellent
Waterfalls Cr	SR 1132	Alleghany	10-9-4	4/6/06	102	55	2.92	2.03	Excellent
Pine Sw amp Cr	SR 1126	Alleghany	10-9-5	4/4/06	98	50	3.51	2.43	Excellent
Pine Swamp Cr	SR 1128	Alleghany	10-9-5	8/19/08	---	34	---	2.72	Good
				4/4/06	---	49	---	2.69	Excellent
				8/18/03	---	26	---	3.63	Good-Fair
Bledsoe Cr	US 21	Alleghany	10-9-7	4/5/06	85	44	3.43	2.62	Not Impaired
Bledsoe Cr	SR 1172	Alleghany	10-9-7	8/18/08	---	42	---	3.75	Excellent
				4/5/06	---	27	---	3.32	Good-Fair
				8/20/03	---	30	---	3.39	Good
Bledsoe Cr	SR 1171	Alleghany	10-9-7	4/5/06	58	23	4.46	2.95	Good-Fair
Glade Cr	SR 1422 nr US 21	Alleghany	10-9-9	11/5/03	---	35	---	2.85	Good
Glade Cr	SR 1422 nr mouth	Alleghany	10-9-9	6/20/08	126	56	4.54	3.21	Excellent
				8/20/03	82	42	4.40	4.01	Good
Wolf Br	SR 1117	Alleghany	10-9-9-1	4/4/06	65	38	3.18	2.67	Not Impaired
Brush Cr	SR 1444	Alleghany	10-9-10	4/3/06	119	53	4.11	2.36	Excellent
Brush Cr	SR 1422	Alleghany	10-9-10	10/2/07	88	37	4.47	3.46	Good
				8/20/03	83	42	3.94	3.34	Excellent
				8/18/08	---	26	---	3.51	Not Impaired
Laurel Br	SR 1105	Alleghany	10-9-10-2	4/4/06	100	43	4.08	2.73	Good
Laurel Br	SR 1105	Alleghany	10-9-10-2	8/18/03	66	33	4.12	3.53	Good
Moccasin Cr	off NC 18	Alleghany	10-9-11	4/3/06	106	48	4.52	3.02	Good
Crab Cr	SR 1450	Alleghany	10-9-12	10/2/07	---	20	---	3.97	Good-Fair
				11/5/03	---	33	---	3.69	Good
UT Crab Cr	400m south of state line	Alleghany	---	10/2/07	48	21	4.08	2.84	Not Impaired
UT Crab Cr	NC 18	Alleghany	---	10/2/07	70	34	3.98	3.31	Not Impaired
UT UT Crab Cr	above UT Crab Cr	Alleghany	---	10/2/07	43	21	4.06	3.76	Not Impaired

Appendix F-1. Fish community sampling methods and criteria.

Sampling Methods

At each sample site, a 600 ft. section of stream was selected and measured. Fish within the delineated stretch of stream were then collected using two backpack electrofishing units and two persons netting the stunned fish. A seine was also used where there were substantial riffles. During the 2008 basinwide assessment BAU staff were assisted by a summer intern from North Carolina State University. After collection, all readily identifiable fish were examined for sores, lesions, fin damage, and skeletal anomalies, measured (total length to the nearest 1 mm), and then released. Those fish that were not readily identifiable were preserved and returned to the laboratory for identification, examination, and total length measurement. These fish have been deposited as voucher specimens with the North Carolina State Museum of Natural Sciences in Raleigh. All young-of-year were excluded from the analyses.

NCIBI (North Carolina Index of Biotic Integrity) Analysis, Evaluation, and Scoring Criteria

The NCIBI is a modification of the Index of Biotic Integrity initially proposed by Karr (1981) and Karr, *et al.* (1986). The IBI method was developed for assessing a stream's biological integrity by examining the structure and health of its fish community. The scores derived from this index are a measure of the ecological health of the waterbody and may not directly correlate to water quality. For example, a stream with excellent water quality, but with poor or fair fish habitat, would not be rated excellent with this index. However, in many instances, a stream which rated excellent on the NCIBI should be expected to have excellent water quality.

The Index of Biological Integrity incorporates information about species richness and composition, trophic composition, fish abundance, and fish condition. The NCIBI summarizes the effects of all factors that influence aquatic faunal communities (water quality, energy source, habitat quality, flow regime, and biotic interactions). While change within a fish community can be caused by many factors, certain aspects of the community are generally more responsive to specific influences. Species composition measurements reflect habitat quality effects. Information on trophic composition reflects the effect of biotic interactions and energy supply. Fish abundance and condition information indicate additional water quality effects. It should be noted, however, that these responses may overlap. For example, a change in fish abundance may be due to decreased energy supply or a decline in habitat quality, not necessarily a change in water quality.

The assessment of biological integrity using the North Carolina Index of Biotic Integrity (NCIBI) is provided by the cumulative assessment of 10 parameters or metrics. The values provided by the metrics are converted into scores on a 1, 3, or 5 scale. A score of 5 represents conditions which would be expected for undisturbed reference streams in the specific river basin or ecoregion, while a score of 1 indicates that the conditions deviate greatly from those expected in undisturbed streams of the region. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score. Finally, the score (an even number between 12 and 60) is then used to determine the ecological integrity class of the stream from which the sample was collected.

The NCIBI has been revised (NCDENR 2006). Currently, the focus of using and applying the NCIBI has been restricted to wadeable streams that can be sampled by a crew of four persons. In 2001, the bioclassifications and criteria were recalibrated against regional reference site data (Biological Assessment Unit Memorandum F-20010922) (Tables 1 – 5). To qualify as a reference site, the site had to satisfy all seven criteria in the order listed in Table 1. Reference sites represented the least impacted or the most minimally impacted streams and the overall biological conditions of the fish communities that could be attained (Table 2).

Table 1. Reference site selection hierarchy -- a watershed-based approach for streams.

Criterion	Qualification
1 -- Habitat	Total habitat score ≥ 65
2 -- NPDES dischargers	No NPDES dischargers ≥ 0.01 MGD above the site or if there are small dischargers (~ 0.01 MGD), the dischargers are more than one mile upstream
3 -- Percent urbanization	$< 10\%$ of the watershed is urban or residential areas
4 -- Percent forested	$\geq 70\%$ of the watershed is forested or in natural vegetation
5 -- Channel incision	At the site, the stream is not incised beyond natural conditions
6 -- Riparian zone integrity	No breaks in the riparian zones or, if there are breaks, the breaks are rare
7 -- Riparian zone width	Mountain streams -- width of the riparian zone along both banks is $\geq 6m$
Exception 1	If the site satisfied Criteria 1 - 6, except one of the two riparian widths was less than one unit optimal, then the site still qualified as a reference site
Exception 2	If the site satisfied Criteria 1 - 3 and 5 - 7, but the percentage of the watershed in forest or natural vegetations was $\geq 60\%$ (rather than $\geq 70\%$), then the site still qualified as a reference site. [Note: in the New River Basin this last exception is $\geq 50\%$.]

Table 2. Regional fish community reference sites in the New River basin.

Waterbody	Station	County	Level IV Ecoregion
Buffalo Cr	NC 88/194	Ashe	Amphibolite Mountains
Meat Camp Cr	SR 1335	Watauga	Amphibolite Mountains
Three Top Cr	SR 1143	Ashe	Amphibolite Mountains
Glade Cr	SR 1422	Alleghany	New River Plateau
Helton Cr	SR 1536	Ashe	New River Plateau
Little R	SR 1128	Alleghany	New River Plateau
Big Laurel Cr	NC 88	Ashe	Southern Crystalline Ridges & Mountains

Table 3. Metrics and scoring criteria for the NCIBI for wadeable streams in the French Broad, Hiwassee, Little Tennessee, New, and Watauga River basins with watersheds ranging between 3.1 and 161 mi².

No.	Metric	Score	
1	No. of species		
	≥ 16 species	5	
	12-15 species	3	
	< 12 species	1	
2	No. of fish		
	320-1,000 fish	5	
	205-319 fish	3	
	< 205 fish	1	
	> 1,000 fish	3	
3	No. of species of darters		
	<u>French Broad & Little Tennessee River Basins</u>	<u>New River, Pigeon River, Watauga¹, & Hiwassee River Basins</u>	
	≥ 4 species	≥ 3 species	5
	2 or 3 species	1 or 2 species	3
	0 or 1 species	0 species	1
4	No. of species of Rock Bass, Smallmouth Bass, and Trout		
	≥ 2 species	5	
	1 species	3	
	0 species	1	
5	No. of species of cyprinids		
	<u>All basins, except Pigeon River Basin</u>	<u>Pigeon River Basin</u>	
	≥ 8 species	≥ 6 species	5
	6 or 7 species	4 or 5 species	3
	≤ 5 species	≤ 3	1
6	No. of intolerant species		
	<u>All basins, except New River Basin</u>	<u>New River Basin</u>	
	≥ 3 species	≥ 5 species	5
	2 species	3 or 4 species	3
	0 or 1 species	0, 1, or 2 species	1
7	Percentage of tolerant individuals		
	≤ 2%	5	
	2-10%	3	
	> 10%	1	
8	Percentage of omnivorous + herbivorous individuals		
	10-36%	5	
	37-50%	3	
	> 50%	1	
	< 10%	1	
9	Percentage of insectivorous individuals		
	55-85%	5	
	40-54%	3	
	< 40%	1	
	> 85%	1	
12	Percentage of species with multiple age groups		
	≥ 65% of all species have multiple age groups	5	
	45-64% all species have multiple age groups	3	
	< 45% all species have multiple age groups	1	

¹Tentative for the Watauga River basin; also includes *Cottus bairdi* (Mottled Sculpin) and *Noturus insignis* (Margined Madtom). The Watauga River Basin and the Toxaway River (Savannah River Basin) are the only river basins in North Carolina where these three benthic, insectivorous groups (darters, Mottled Sculpin, and Margined Madtom) are sympatric.

Table 4. Tolerance ratings and adult trophic guild assignments for fish in the New River basin. Species collected in 2008 are highlighted in blue. Common and scientific names follow Nelson, *et al.* (2004).

Family/ Species	Common Name	Tolerance Rating	Trophic Guild of Adults
Cyprinidae	Carp and Minnows		
<i>Campostoma anomalum</i>	Central Stoneroller	Intermediate	Herbivore
<i>Clinostomus funduloides</i>	Rosyside Dace	Intermediate	Insectivore
<i>Ctenopharyngodon idella</i>	Grass Carp	Tolerant	Herbivore
<i>Cyprinella galactura</i>	Whitetail Shiner	Intermediate	Insectivore
<i>C. spiloptera</i>	Spotfin Shiner	Intermediate	Insectivore
<i>Cyprinus carpio</i>	Common Carp	Tolerant	Omnivore
<i>Exoglossum laurae</i>	Tonguetied Minnow	Intolerant	Insectivore
<i>Hybopsis hypsinotus</i>	Highback Chub	Intolerant	Insectivore
<i>Luxilus albeolus</i>	White Shiner	Intermediate	Insectivore
<i>L. coccogenis</i>	Warpaint Shiner	Intermediate	Insectivore
<i>Nocomis leptoccephalus</i>	Bluehead Chub	Intermediate	Omnivore
<i>N. platyrhynchus</i>	Bigmouth Chub	Intermediate	Omnivore
<i>Notemigonus crysoleucas</i>	Golden Shiner	Tolerant	Omnivore
<i>Notropis chiliticus</i>	Redlip Shiner	Intermediate	Insectivore
<i>N. hudsonius</i>	Spottail Shiner	Intermediate	Omnivore
<i>N. leuciodus</i>	Tennessee Shiner	Intermediate	Insectivore
<i>N. photogenis</i>	Silver Shiner	Intolerant	Insectivore
<i>N. rubricroceus</i>	Saffron Shiner	Intermediate	Insectivore
<i>N. scabriceps</i>	New River Shiner	Intolerant	Insectivore
<i>N. volucellus</i>	Mimic Shiner	Intolerant	Insectivore
<i>N. sp cf. rubellus</i>	Kanawha Rosyface Shiner	Intolerant	Insectivore
<i>Phenacobius teretulus</i>	Kanawha Minnow	Intolerant	Insectivore
<i>Phoxinus oreas</i>	Mountain Redbelly Dace	Intermediate	Herbivore
<i>Pimephales notatus</i>	Bluntnose Minnow	Tolerant	Omnivore
<i>P. promelas</i>	Fathead Minnow	Tolerant	Omnivore
<i>Rhinichthys cataractae</i>	Longnose Dace	Intermediate	Insectivore
<i>R. obtusus</i>	Western Blacknose Dace	Intermediate	Insectivore
<i>Semotilus atromaculatus</i>	Creek Chub	Tolerant	Insectivore
Catostomidae	Suckers		
<i>Catostomus commersonii</i>	White Sucker	Tolerant	Omnivore
<i>Hypentelium nigricans</i>	Northern Hogsucker	Intermediate	Insectivore
Ictaluridae	North American Catfishes		
<i>Ameiurus nebulosus</i>	Brown Bullhead	Tolerant	Omnivore
<i>Pylodictis olivaris</i>	Flathead Catfish	Intermediate	Piscivore
Esocidae	Pikes		
<i>Esox masquinongy</i>	Muskellunge	Intermediate	Piscivore
Salmonidae	Trouts and Salmons		
<i>Oncorhynchus mykiss</i>	Rainbow Trout	Intolerant	Insectivore
<i>Salmo trutta</i>	Brown Trout	Intermediate	Piscivore
<i>Salvelinus fontinalis</i>	Brook Trout	Intolerant	Insectivore
Cottidae	Sculpins		
<i>Cottus bairdii</i>	Mottled Sculpin	Intermediate	Insectivore
Centrarchidae	Sunfishes		
<i>Ambloplites rupestris</i>	Rock Bass	Intolerant	Piscivore
<i>Lepomis auritus</i>	Redbreast Sunfish	Tolerant	Insectivore
<i>L. cyanellus</i>	Green Sunfish	Tolerant	Insectivore
<i>L. gibbosus</i>	Pumpkinseed	Intermediate	Insectivore
<i>L. gulosus</i>	Warmouth	Intermediate	Insectivore
<i>L. macrochirus</i>	Bluegill	Intermediate	Insectivore
<i>Micropterus dolomieu</i>	Smallmouth Bass	Intolerant	Piscivore
<i>M. salmoides</i>	Largemouth Bass	Intermediate	Piscivore
<i>Pomoxis nigromaculatus</i>	Black Crappie	Intermediate	Piscivore
Percidae	Perches		
<i>Etheostoma blennioides</i>	Greenside Darter	Intermediate	Insectivore
<i>E. flabellare</i>	Fantail Darter	Intermediate	Insectivore
<i>E. kanawhae</i>	Kanawha Darter	Intolerant	Insectivore
<i>E. olmstedii</i>	Tessellated Darter	Intermediate	Insectivore
<i>Percina caprodes</i>	Logperch	Intermediate	Insectivore
<i>P. gymnocephala</i>	Appalachia Darter	Intolerant	Insectivore
<i>P. oxyrhynchus</i>	Sharpnose Darter	Intolerant	Insectivore

Table 5. Scores and classes for evaluating the fish community of a wadeable stream using the North Carolina Index of Biotic Integrity in the French Broad, Hiwassee, Little Tennessee, New, and Watauga River basins.

NCIBI Scores	NCIBI Classes
58 or 60	Excellent
48, 50, 52, 54, or 56	Good
40, 42, 44, or 46	Good-Fair
34, 36, or 38	Fair
≤ 32	Poor

Criteria and ratings are applicable only to wadeable streams in the New River basin. Metrics and ratings are the same as those for the French Broad, Hiwassee, Little Tennessee, and Watauga River basins and should not be applied to non-wadeable streams nor to small, wadeable Southern Appalachian type trout streams in each of these basins. Physical attributes of Southern Appalachian type trout streams may include, but are not limited to, gradient (often high-gradient), certain visual aspects of the stream and riparian zones (e.g., *Rhododendron*-, *Leucothoe*-, and *Tsuga*-lined), presence of boulder and rock outcrop plunge pools, overall faunal characteristics (naturally low fish diversity), low specific conductance (often less than 25µS/cm), temperature (often less than 20°C), clarity (gin-clear), elevation (which will vary from basin to basin and within a basin), and stream order (1st – 3rd). These streams are currently not rated.

Blackspot and Other Diseases

Blackspot and yellow grub diseases are naturally occurring, common infections of fish by an immature stage of flukes. The life cycle involves fish, snails, and piscivorous birds. Heavy, acute infections can be fatal, especially to small fish. However, fish can carry amazingly high worm burdens without any apparent ill effects (Noga 1996). The infections may often be disfiguring and render the fish aesthetically unpleasing (Figure 1).

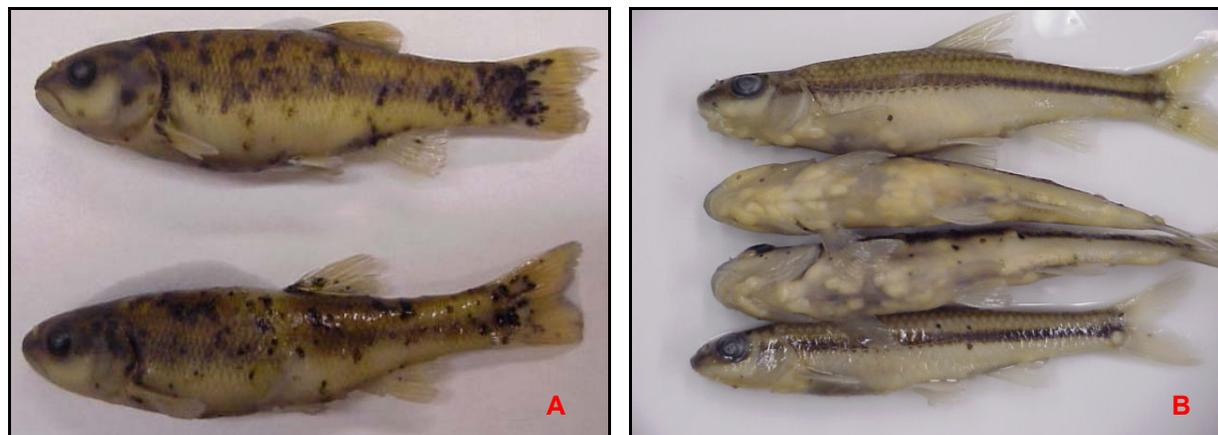


Figure 1. Heavy infestation of blackspot disease in creek chub (A) and yellow grub in bigeye chub (B).

Although some researchers incorporate the incidence of black spot and yellow grub into indices of biotic integrity (e.g., Steedman 1991), others, because of a lack of a consistent inverse relationship to environmental quality, do not (e.g., Sanders *et al.* 1999). The diseases are not considered in the NCIBI because it is widespread, affecting fish in all types of streams.

Appendix F-2. A summary of fish community assessment data for 2008.

Monitoring efforts for 2008 may be summarized as:

- Twenty-two fish community samples were collected as part of the basinwide monitoring cycle; samples were last collected during the 1998 basinwide assessment. None of the sites sampled were on the impaired streams (§303d) list (NCDENR 2007).
- Nine sites had not been previously sampled, were in rural watersheds where there were no NPDES dischargers, and were selected as potential fish community regional reference sites (i.e. Obids, Roan, Prathers, Three Top, Big Laurel, Buffalo, Grassy, Pine Swamp, Brush, and Crab creeks). Streams possessing exceptionally high quality instream, riparian, and watershed characteristics qualifying them as new fish community regional reference sites included Buffalo Creek, Three Top, and Big Laurel creeks (Appendices F-1 and F-6).
- The remaining 13 sites had been last sampled in 1998 (Appendix F-3). Two of these sites were relocated downstream to capture more of the watershed (Naked Creek) or upstream into an adjacent Level IV ecoregion to serve as a reference site (Meat Camp Creek).
- The drainage areas of the assessed watersheds ranged from 5.3 to 56.2 square miles (Appendix F-4).
- The most widely distributed species were the Fantail Darter, collected at all 22 sites, and the Central Stoneroller, Bluehead Chub, and Northern Hogsucker which were each collected at 21 sites. The most abundant species were the Central Stoneroller, Mottled Sculpin, Mountain Redbelly Dace, Bluehead Chub, and Fantail Darter (Appendix F-5).
- Sixteen of the samples were evaluated and rated using the North Carolina Index of Biotic Integrity (NCIBI) (Appendices F-1, F-3, and F-4). The NCIBI scores ranged from 36 to 56 and the NCIBI ratings ranged from Fair to Good (Figures 1 and 2); 14 of the 16 sites were rated Good-Fair or Good. No sites rated Poor or Excellent.
- The new regional fish community reference sites rated Good (Big Laurel Creek) and Not Rated (Meat Camp, Buffalo, and Three Top creeks).

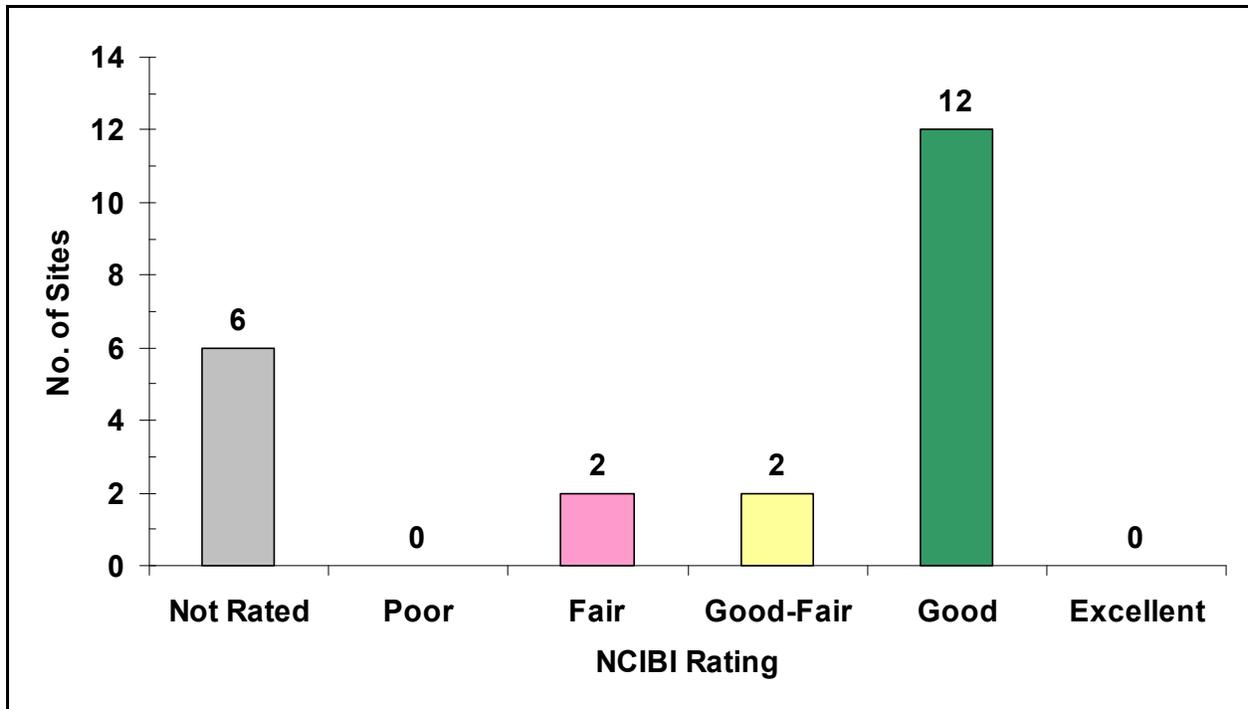


Figure 1. Distribution of the ratings of 22 fish community sites in the New River basin, 2008.

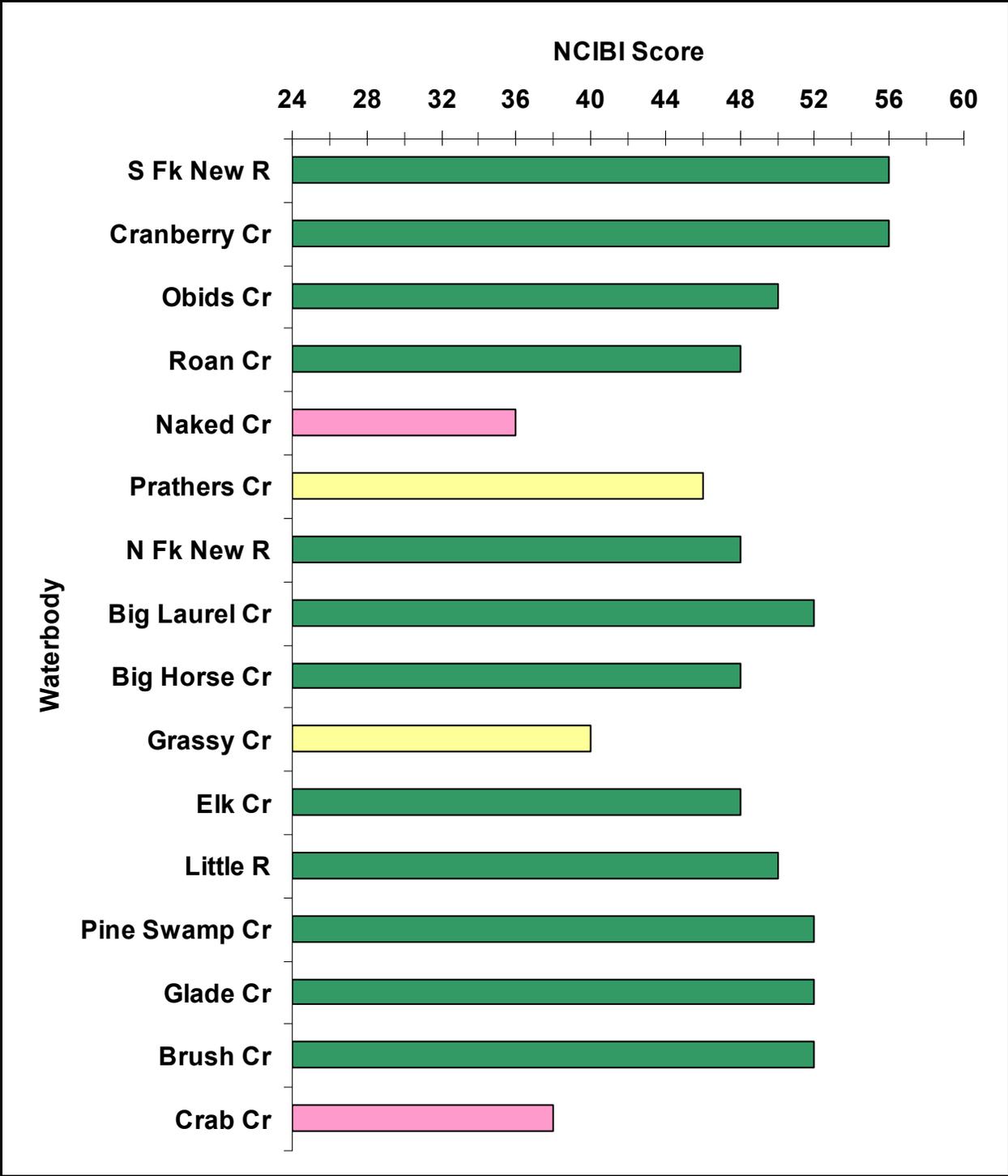


Figure 2. NCIBI scores and ratings of 16 fish community basinwide sites in the New River basin, 2008. Green = Good, Yellow = Good-Fair, and Rose = Fair. Six Not Rated sites are not plotted.

- Sites rated Fair were found in areas receiving nonpoint source runoff from urban or agricultural areas or below wastewater treatment plants.
- Eight of the 22 sites had been sampled and rated during the last assessment in 1998 (Figure 3). Seven of the sites had no appreciable change in the scores or the ratings and 1 site had a score and rating that increased over the 10 year period. The improvement in the Little River from Good-Fair (NCIBI = 44) to Good (NCIBI = 50) resulted from a slight increase in the species diversity and a more balanced trophic structure, both which may have resulted from sampling under lower flow conditions in 2008 than in 1998.
- The instream and riparian habitat assessment scores at the 22 sites ranged from 50 to 95 (Appendix F-6). Habitat degradation across the basin was most pronounced in the instabilities of the banks, the lack of a canopy; and the narrow buffers. Extremely low scores were attributable to long-term, basinwide, poor landuse practices, chronic erosion of the easily eroded banks, nonpoint source sedimentation, and upstream urbanization.
- No dissolved oxygen concentrations for any of the streams were less than their respective water quality standard (Appendix F-7).
- Specific conductance ranged from 29 $\mu\text{S}/\text{cm}$ at Pine Swamp and Brush Creeks to 126 $\mu\text{S}/\text{cm}$ at the South Fork New River (Appendix F-7). Elevated readings at two other sites were a function of being downstream from permitted dischargers, having urbanized areas within the watersheds, and being situated in agricultural valleys with golf courses along their banks.
- Eighteen of the 22 pH measurements met the water quality standard (6 s.u.-9 s.u.), measurements less than the standard were recorded at Cranberry, Elk, and Glade Creeks and at the Little River (Appendix F-7).
- The basin has been experiencing a drought for 22 months ranging most often from Severe to as great as Exceptional (Appendix G-1). Since January 2000, the basin has been in a Moderate, Severe, or Extreme drought more than one-third of the time. Normal conditions have prevailed slightly less than 50 percent of the time.

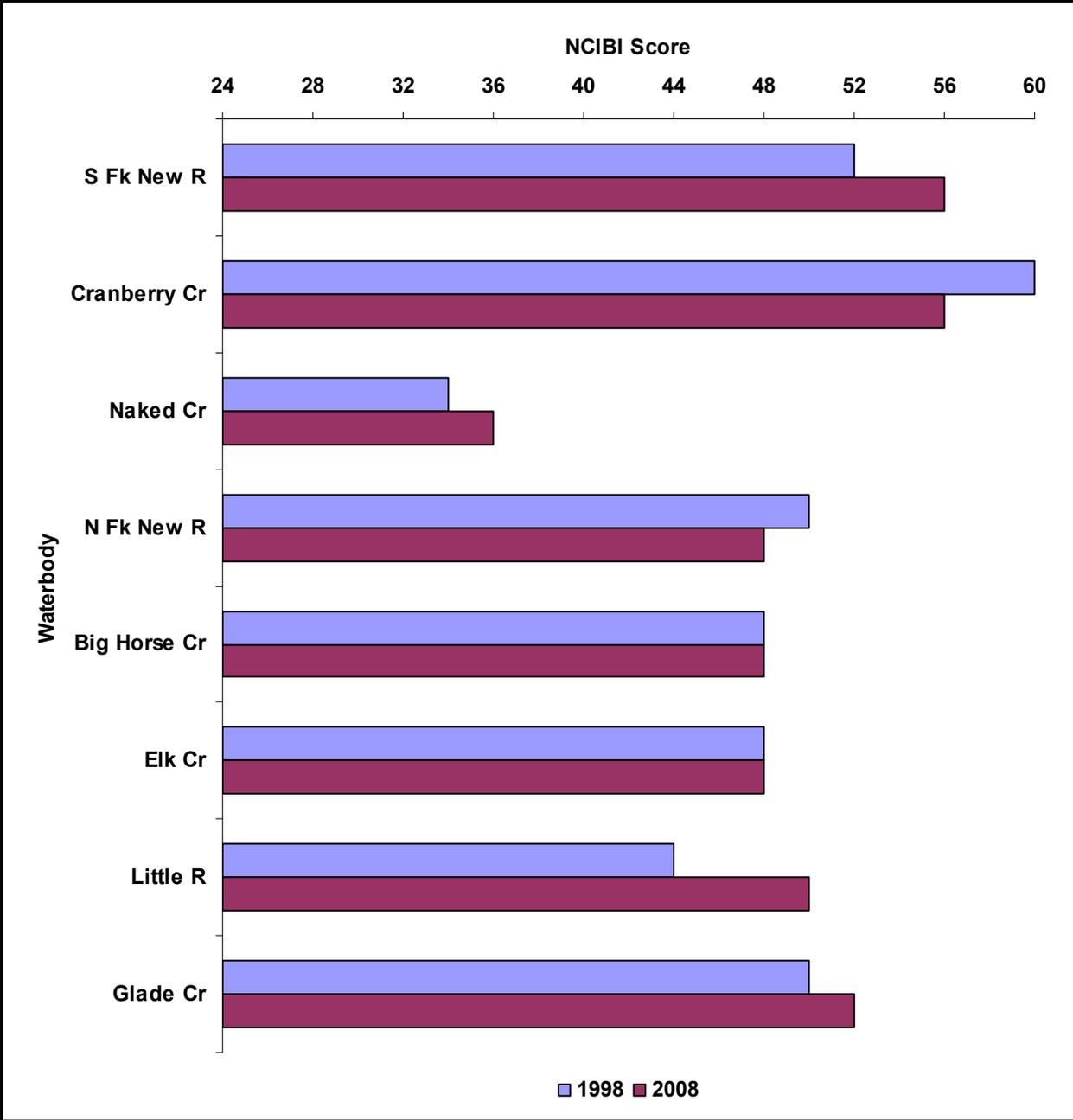


Figure 3. NCIBI scores and ratings of eight repeat fish community sites in the New River basin, 1998 and 2008.

**Appendix F-3. Fish community data collected from the New River basin, 1998 and 2008.
Basinwide sites sampled in 2008 are in bold font.**

Waterbody	Station	County	Index No.	Date	NCIBI Score	NCIBI Rating
S Fk New R	US 421	Watauga	10-1-(3.5)	05/22/08	56	Good
				06/08/98	52	Good
M Fk S Fk New R	SR 1522	Watauga	10-1-2-(15)	05/22/08	---	Not Rated
				06/09/98	58	Excellent
Howard Cr	SR 1306	Watauga	10-1-9-(6)	05/21/08	---	Not Rated
				06/08/98	---	Not Rated
Meat Camp Cr	SR 1335	Watauga	10-1-10	05/21/08	---	Not Rated
Meat Camp Cr	SR 1333	Watauga	10-1-10	06/09/98	---	Not Rated
Cranberry Cr	SR 1600	Ashe	10-1-19	05/08/08	56	Good
				06/30/98	60	Excellent
Obids Cr	SR 1192	Ashe	10-1-27-(2)	05/09/08	50	Good
Roan Cr	SR 1588	Ashe	10-1-31-(2)	05/19/08	48	Good
Naked Cr	NC 16/88	Ashe	10-1-32	06/09/98	34	Fair
Naked Cr	off SR 1589	Ashe	10-1-32	05/09/08	36	Fair
Prathers Cr	off SR 1302	Alleghany	10-1-38	05/07/08	46	Good-Fair
N Fk New R	SR 1119	Ashe	10-2-(1)	05/21/08	48	Good
				06/29/98	50	Good
Three Top Cr	SR 1123	Ashe	10-2-13	05/20/08	---	Not Rated
Big Laurel Cr	NC 88	Ashe	10-2-14	05/20/08	52	Good
Buffalo Cr	NC 88/194	Ashe	10-2-20	05/19/08	---	Not Rated
Big Horse Cr	SR 1350	Ashe	10-2-21-(1)	05/20/08	48	Good
				06/29/98	48	Good
Helton Cr	SR 1536	Ashe	10-2-27	05/08/08	---	Not Rated
				06/30/98	52	Good
Grassy Cr	SR 1549	Ashe	10-3	05/08/08	40	Good-Fair
Elk Cr	SR 1341	Alleghany	10-6-(2)	05/07/08	48	Good
				06/30/98	48	Good
Little R	SR 1128	Alleghany	10-9-(1)	05/06/08	50	Good
				07/01/98	44	Good-Fair
Pine Swamp Cr	SR 1128	Alleghany	10-9-5	05/06/08	52	Good
Glade Cr	SR 1422	Alleghany	10-9-9	05/06/08	52	Good
				07/01/98	50	Good
Brush Cr	SR 1433	Alleghany	10-9-10	05/05/08	52	Good
Crab Cr	NC 18	Alleghany	10-9-12	05/05/08	38	Fair

Appendix F-4. Fish community metric values from 22 Wadeable streams in the New River basinwide monitoring program, 2008¹.

Waterbody	Location	County	d. a. (mi ²)	Date	No. Species	No. Fish	No. Sp. Darters	No. Sp. RST	No. Sp. Cyprinids	No. Intol. Sp.	% Tolerant	% Omni. +Herb.	% Insect.	% MA
S Fk New R	US 421	Watauga	34.2	05/22/08	22	2058	4	3	12	8	1	42	57	68
M Fk S Fk New R	SR 1522	Watauga	12.0	05/22/08	14	803	1	2	6	2	4	9	85	57
Howard Cr	SR 1306	Watauga	7.9	05/21/08	17	242	2	3	6	4	3	29	64	59
Meat Camp Cr	SR 1335	Watauga	10.7	05/21/08	10	1060	2	3	4	3	0	1	98	70
Cranberry Cr	SR 1600	Ashe	36.8	05/08/08	22	1075	3	2	15	9	1	35	64	64
Obids Cr	SR 1192	Ashe	8.3	05/09/08	17	1294	4	3	7	4	1	35	53	65
Roan Cr	SR 1588	Ashe	6.7	05/19/08	14	1273	3	3	6	4	0	32	67	64
Naked Cr	off SR 1589	Ashe	12.4	05/09/08	20	1242	2	3	8	3	11	56	22	55
Prathers Cr	off SR 1302	Alleghany	13.7	05/07/08	19	1925	2	3	11	5	0	68	31	79
N Fk New R	SR 1119	Ashe	23.9	05/21/08	15	1368	2	1	9	3	1	18	82	73
Three Top Cr	SR 1123	Ashe	23.1	05/20/08	15	420	3	2	7	4	0	7	91	73
Big Laurel Cr	NC 88	Ashe	29.0	05/20/08	19	745	3	2	12	7	2	57	42	68
Buffalo Cr	NC 88/194	Ashe	12.6	05/19/08	15	942	2	3	7	3	0	6	92	73
Big Horse Cr	SR 1350	Ashe	56.2	05/20/08	15	652	2	3	7	6	0	48	49	73
Helton Cr	SR 1536	Ashe	43.7	05/08/08	15	1388	2	0	10	3	0	59	41	67
Grassy Cr	SR 1549	Ashe	10.6	05/08/08	18	1266	2	3	9	3	1	82	12	50
Elk Cr	SR 1341	Alleghany	17.4	05/07/08	20	1495	4	2	11	7	0	61	38	70
Little R	SR 1128	Alleghany	14.1	05/06/08	16	1444	4	1	8	3	8	24	75	94
Pine Swamp Cr	SR 1128	Alleghany	5.3	05/06/08	16	673	3	2	8	3	11	36	62	81
Glade Cr	SR 1422	Alleghany	13.6	05/06/08	20	1862	4	1	12	5	2	42	58	70
Brush Cr	SR 1433	Alleghany	18.1	05/05/08	19	1490	4	2	10	5	5	42	57	84
Crab Cr	NC 18	Alleghany	11.2	05/05/08	14	2368	5	1	7	3	0	65	35	79

¹Abbreviations are d. a. = drainage area, No. = number, Sp. = species, RST = rockbass, smallmouth bass, and trout, Intol. = intolerants, Omni. + Herb. = omnivores+herbivores, Insect. = insectivores, and MA = species with multiple age groups.

Appendix F-5. Fish distributional records for the New River basin.

Based upon Menhinick (1991), NC DWQ's data, and data from other researchers, 52 species have been collected from the New River basin (Table 4 in Appendix F-1). The known species assemblage includes 26 species of minnows, 2 species of suckers, 9 species of sunfish and bass, and 7 species of darters. Eight species are endemic to the basin: Tonguetied Minnow, Bigmouth Chub, New River Shiner, Kanawha Rosyface Shiner, Kanawha Minnow, Kanawha Darter, Appalachia Darter, and Sharpnose Darter. A few new river basin and county distributional records were also recorded in 2008 from DWQ's fish community monitoring efforts (Table 1).

Table 1. New distributional records for the New River basin.

Family/Species	Common Name	County
Cyprinidae	Carps and Minnows	
<i>Hybopsis hypsinotus</i>	Highback Chub	Alleghany
<i>Nocomis leptcephalus</i>	Bluehead Chub	Watauga
<i>Notropis leuciodus</i>	Tennessee Shiner	Ashe
<i>N. chiliticus</i>	Redlip Shiner	Ashe (also collected in 1998)
Ictaluridae	North American Catfishes	
<i>Ameiurus nebulosus</i>	Brown Bullhead	Ashe
Centrarchidae	Sunfishes	
<i>Lepomis cyanellus</i>	Green Sunfish	Watauga
<i>Micropterus salmoides</i>	Largemouth Bass	Ashe

At least 24 of the 52 species (46 percent of the total basin fauna) are nonindigenous (exotic) and were introduced either as sportfish, forage fish, baitfish, or for reasons unknown (Table 2) (<http://www.esb.enr.state.nc.us/Native%20and%20Introduced%20Freshwater%20Fish%20in%20North%20Carolina.2-1.htm>). In 2008, 17 of the 42 species collected were nonindigenous species. Each of the streams sampled in 2008 had at least one, sometimes as many as eight, nonindigenous species present. They constituted from 6.7 percent to 40.0 percent of the total number of species collected at a site and from 0.2 percent to almost 40 percent of the total number of fish collected at a site.

Table 2. Nonindigenous species in the New River basin. Species collected in 2008 are highlighted in blue.

Family/Species	Common Name	Family/Species	Common Name
Cyprinidae	Carps and Minnows	Salmonidae	Trouts and Salmons
<i>Ctenopharyngodon idella</i>	Grass Carp	<i>Oncorhynchus mykiss</i>	Rainbow Trout
<i>Cyprinella galactura</i>	Whitetail Shiner	<i>Salmo trutta</i>	Brown Trout
<i>Cyprinus carpio</i>	Common Carp	Centrarchidae	Sunfishes
<i>Hybopsis hypsinotus</i>	Highback Chub	<i>Ambloplites rupestris</i>	Rock Bass
<i>Luxilus coccogenis</i>	Warpaint Shiner	<i>Lepomis auritus</i>	Redbreast Sunfish
<i>Notemigonus crysoleucas</i>	Golden Shiner	<i>L. cyanellus</i>	Green Sunfish
<i>Notropis chiliticus</i>	Redlip Shiner	<i>L. gibbosus</i>	Pumpkinseed Sunfish
<i>N. leuciodus</i>	Tennessee Shiner	<i>L. gulosus</i>	Wormouth
<i>N. rubricroceus</i>	Saffron Shiner	<i>L. macrochirus</i>	Bluegill
<i>Pimephales promelas</i>	Fathead Minnow	<i>Micropterus dolomieu</i>	Smallmouth Bass
Ictaluridae	North American Catfishes	<i>M. salmoides</i>	Largemouth Bass
<i>Ameiurus nebulosus</i>	Brown Bullhead	<i>Pomoxis nigromaculatus</i>	Black Crappie
Esocidae	Pikes	Percidae	Perches
<i>Esox masquinongy</i>	Muskellunge	<i>Etheostoma olmstedi</i>	Tessellated Darter

Special protection status has been given to six species by the U. S. Department of the Interior, the NC Wildlife Resources Commission, or the NC Natural Heritage Program under the NC State Endangered Species Act (G.S. 113-331 to 113-337) (LeGrand *et al.* 2008; Menhinick and Braswell 1997) (Table 3). During the assessment period, the Kanawha Darter was collected at 18 sites (absent from Middle Fork South Fork New River, Howard Creek, Naked Creek, and Grassy Creek), the Tonguetied Minnow was collected at 9 sites, the Kanawha Minnow at 8 sites, and the Kanawha Rosyface Shiner at 5 sites. No

Logperch or Sharpnose Darter were collected in 2008; they are typically found in larger streams and rivers that are not sampled as part of the wadeable stream fish community assessment program.

Table 3. Species of fish listed as threatened, of special concern, or significantly rare in the New River basin.

Species	Common Name	Status	State Rank
<i>Exoglossum laurae</i>	Tonguetied Minnow	Significantly Rare	S2
<i>Notropis sp. cf. rubellus</i>	Kanawha Rosyface Shiner	Significantly Rare	S2
<i>Phenacobius teretulus</i>	Kanawha Minnow	Special Concern	S2
<i>Etheostoma kanawhae</i>	Kanawha Darter	Significantly Rare	S3
<i>Percina caprodes</i>	Logperch	Threatened	S1
<i>Percina oxyrhynchus</i>	Sharpnose Darter	Special Concern	S1

S1 = Critically imperiled in North Carolina because of extreme rarity or because of some factor (s) making it especially vulnerable to extirpation from North Carolina; S2 = imperiled in North Carolina due to rarity or some factor(s) making it very vulnerable to extirpation from the state; and S3 = rare or uncommon in North Carolina (LeGrand *et al.* 2008).

In 2008, 42 species were collected. Species not collected included those with preferences for larger streams and rivers (Flathead Catfish, Muskellunge, Sharpnose Darter, and Logperch) and some of the more uncommon basin species such as Mimic Shiner and Brook Trout. Other summaries of the data are found in Table 4.

Table 4. Fish community summaries for the New River basin, 2008.

Summary	Species
Most widely distributed species (collected at all or 21 of the 22 sites)	Fantail Darter, Central Stoneroller, Bluehead Chub, and Northern Hogsucker
Less widely distributed species (collected from a single site)	Whitetail Shiner, Spotfin Shiner, White Shiner, Spottail Shiner, Bluntnose Minnow, Brown Bullhead, Pumpkinseed, Largemouth Bass, and Black Crappie
Most abundant species (constituting two-thirds of all the fish collected)	Central Stoneroller, Mottled Sculpin, Mountain Redbelly Dace, Bluehead Chub, and Fantail Darter
Rare species (less than 10 specimens collected)	Whitetail Shiner, Spotfin Shiner, Highback Chub, White Shiner, Spottail Shiner, Tennessee Shiner, Brown Bullhead, Bluegill, Largemouth Bass, and Black Crappie

Appendix F-6. Habitat evaluations and stream and riparian habitats at 22 fish community monitoring sites in the New River basin, 2008.

Habitat Assessments

A method and scoring system has been developed to evaluate the physical habitats of a stream (NCDENR 2006). The narrative descriptions of eight habitat characteristics, including channel modification, amount of instream habitat, type of bottom substrate, pool variety, riffle frequency, bank stability, light penetration, and riparian zone width, are converted into numerical scores. The total habitat score ranges between 1 and 100. Higher numbers suggest better habitat quality, but criteria have not been developed to assign ratings. Scores greater than 65 generally represent moderate to high quality habitat sites, whereas scores less than 65 generally represent low to poor quality habitat sites (DWQ unpublished data).

Almost 82 percent of the 22 streams sampled in 2008 had overall moderate to high quality habitats (score ≥ 65). The remaining 18 percent had overall low to poor quality habitats (score < 65) (Figure 1 and Tables 1 and 2). Habitat scores ranged from 50 at Naked Creek to 95 at Grassy Creek (Tables 1 and 2).

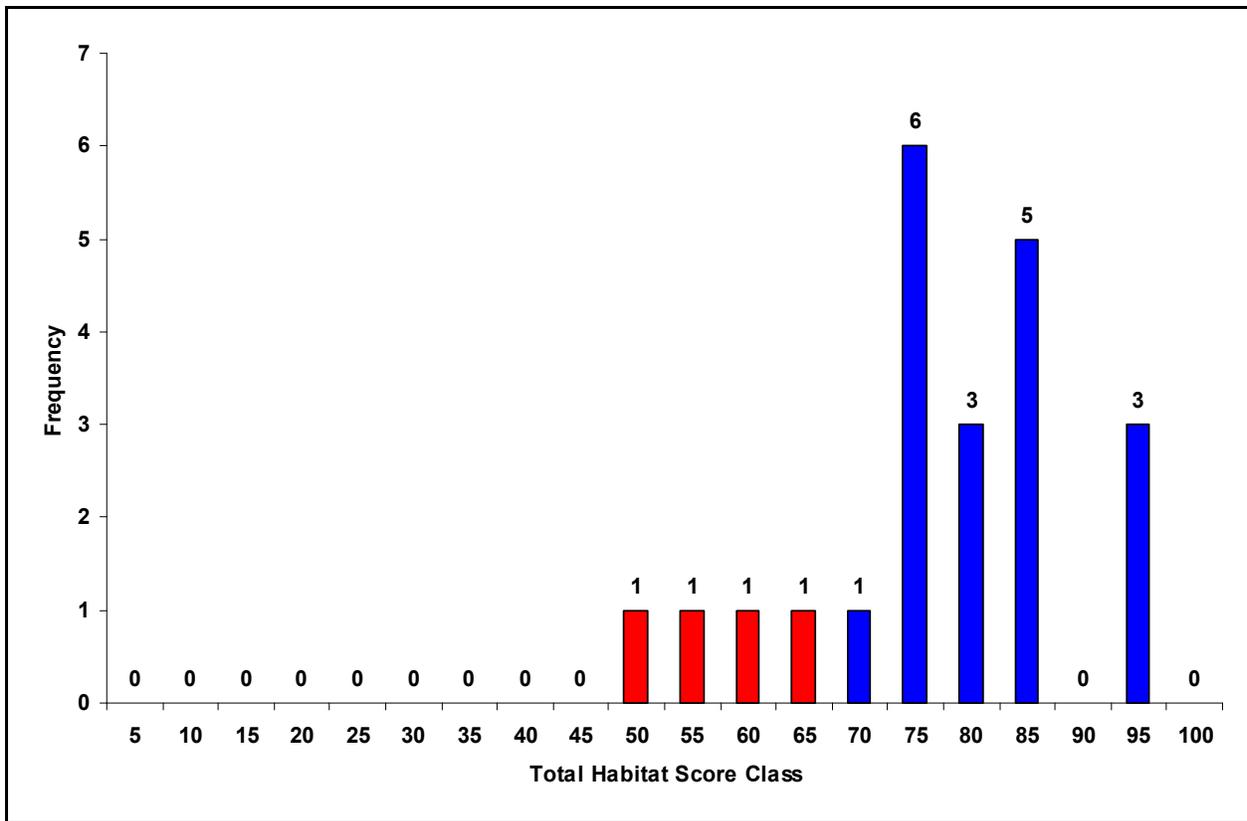


Figure 1. Distribution of the total habitat scores at 22 fish community sites in the New River basin, 2008. High to moderate quality scores are shown in blue and low to poor quality habitat sites are shown in red.

Table 1. Habitat evaluations at 22 basinwide fish community sites in the New River basin, 2008. Red bold denotes less than optimal habitat conditions.

Waterbody	Location	County	Channel	Instream				Bank	Bank	Shade	Riparian	Riparian	Total
				Habitat	Substrate	Pools	Riffles	Stability-L	Stability-R		Zone-L	Zone-R	
S Fk New R	US 421	Watauga	5	16	5	4	10	5	5	5	5	3	63
M Fk S Fk New R	SR 1522	Watauga	5	20	8	6	16	3	5	8	2	2	75
Howard Cr	SR 1306	Watauga	5	20	12	6	16	7	7	10	4	4	91
Meat Camp Cr	SR 1335	Watauga	5	18	12	0	16	6	5	5	5	3	75
Cranberry Cr	SR 1600	Ashe	4	16	8	4	14	2	3	0	1	1	53
Obids Cr	SR 1192	Ashe	5	19	13	9	16	2	7	7	1	5	84
Roan Cr	SR 1588	Ashe	5	19	8	8	16	5	5	7	2	2	77
Naked Cr	off SR 1589	Ashe	5	15	6	4	7	3	3	5	1	1	50
Prathers Cr	off SR 1302	Alleghany	5	18	14	6	16	4	4	4	2	2	75
N Fk New R	SR 1119	Ashe	5	18	8	4	16	4	4	4	5	3	71
Three Top Cr	SR 1143	Ashe	5	20	12	6	16	7	7	7	3	2	85
Big Laurel Cr	NC 88	Ashe	5	16	8	8	10	5	5	5	5	4	71
Buffalo Cr	NC 88/194	Ashe	5	20	12	4	16	6	6	7	4	3	83
Big Horse Cr	SR 1350	Ashe	5	16	8	4	5	5	4	2	5	5	59
Helton Cr	SR 1536	Ashe	5	18	13	4	15	6	4	7	5	3	80
Grassy Cr	SR 1549	Ashe	5	19	14	8	16	7	7	9	5	5	95
Elk Cr	SR 1341	Alleghany	5	20	12	10	16	3	3	5	5	5	84
Little R	SR 1128	Alleghany	5	19	10	6	16	7	6	8	5	3	85
Pine Swamp Cr	SR 1128	Alleghany	5	20	13	8	16	6	6	8	4	5	91
Glade Cr	SR 1422	Alleghany	5	15	5	6	15	4	4	5	5	4	68
Brush Cr	SR 1433	Alleghany	5	19	13	6	16	5	5	2	2	2	75
Crab Cr	NC 18	Alleghany	5	19	12	10	16	4	4	2	1	4	77
Maximum possible scores			5	20	15	10	16	7	7	10	5	5	100

Table 2. Rankings of 22 waterbodies in New River basin according to the total habitat scores, 2008.

Waterbody	Location	County	Level IV Ecoregion	Score
High to Moderate Quality Habitats				
Grassy Cr	SR 1549	Ashe	New River Plateau	95
Howard Cr	SR 1306	Watauga	Amphibolite Mountains	91
Pine Swamp Cr	SR 1128	Alleghany	New River Plateau	91
Little R	SR 1128	Alleghany	New River Plateau	85
Three Top Cr	SR 1143	Ashe	Amphibolite Mountains	85
Elk Cr	SR 1341	Alleghany	New River Plateau	84
Obids Cr	SR 1192	Ashe	New River Plateau	84
Buffalo Cr	NC 88/194	Ashe	Amphibolite Mountains	83
Helton Cr	SR 1536	Ashe	New River Plateau	80
Crab Cr	NC 18	Alleghany	New River Plateau	77
Roan Cr	SR 1588	Ashe	New River Plateau	77
Brush Cr	SR 1433	Alleghany	New River Plateau	75
M Fk S Fk New R	SR 1522	Watauga	Southern Crystalline Ridges & Mountains	75
Meat Camp Cr	SR 1335	Watauga	Amphibolite Mountains	75
Prathers Cr	off SR 1302	Alleghany	New River Plateau	75
Big Laurel Cr	NC 88	Ashe	Southern Crystalline Ridges & Mountains	71
N Fk New R	SR 1119	Ashe	Southern Crystalline Ridges & Mountains	71
Glade Cr	SR 1422	Alleghany	New River Plateau	68
Low to Poor Quality Habitats				
S Fk New R	US 421	Watauga	Southern Crystalline Ridges & Mountains	63
Big Horse Cr	SR 1350	Ashe	New River Plateau	59
Cranberry Cr	SR 1600	Ashe	New River Plateau	53
Naked Cr	off SR 1589	Ashe	New River Plateau	50

Major differences between the high to moderate and the low to poor quality habitat types were in the substrates, riffles, and shade (Table 3). Differences were not as pronounced in the degree of channel modification, abundance of pools, banks stabilities, or width of riparian zones. Extremely low scores were attributable to landuse practices, chronic erosion of the easily eroded banks, nonpoint source sedimentation within the respective watersheds, and upstream urbanization.

Table 3. Mean habitat scores for 22 fish community sites in the New River basin, 2008.

Habitat characteristics	Low - Poor Quality Habitat	Moderate - High Quality Habitat	Maximum Score
Substrate	6.8	11.1	15
Riffles	9.0	15.6	16
Shade	3.0	6.1	10

Characteristics of moderate to high quality habitat streams are (Figure 2):

- instream habitats composed of rocks, sticks, leafpacks, snags, logs, undercut banks and root mats;
- a substrate of cobble and gravel with low embeddedness;
- frequent pools and riffles of varying depths and widths; and
- stable banks with a good tree canopy and a medium to wide riparian zone with no or rare breaks.



Figure 2. High quality instream habitats and wide riparian zones with a good tree canopy at Grassy Creek at SR 1549, Ashe County (left) and Howard Creek at SR 1306, Watauga County (right).

Characteristics of low to poor quality habitat streams are (Figure 3):

- a substrate of primarily sand with instream bar development;
- an absence of riffles; if present, they are infrequent and usually caused by embedded, coarse woody debris; and
- a deeply entrenched channel with easily erodible and unstable, vertical, sparsely vegetated banks offering minimal shading.

The Cranberry Creek and Naked Creek watersheds would be ideal candidates for stream restoration and bank stabilization/re-vegetation projects.



Figure 3. Narrow riparian zones and a lack of canopy at Cranberry Creek at SR 1600 (left) and at Naked Creek off SR 1589 (right), Ashe County.

Habitat and NCIBI Relationships

The habitat vs. NCIBI relationship for the New River Basin is weak (Figure 4), in part because only 34 samples have been collected during the past 10 years and the fact that it seems that the fish communities are not strongly influenced by the proximal instream and riparian habitats. For example, Cranberry Creek was rated Excellent in 1998 and a very high Good in 2008, yet the total habitat scores were 46 and 53, respectively. Conversely, Grassy Creek had a total habitat score of 95, but was rated Good-Fair. Only four samples had total habitat scores less than 65 (low to poor quality habitats); about an equal number of samples had scores between 65 and 80 (moderate quality) and greater than 85 (high quality). Combining

the two assessment periods, 2 sites rated Excellent, 18 as Good, 5 as Good-Fair, 3 as Fair, 0 as Poor, and 8 as Not Rated. In 2008, 75 percent of the sites with a Good rating and 100 percent of the sites with a Good-Fair rating had moderate to high quality habitats (Table 4). Two sites rating Fair or Good had low to poor quality habitats.

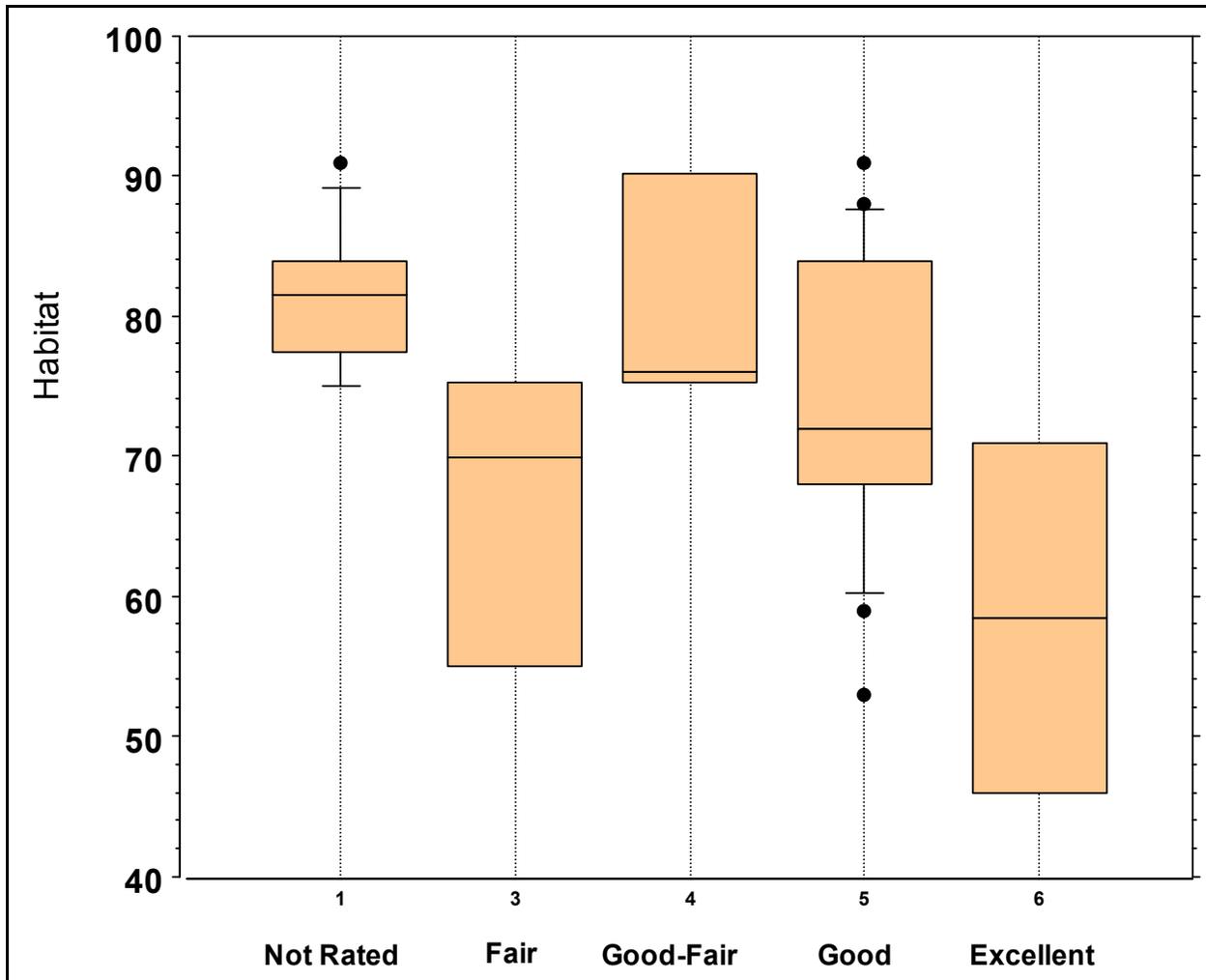


Figure 4. Relationship between total habitat scores and NCIBI ratings in the New River basin, 1998 and 2008.

One possible explanation for the weak relationships may be that of more importance to the community is the condition and landuse characteristics of the entire watershed from the sample site upstream to the headwaters, rather than the proximal conditions. For example, the immediate instream and riparian habitat characteristics were of very high quality at Grassy Creek, but the watershed appeared to be in pasture with grazing livestock and limited forests. The fish community responded to these entire watershed impairments by being rated as Good-Fair rather than the proximal habitat conditions. Similar situations may also be occurring where the community rated better than expected and where the community rated lower than expected (Table 4).

Table 4. NCIBI ratings and habitat quality for 22 streams of the New River basin, 2008.¹

NCIBI Rating	Waterbodies with Low to Poor Quality Habitat (Score < 65)	Waterbodies with Moderate to High Quality Habitat (Score ≥ 65)
Excellent	None	None
Good	Cranberry Cr, Big Horse Cr, S Fk New R	Little R, Glade Cr, Elk Cr, Brush Cr, Pine Swamp Cr, Obids Cr, Roan Cr, Big Laurel Cr, N Fk New R
Good-Fair	None	Grassy Cr, Prathers Cr
Fair	Naked Cr	Crab Cr
Poor	None	None
Not Rated	None	Helton Cr, Meat Camp Cr, M Fk S Fk New R, Howard Cr, Three Top Cr., Buffalo Cr

¹Blue denotes streams with moderate to high quality habitats and fish communities rated Good or Excellent. Red denotes streams with low to poor quality habitats and fish communities rated Fair or Poor.

Appendix F-7. Water quality at 22 fish community sites in the New River basin, 2008.

Water quality data (temperature, specific conductance, dissolved oxygen, and pH) were collected at each site during fish community assessments in 2008 (Table 1). The magnitude of water temperatures were a function of time of day and canopy cover. No dissolved oxygen concentrations were less than the respective water quality standard for any of the streams (e.g., 5 mg/L for Class C waters and 6 mg/L for trout waters). Dissolved oxygen saturation ranged from 78 percent at the South Fork New River to 99 percent at Crab Creek. Saturation was a function of time of day, canopy cover, and periphyton production. Conductivity (specific conductance) ranged from 29 $\mu\text{S}/\text{cm}$ at Pine Swamp and Brush Creeks to 126 $\mu\text{S}/\text{cm}$ at the South Fork New River which has an urbanized and industrial watershed and receives effluent from the Town of Boone's WWTP (NC0020621, $Q_w = 3.2$ MGD) (Table 1 and Figure 1). The elevated readings at Naked Creek and Middle Fork South Fork New River were also a function of being downstream from permitted dischargers, having urbanized areas within the watersheds, and being situated in agricultural valleys with golf courses along their banks. Eighteen of the 22 pH measurements met the water quality standard (6 s.u.-9 s.u.), measurements less than 6 s.u. and not meeting the water quality standard were recorded at Cranberry, Elk, and Glade Creeks and at the Little River.

Table 1. Water quality measurements at 22 fish community sites in the New River basin, 2008. Red bold denotes less than the water quality standard.

Waterbody	Location	County	Date	Temperature (°C)	Specific Conductance ($\mu\text{S}/\text{cm}$)	Dissolved Oxygen (mg/L)	Saturation (%)	pH (s.u.)
S Fk New R	US 421	Watauga	05/22/08	11.7	126	8.5	78.4	6.0
M Fk S Fk New R	SR 1522	Watauga	05/22/08	12.3	92	9.3	86.9	6.4
Howard Cr	SR 1306	Watauga	05/21/08	15.1	45	9.3	92.5	6.5
Meat Camp Cr	SR 1335	Watauga	05/21/08	13.2	42	9.8	93.5	6.5
Cranberry Cr	SR 1600	Ashe	05/08/08	15.4	39	9.1	91.1	5.7
Obids Cr	SR 1192	Ashe	05/09/08	15.5	37	9.3	93.3	6.4
Roan Cr	SR 1588	Ashe	05/19/08	12.5	38	10.4	97.6	6.1
Naked Cr	off SR 1589	Ashe	05/09/08	15.6	104	8.1	81.4	6.2
Prathers Cr	off SR 1302	Alleghany	05/07/08	17.2	42	8.7	90.4	7.2
N Fk New R	SR 1119	Ashe	05/21/08	11.2	59	10.2	93.0	6.5
Three Top Cr	SR 1143	Ashe	05/20/08	14.4	38	9.5	93.0	6.4
Big Laurel Cr	NC 88	Ashe	05/20/08	13.8	42	9.9	95.7	6.4
Buffalo Cr	NC 88/194	Ashe	05/19/08	17.0	62	9.3	96.3	6.9
Big Horse Cr	SR 1350	Ashe	05/20/08	12.5	46	9.7	91.1	6.0
Helton Cr	SR 1536	Ashe	05/08/08	14.9	57	9.7	96.0	7.4
Grassy Cr	SR 1549	Ashe	05/08/08	18.0	84	8.5	89.8	7.7
Elk Cr	SR 1341	Alleghany	05/07/08	11.9	50	9.6	88.9	5.8
Little R	SR 1128	Alleghany	05/06/08	9.9	35	10.3	91.1	5.5
Pine Swamp Cr	SR 1128	Alleghany	05/06/08	12.4	29	10.0	93.7	6.1
Glade Cr	SR 1422	Alleghany	05/06/08	16.2	32	9.2	93.6	5.9
Brush Cr	SR 1433	Alleghany	05/05/08	17.7	29	9.0	94.5	6.2
Crab Cr	NC 18	Alleghany	05/05/08	16.1	50	9.7	98.5	6.7

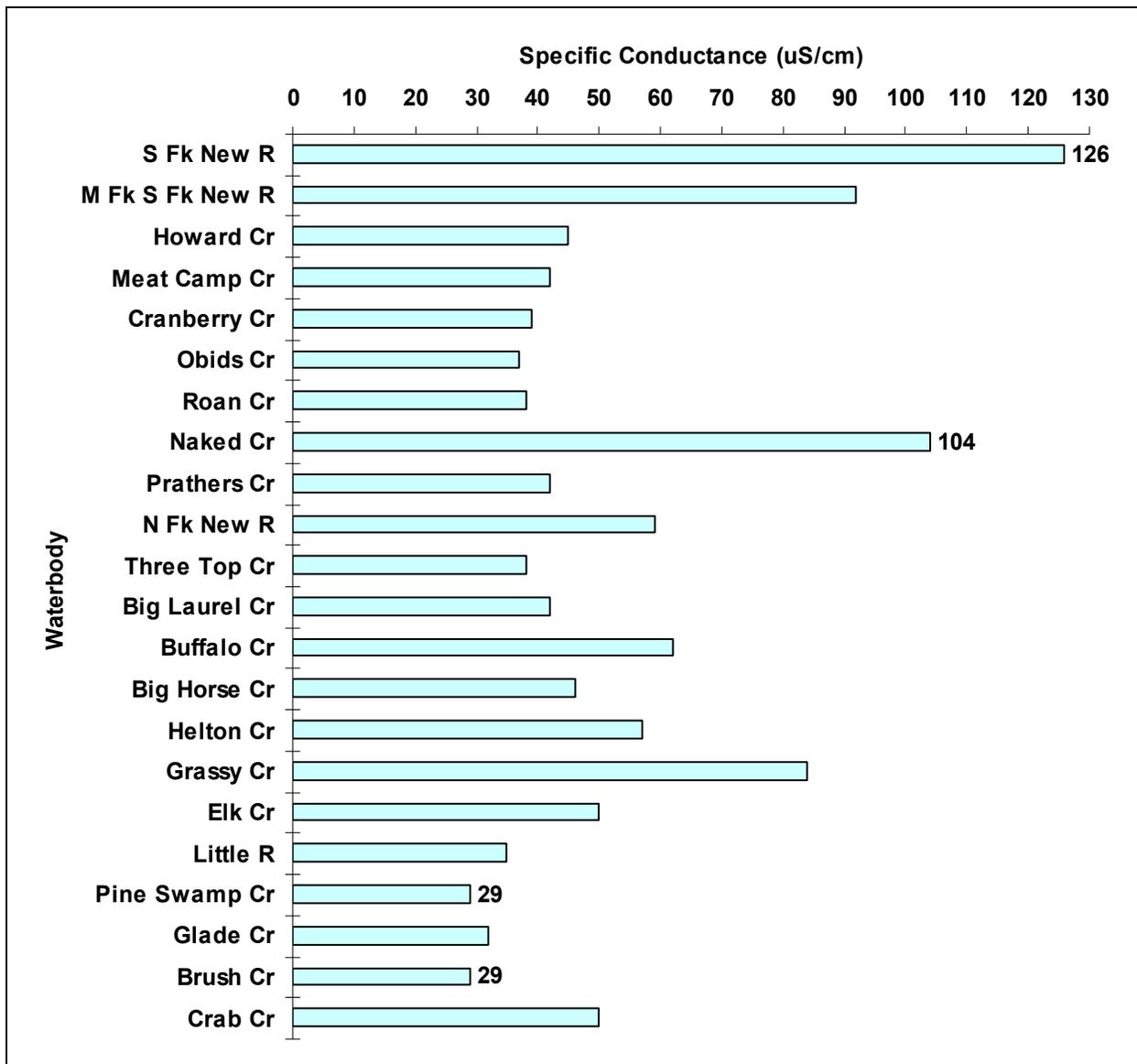


Figure 1. Specific conductance at 22 fish community sites in the New River basin, 2008.

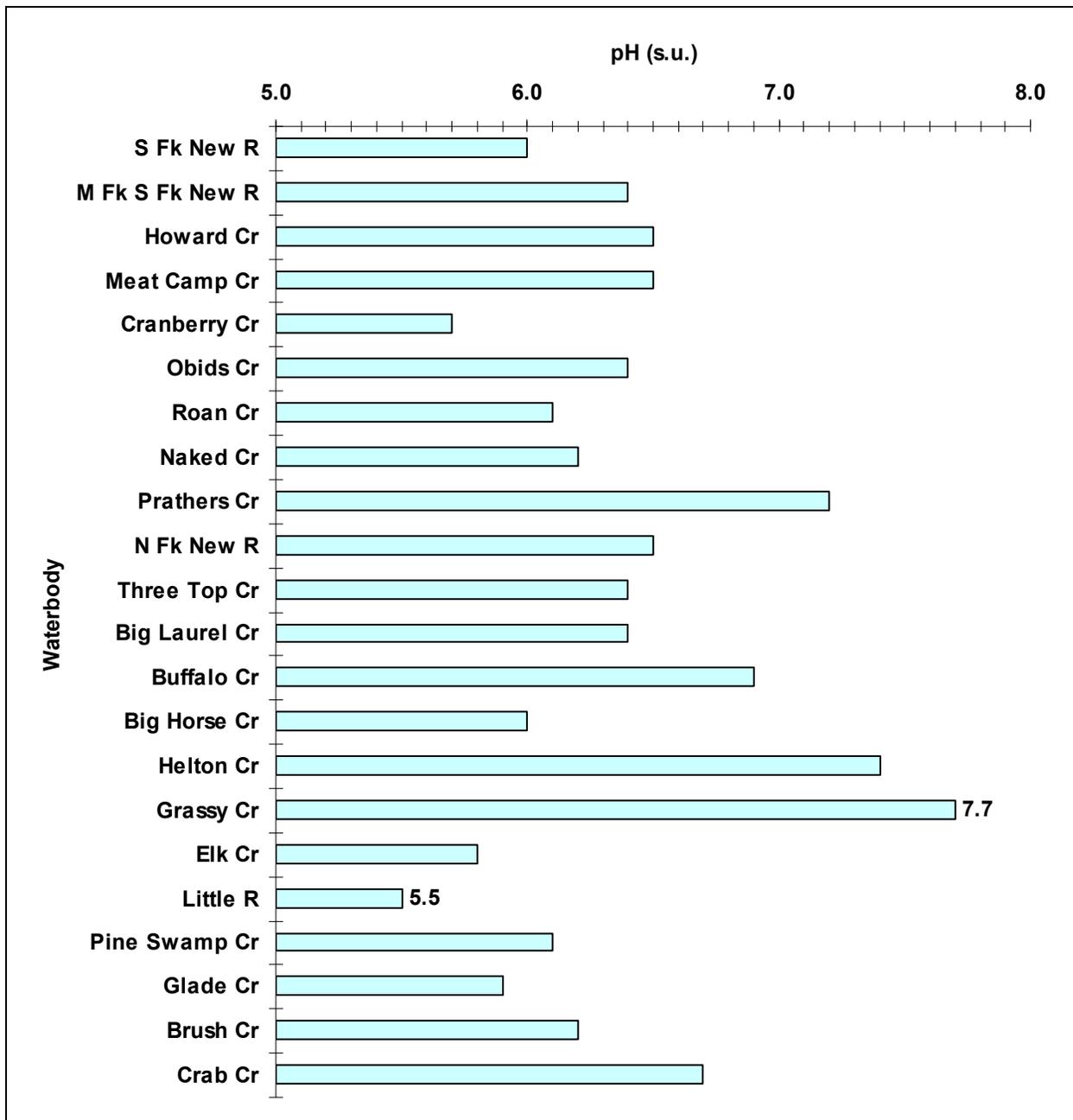


Figure 2. pH at 22 fish community sites in the New River basin, 2008.

Appendix F-8. Fish community references.

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Appendix G-1. Flow measurement and flow conditions in the New River basin.

Useful web links for drought and flow-related data may be found in Table 1. Between March 2007 and December 2008, the basin has been experiencing drought-like conditions. Area-weighted averages for the HUC 05050001 in North Carolina and Virginia from January 04, 2000 to November 25, 2008 have ranged from Normal to Extreme (Figure 1). Since January 2000, the basin has been in a Moderate, Severe, or Extreme drought more than one-third of the time; normal conditions have prevailed slightly less than 50 percent of the time.

Table 1. Drought and flow-related web sites.

Source	Web Address
National Weather Service Forecasts Office, Raleigh, NC	http://www.meas.ncsu.edu/nws/www/cases/
NC Division of Water Resources, Drought Monitoring	http://www.ncwater.org/Drought_Monitoring/
NC Drought Management Advisory Council	http://www.ncdrought.org/archive/index.php
USGS (real-time streamflow data for North Carolina)	http://waterdata.usgs.gov/nc/nwis/current?type=flow

Between January 01 and September 30, 2008, the lowest daily mean flow at the only USGS gauge site in the basin, the South Fork New River at Jefferson, was 73 cfs on August 24th; the greatest daily mean flow was 2,610 cfs on March 5th (Figure 2). The lowest daily mean flow on record for this site is 65 cfs recorded on September 09, 1925 (Weaver 2005). During fish community sampling from early to mid-May 2008, flows were approximately 60 percent of the historical median daily flows (Figure 2). The last time fish community assessments were conducted in the basin was in June 1998 when daily flows were consistently well-above the historic median flow (Figure 3). During benthic macroinvertebrate sampling from July through August 2008 flows were often well below median flow.

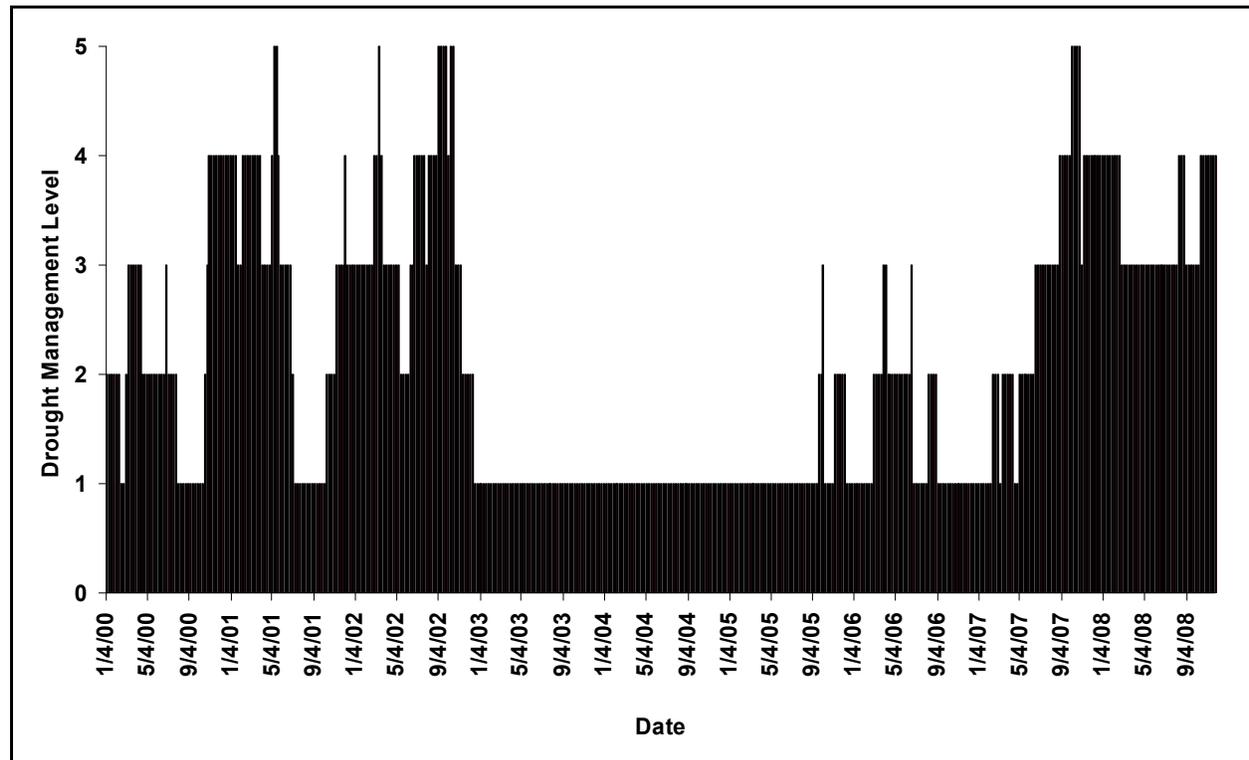


Figure 1. Drought monitor history (area weighted average) for HUC 05050001 in North Carolina and Virginia, January 04, 2000 – November 25, 2008. Drought Management Level 1 = Normal, 2 = Abnormally Dry, 3 = Moderate, 4 = Severe, and 5 = Extreme. Data modified from http://www.ncwater.org/Drought_Monitoring/dmhistory/?type=HUC8&id=05050001.

During the past 10 years, the basin has experienced prolonged droughts, e.g., 1998-2002 and 2007-2008, and exceptionally high flows resulting from the remnants of hurricanes (Figures 2 and 3). During a three week period in September 2004, the tropical storm remnants of Hurricanes Frances, Ivan, and Jeanne lead to wide-spread flooding throughout the central and northern mountains in the Catawba, French Broad, New, and Watauga River basins. Rainfall estimates for the combined three storms totaled more than 20-30 inches in certain watersheds. Runoff from the storms produced flash-floods throughout the region with peak flows in excess of 10,000 cfs (approximately 500 times median flows) in upper tributary streams; peaks flows in some tributary rivers exceeded 50,000 cfs. In the New River basin, the peak flow during Hurricane Frances (September 7th - 9th) was 14,700 cfs which had an approximate recurrence interval of 10 to 25 years. During Hurricane Ivan (September 17th & 18th) the peak flow was 7,550 cfs which had an approximate recurrence interval of 2 to 5 years.

Changes in the benthic macroinvertebrate community are often used to help assess between-year changes in water quality. However, some between-year changes in the communities may be due partly to changes in flow. High flows magnify the potential effects of nonpoint source runoff and in areas of high imperviousness, this can lead to scour, substrate instability, and reduced periphyton. Low flows may accentuate the effect of point source dischargers by providing less dilution of wastes. Whether a change is flow-related is decided on a site-by-site basis, looking at:

- Flow. The daily flow patterns over a six to twelve month period prior to the collections are examined using the most comparable records from USGS gaging stations. Areas primarily affected by nonpoint source runoff are expected to have a decline in water quality after high flow, but may improve during low flow. The exception to this rule is the smaller headwater streams, which may cease flowing during extreme droughts. Streams affected primarily by point source dischargers may improve after high flow (with dilution of the effluent) and decline after low flows. These changes, however, occasionally produce a between-year change of only one bioclassification.
- Changes throughout the subbasin, especially at reference sites. Flow-related changes usually affect a whole group of sites, not just single sites.
- Changes in species composition. Real changes in water quality are usually reflected in a significant change in the composition of the invertebrate community.

Consequently, all between-year changes in the biological communities are considered in light of flow conditions. Daily flow information is obtained from the closest available USGS monitoring site and compared to the long-term median flows. High flow is defined by BUA Staff as a median flow greater than 140 percent of the long-term median for that time period, usually July or August. Low flow is defined as a median flow less than 60 percent of the long-term median, while normal flow is 60 percent to 140 percent of the median. Although broad scale regional patterns are often observed, there may be large geographical variation within the state and large variation within a single summer period.

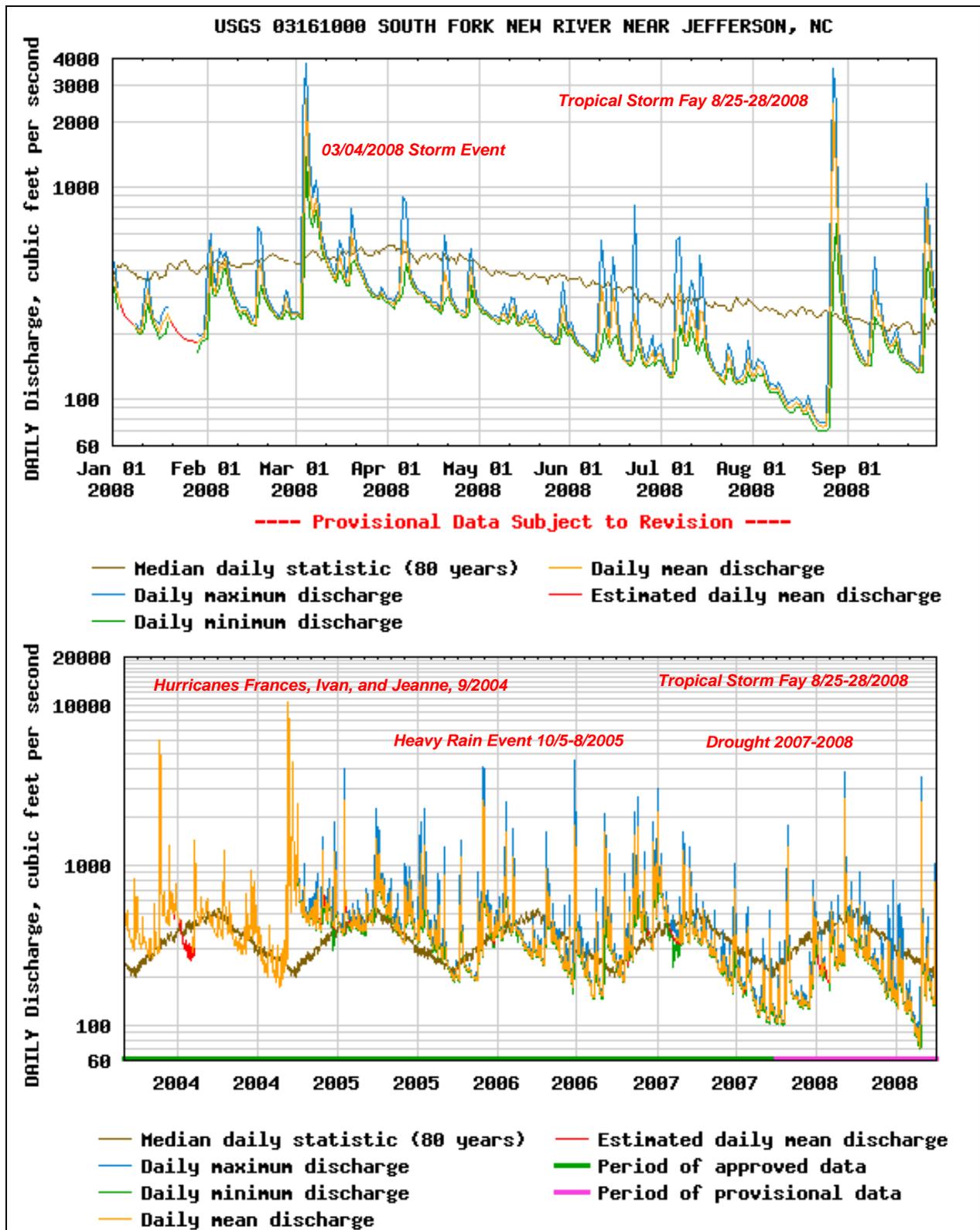


Figure 2. Flows in the South Fork New River near Jefferson from January 01, 2008 – September 30, 2008 (top) and from September 30, 2003 to September 30, 2008 (bottom).

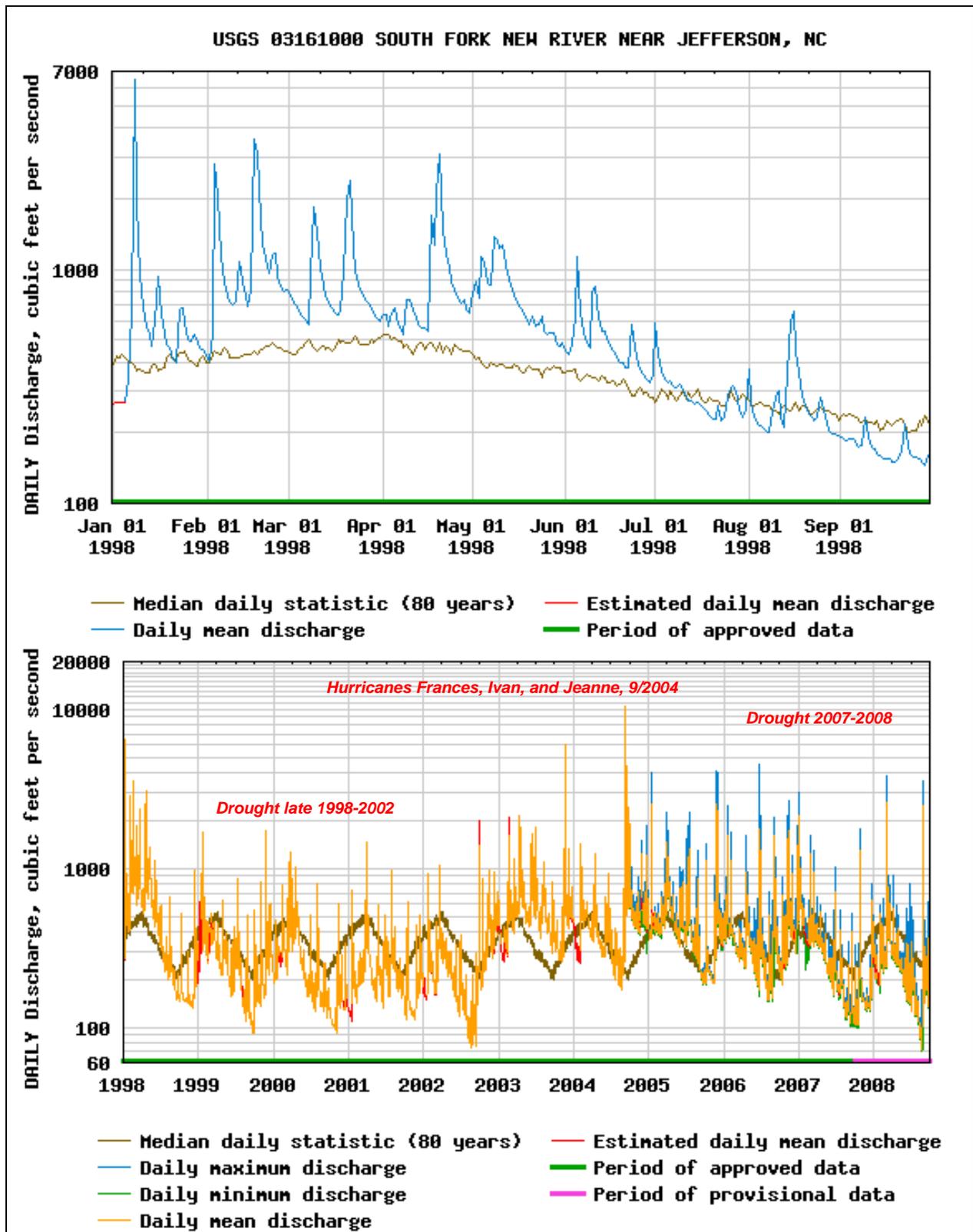


Figure 3. Flows in the South Fork New River near Jefferson, January 01, 1998 – September 30, 1998 (top) and from September 30, 1998 to September 30, 2008 (bottom).

Appendix S-1. Fish and benthos site summaries for basinwide sites collected in the New River basin for the 2008 cycle.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
NEW R	SR 1345	KB34	08/19/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.552222	-81.183333	10b	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; ORW	823	2335	125	0.4

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	40	10	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Boone, Jimmy Smith WWTP	NC0020621	4.82
United Chemi-Con, Inc.	NC0000019	1.018

Water Quality Parameters

Temperature (°C)	26.1
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	75
pH (s.u.)	8.0

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	0
Left Riparian Score (5)	3
Right Riparian Score (5)	0
Total Habitat Score (100)	61

Site Photograph



Substrate	mix of gravel, sand; some boulder, cobble, bedrock
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/19/08	10535	105	50	4.58	3.42	Excellent
08/21/03	9236	86	51	3.61	3.13	Excellent
08/19/98	7721	73	37	4.40	3.53	Good
07/26/93	6278	102	47	4.70	3.61	Excellent
07/11/90	5376	99	49	4.88	3.52	Good

Taxonomic Analysis

Despite having 11 prior sampling events, there were still several EPT taxa reported for the first time at the site in 2008, including: *Acroneuria evoluta*, *Apatania*, *Protoptila*, *Mystacides*, *Oecetis avara*, and *Trienodes perna/helo*. Also collected for the first time at the site was the midge *Cricotopus nostocicola*; there are only nine other records for the species in the BAU database.

Data Analysis

The site is 4.6 northwest of Sparta. The site receives water from the North Fork and South Fork New River catchments along with smaller catchments in Virginia.

The site has undergone yearly summer benthic sampling from 1983 through 1990, then once each five years beginning in 1993. The site has received ratings of either Good or Excellent following each sampling event. EPT Richness range from 37 to 51; NCBI values from 3.61 to 5.53. EPT richness in 2008 is near the highest value for the site; NCBI value is near the middle of the range. Overall the benthic community at the site has generally been stable since 1983.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
S FK NEW R	US 421	KB16	08/19/08	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.220833	-81.640000	10-1-(3.5)b	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C:+	35	3088	15	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	0	100	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Boone, Jimmy Smith WWTP	NC0020621	4.82

Water Quality Parameters

Temperature (°C)	23.7
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	276
pH (s.u.)	7.6

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	10
Bottom Substrate (15)	6
Pool Variety (10)	10
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	2
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	1
Total Habitat Score (100)	58

Site Photograph



Substrate	mix of cobble, gravel, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/19/08	10551	75	19	5.80	4.88	Fair
11/04/03	9302	---	11	---	4.25	Fair
08/20/03	9257	67	24	5.46	4.81	Good-Fair
08/17/98	7734	71	22	5.68	4.14	Good-Fair
07/12/93	6261	69	18	6.17	3.80	Fair

Taxonomic Analysis

The 2008 sample is dominated by taxa that are pollution-tolerant. Abundant mayflies found here in 2008 included: *Pseudocloeon propinquum*, *Plauditus dubius* group, *Heterocloeon anoka*, *Isonychia*, and *Baetis flavistriga*. Other abundant taxa here that are considered generalists and are tolerant were the caddisfly *Cheumatopsyche* and the dragonfly *Calopteryx*.

Data Analysis

The South Fork New River at US 421/221 rated Fair in 2008, the same rating as in 2003. There have been eight samples collected here from 1984 through 2008. Of the seven summer samples (all Full Scale samples) this site rated Fair four times and Good-Fair thrice. This site is just downstream of the Boone WWTP. The 2004 Basinwide Assessment Report noted a gradual decrease in the Biotic Index here (indicating a slightly more pollution-sensitive benthic community) in relation to reductions in NH3 and TKN from effluent from the Boone WWTP beginning in 1998. Unfortunately this trend did not continue in 2008 and the Biotic Index is now back to the level it was in the mid 1990's which indicates a more pollution-tolerant benthic community. This watershed is also heavily agricultural. A large silt load covers 40% of the benthos of this reach limiting habitat for aquatic macroinvertebrates. There is very little substrate over 10 inches in length in this reach. Overall habitat quality here is low and has been since at least 2003 (scores of 58, 59 and 60).

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
S FK NEW R	US 421	05/22/08	KF12	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.220736	-81.639974	10-1-(3.5)b	Southern Crystalline Ridges & Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C, +	34.2	3100	13	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	70	15	10	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Boone WWTP (0.9 miles upstream)	NC0020621	4.8

Water Quality Parameters

Temperature (°C)	11.7
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	126
pH (s.u.)	6.0

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	5
Pool Variety (10)	4
Riffle Habitat (16)	10
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	63

Site Photograph



Substrate	gravel, sand, boulder, silt.
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/22/08	2008-49	22	56	Good
06/08/98	98-51	20	52	Good

Most Abundant Species	Western Blacknose Dace.
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Exotic Species	Rock Bass, Rainbow Trout, Brown Trout.
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Species Change Since Last Cycle	Gains -- Kanawha Minnow, Greenside Darter, Kanawha Darter, Appalachia Darter. Losses -- Bluegill.
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Data Analysis

Watershed -- this large site is located in the northeast corner of Boone and drains the entire southern-most tip of the New River basin in Watauga County, including the catchments of Winkler Creek, Middle Fork South Fork New River, and East Fork South Fork New River. **Habitats** -- shallow runs, with a few large riffles, and a few shallow side pools; the canopy was open due to the river's width, but the banks were generally healthy; substrates were highly embedded in this reach of the river; conductivity was elevated because of Boone's WWTP. **2008** -- an extremely diverse and abundant (n=2058) community of fish was collected, including eight intolerant taxa, three of which were not previously collected; Western Blacknose Dace (n=524) comprised 25% of the sample, and Central Stoneroller represented 24% (n=484). **1998-2008** -- although many more fish were collected in 2008, little difference exists between the trophic structures and NCIBI values between samples, suggesting that little has changed in this watershed over a 10 year period (in spite of upstream fish kill in 2003); overall, the fish community continues to thrive here, and suggests good water quality.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
S FK NEW R	SR 1169	KB2	08/18/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.299167	-81.468056	10-1-(20.5)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-V; HQW	143	2830	25	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	25	0	75	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Boone, Jimmy Smith WWTP	NC0020621	4.82

Water Quality Parameters

Temperature (°C)	23.4
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	105
pH (s.u.)	9.2

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	8
Pool Variety (10)	0
Riffle Habitat (16)	7
Left Bank Stability (7)	2
Right Bank Stability (7)	5
Light Penetration (10)	2
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	42

Site Photograph



Substrate	mix of cobble, gravel, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/18/08	10547	99	38	4.84	3.78	Good
08/21/03	9263	98	45	4.19	3.33	Excellent
08/18/98	7737	101	48	4.61	3.64	Excellent

Taxonomic Analysis

Small changes in rare and in some cases common taxa were the main differences between the 2008 collection and past collections. Only one taxonomic group showed any drastic changes: the dragonfly family Gomphidae. In both 1998 and 2003 four taxa were found in the samples but in 2008, this group was absent. One unusual chironomid taxa was found in 2008: *Polypedilum* sp. P. The infrequently collected caddisfly *Oecetis avara* was first collected here in 2008. There are only 37 BAU records of this species. Overall EPT and total diversity remains high here.

Data Analysis

This South Fork New River site rated Good in 2008, a decrease from Excellent in both 1998 and 2003. An increase in the Biotic Index indicates that a more pollution-tolerant community resides in this reach than did in previous years. The number of EPT taxa was also lower in 2008 compared with 1998 and 2003. This reach earned a low habitat score due to limited in-stream habitat including substrate sizes that consisted mostly of sand, silt and gravel. The water quality at SR 1169 is an improvement from the next site upstream of here (at US 421, approximately 20 miles upstream). That site rated Fair in 2008.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
S FK NEW R	NC 16/18	KB3	06/19/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.393056	-81.407222	10-1-(26)b	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV;HQW	205	2660	40	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	60	30	10	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Boone, Jimmy Smith WWTP	NC0020621	4.82

Water Quality Parameters

Temperature (°C)	23.1
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	66
pH (s.u.)	8.5

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	69

Site Photograph



Substrate	mix of bedrock, boulder, cobble, gravel, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/19/08	10474	106	54	4.26	3.48	Excellent
08/22/03	9271	104	58	3.67	3.12	Excellent
08/18/98	7742	95	48	4.01	3.44	Excellent
07/14/93	6270	104	51	3.41	2.75	Excellent
07/11/90	5375	97	50	3.79	3.11	Excellent

Taxonomic Analysis

A large number of taxa were collected here in 2008. The number of EPT taxa collected was 54, only 4 fewer than in 2003, but the total number of taxa collected was slightly higher in 2008 than 2003 (106 versus 104). A diverse aquatic macroinvertebrate community resides in this reach of the South Fork New River. Abundant taxa in past years were generally both collected again in 2008 and were also abundant. Some notable taxa were first collected at the site in 2008, including: the mayflies *Drunella lata*, *Eurylophella aestiva* and *Anthopotamus* (all common in the sample); the stoneflies *Acroneuria mela* and *Agnetina annulipes* (both rare in the sample); and the caddisfly *Apatania* (common in the sample).

Data Analysis

This South Fork New River site rated Excellent again in 2008 as it has following each prior sampling event since 1987. The 2008 sample was collected one to two months earlier in the year than past samples, but still within the summer basinwide sampling window. This earlier sampling may have accounted for a few taxa not seen in previous samples (e.g. *Drunella lata*, *Eurylophella aestiva*). Though the total number of aquatic invertebrate taxa collected in 2008 was greater than in all previous years, the Biotic Index was also higher suggesting a slightly more pollution-sensitive community than in past years.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
S FK NEW R	US 221 BELOW CRANBERRY CREEK	KB10	08/22/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.473889	-81.336944	10-1-(33.5)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
B:ORW	300	2545	25	0.4

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	25	25	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Boone, Jimmy Smith WWTP	NC0020621	4.82

Water Quality Parameters

Temperature (°C)	22.6
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	82
pH (s.u.)	8.1
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	11
Pool Variety (10)	10
Riffle Habitat (16)	10
Left Bank Stability (7)	3
Right Bank Stability (7)	6
Light Penetration (10)	0
Left Riparian Score (5)	1
Right Riparian Score (5)	4
Total Habitat Score (100)	63

Substrate mix of bedrock, boulder, cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/22/08	10563	102	49	4.41	3.26	Excellent
08/23/03	9272	112	47	4.62	3.43	Excellent
08/20/98	7749	112	55	4.24	3.57	Excellent
07/15/93	6273	103	46	4.06	3.09	Excellent

Taxonomic Analysis

A large number of taxa continue to inhabit this downstream section of the South Fork New River. Many pollution-sensitive taxa are abundant here, including the mayflies: *Heterocloeon curiosum*, *Acerpenna macdunnoughi*, *Serratella serratoides*, *Stenacron pallidum*, and *Leucrocota*. The pollution-sensitive stonefly *Acroneuria arenosa* and the caddisflies *Brachycentrus numerosus* and *Helicopsyche* were also abundant here in 2008. Most taxa collected in 2008 were also collected in previous years.

Data Analysis

This site has consistently rated Excellent since 1990. A total of thirteen samples have been collected from this location since 1983. The number of Total Taxa and EPT Taxa have remained high and the Biotic Index has been consistent in showing a pollution-sensitive aquatic community residing here. The site upstream of here (NC 16-88, approximately 18 miles upstream) was also Excellent. The US 221 site is the farthest downstream basinwide site on the South Fork New River. The South Fork and North Fork New River converge approximately 15 miles downstream of this site and then flow northward to Virginia a further five miles downstream. There are no permitted discharges between the US 221 site and the North Carolina-Virginia border, suggesting that an Excellent water quality rating could continue downstream to Virginia.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
M FK S FK NEW R	SR 1522	KB1	08/19/08	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.201389	-81.650000	10-1-2-(15)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV;CA:+	12	3100	5	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	0	0	100 (golf course/greenway trail)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	18.3
Dissolved Oxygen (mg/L)	9.3
Specific Conductance (µS/cm)	111
pH (s.u.)	6.9

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	6
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	2
Right Bank Stability (7)	3
Light Penetration (10)	2
Left Riparian Score (5)	0
Right Riparian Score (5)	2
Total Habitat Score (100)	56

Site Photograph



Substrate	mix of cobble, gravel, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/19/08	10550	---	27	---	4.19	Good-Fair
11/04/03	9307	---	29*	---	2.99	Good
08/20/03	9259	---	24	---	3.26	Good-Fair
08/17/98	7732	---	31	---	2.99	Good
07/12/93	6260	---	37	---	2.97	Excellent

*value corrected for seasonality

Taxonomic Analysis

In general, the EPT taxa found in the Middle Fork of the South Fork New River in 2008 were typical of previous collections. However, the most recent collection contained fewer EPT taxa than most of the past sampling efforts. This site supports an increasingly pollution-tolerant benthic community. Abundant taxa found in 2008 were cosmopolitan species (e.g. *Isonychia*, *Cheumatopsyche*, *Plauditus dubius* group) with few pollution-sensitive species.

Data Analysis

This site rated Good-Fair in 2008, the same rating it received in summer 2003. The four summer basinwide collections have seen this site go from Excellent and Good in 1993 and 1998 respectively, to Good-Fair in 2003 and 2008. The Biotic Index indicates that the benthic community is becoming more tolerant of aquatic pollution with sensitive species no longer residing in this reach. This site is located just downstream of Boone Golf Club, a large expanse of open area with only a narrow grass riparian zone and few trees. Silt and sand comprised 30% of the benthic area, limiting interstitial benthic habitats and increasing embeddedness. Additionally, there is a small reservoir 1.6 miles upsteam of this site and three minor dischargers (>1.5 miles upstream) that may be affecting the benthic community here. In October 2003, one of these dischargers, Blowing Rock Water Treatment Plant (WTP), spilled approximately 3,000 gallons of sodium hydroxide into the Middle Fork South Fork New River (BAU memorandum B-20031113). There does not appear to be any long term effect of this event on the macroinvertebrate community at SR 1522.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
M FK S FK NEW R	SR 1522	05/22/08	KF8	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.20128	-81.649851	10-1-2-(15)	Southern Crystalline Ridges & Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV, CA, +	12	3100	5	0.5	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	20	10	20 (golf course)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	12.3
Dissolved Oxygen (mg/L)	9.3
Specific Conductance (µS/cm)	92
pH (s.u.)	6.4

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	3
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	75

Site Photograph



Substrate	cobble, gravel, boulder, silt, sand.
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/22/08	2008-50	14	38	Not Rated
06/09/98	98-53	16	58	Excellent

Most Abundant Species	Mottled Sculpin.	Exotic Species	Green Sunfish, Bluegill, Rainbow Trout, Brown Trout.
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Species Change Since Last Cycle	Gains -- Green Sunfish, Rosyside Dace, Bluehead Chub, Creek Chub. Losses -- Rock Bass, New River Shiner, Kanawha Minnow, Longnose Dace, Greenside Darter, Kanawha Darter.
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Data Analysis

Watershed - a large trib to the South Fork New River; drains the southern-most tip of the basin. **Habitats** - riffles, runs, swift chutes, and a few snag pools; high substrate embeddedness; bordered by a golf course (left) and a fenced cattle operation (right) with narrow riparian widths; the four NPDES facilities (combined discharge of 1.0 MGD, 1.9 to 7.0 miles above) may have elevated the instream waste concentration during droughts. **2008** - a diverse and abundant community of fish (n=803) was collected, including two intolerant taxa (Tounguetied Minnow, and Rainbow Trout); however six of ten NCIBI metrics fell during this assessment. **1998-2003** -- the decline in bioclassification, and particularly the loss of four sparsely populated intolerant species (Rock Bass, New River Shiner, Kanawha Minnow, and Kanawha Darter - 18 individuals combined) may be related to a 2003 spill of sodium hydroxide (3,000 gal.), that occurred in Blowing Rock. These losses may be explained by the combined effects of this spill, and the urban nature of this stream. In light of these extremes, this site was Not Rated; it has likely seen impressive recovery toward its previous bioclass and may continue to improve.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
E FK S FK NEW R	SR 1522	KB12	08/19/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.202222	-81.648889	10-1-3-(8)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV;CA:+	7.2	3100	5	0.1

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	25	0	75 (golf course)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	18.5
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	61
pH (s.u.)	6.1
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	11
Bottom Substrate (15)	6
Pool Variety (10)	4
Riffle Habitat (16)	12
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	0
Total Habitat Score (100)	44

Substrate	mix of boulder, cobble, gravel, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/19/08	10549	---	31	---	3.54	Good
11/04/03	9306	---	3	---	5.21	Poor
08/20/03	9258	---	31	---	3.06	Good
08/17/98	7731	---	32	---	3.29	Good
07/12/93	6259	---	37	---	3.34	Excellent

Taxonomic Analysis

The EPT taxa found in the East Fork of the South Fork New River in 2008 were similar to past basinwide collections. Some taxa were collected in lower abundances (e.g. *Isonychia*) and some have yet to reestablish (e.g. *Maccaffertium pudicum* and *Ceratopsyche sparna*) following an acute, unknown event that occurred in 2003 after the basinwide sampling event for that year. In terms of EPT richness the benthic community has recovered to summer 2003 levels. This site still supports a pollution-intolerant benthic community.

Data Analysis

This site rated Good in 2008, the same classification it received in summer 1998 and 2003. The loss of benthic fauna in late 2003 following an acute, unknown event does not appear to have been permanent. This site was sampled in November 2003 as a reference site after a spill in the Middle Fork South Fork New River (BAU memorandum B-20031113). This East Fork site has no dischargers upstream nor any larger reservoirs which may have been the source of the problems seen in late 2003. Despite the ample evidence of being located just downstream of Boone Golf Club (e.g. grass clippings and golf balls in stream) the benthic fauna at this site appears less affected by the golf course in 2008 than the Middle Fork South Fork New River.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
WINKLER CR	SR 1549	KB17	08/19/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.198333	-81.673611	10-1-4-(3.5)a	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	5.5	3145	6	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	50	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

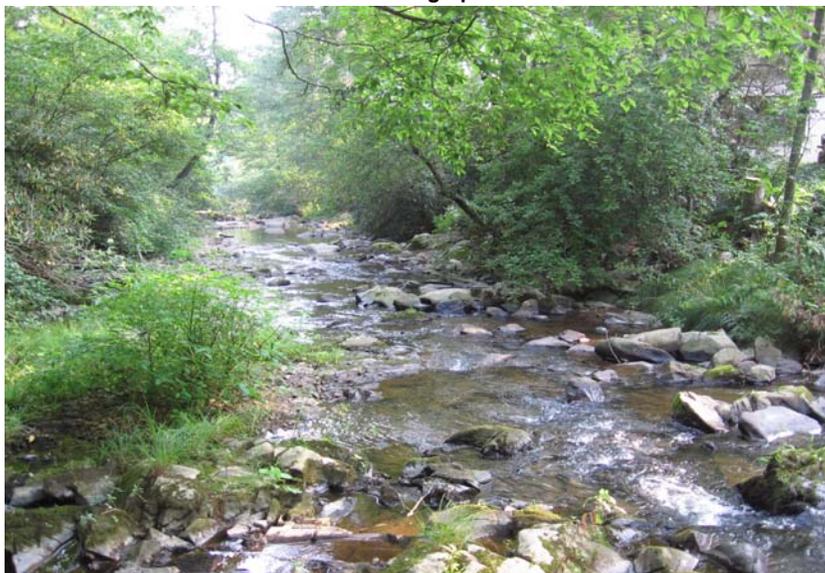
Temperature (°C)	16.2
Dissolved Oxygen (mg/L)	9.6
Specific Conductance (µS/cm)	46
pH (s.u.)	6.0

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	10
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	76

Site Photograph



Substrate mix of mostly bedrock and boulder with some cobble and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/19/08	10548	---	36	---	2.93	Excellent
08/21/03	9262	---	39	---	2.36	Excellent
08/17/98	7733	---	34	---	2.89	Good
07/12/93	6258	---	37	---	2.02	Excellent

Taxonomic Analysis

EPT taxa collected in 2008 were very similar to past samples here. Abundant taxa included the mayflies *Baetis pluto*, *Epeorus vitreus*, *Maccaffertium modestum*, *M. pudicum* and *Paraleptophlebia*. Six stonefly taxa were found at Winkler Creek with *Leuctra* and *Tallaperla* being dominant. Caddisflies were well represented with 12 taxa present, but only *Ceratopsyche sparna*, *Cheumatopsyche* and *Dolophilodes* were abundant. The less commonly collected caddisfly, *Mystacides* nr. *alafimbriata*, was found to be common here in 2008.

Data Analysis

The benthic site on Winkler Creek is near the headwaters of South Fork New River, and is located within and near the town limits of Boone. Much of the catchment upstream of the site is forested; only a very minor portion is urban.

Winkler Creek rated Excellent in 2008, the same as in 2003 and 1993. The number of EPT taxa collected here has remained stable since the first sampling effort in 1993. The low Biotic Index indicates a pollution-intolerant benthic community residing in this section of Winkler Creek.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HOWARD CR	SR 1306	05/21/08	KF6	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.241748	-81.66127	10-1-9-(6)	Amphibolite Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr,HQW	7.9	3198	7	0.4	No

Visible Landuse (%)	Forested/Wetland	Residential/School	Agriculture	Other (describe)
	85	15	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

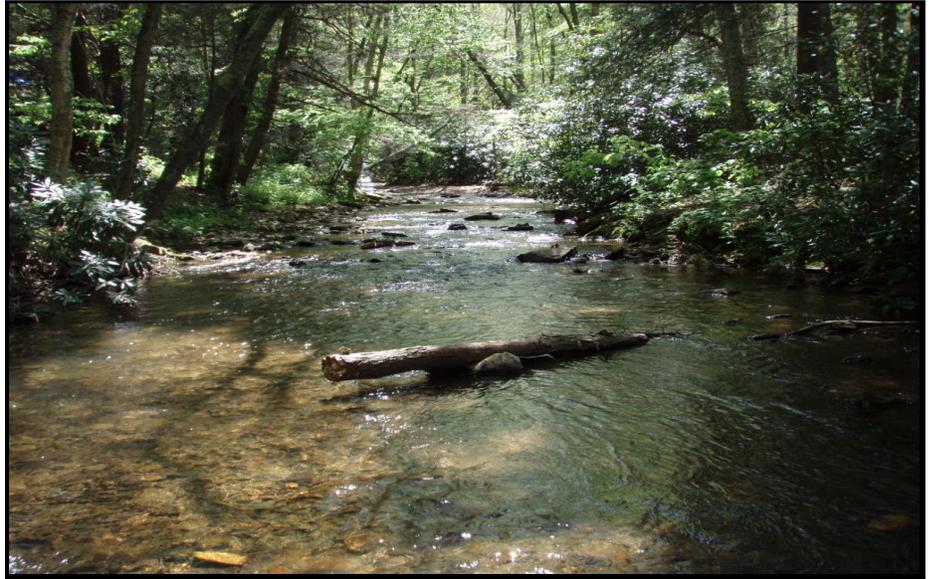
Temperature (°C)	15.1
Dissolved Oxygen (mg/L)	9.3
Specific Conductance (µS/cm)	45
pH (s.u.)	6.5

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	91

Site Photograph



Substrate	abundant flat rocks, cobble, gravel, boulder.
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/21/08	2008-48	17	--	Not Rated
06/08/98	98-52	12	--	Not Rated

Most Abundant Species	Central Stoneroller.	Exotic Species	Rock Bass, Redbreast Sunfish, Green Sunfish, Bluegill, Rainbow Trout, Brown Trout.
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Species Change Since Last Cycle	Gains -- Green Sunfish, Bluegill, Tonguetied Minnow, Bluehead Chub, Longnose Dace, Appalachia Darter. Losses -- Creek Chub.
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Data Analysis

Watershed -- a tributary to the North Fork New River located one watershed south of the Meat Camp Creek catchment in northeast Watauga County; drains the primarily forested area just north of Boone. **Habitats** -- high quality instream habitats consisting of excellent riffles, bedrock chutes, and pools; great canopy coverage offering abundant shade to the stream; very stable banks with a diverse mix of undisturbed vegetation in the riparian zones. **2008** -- a highly diverse mix of cold, cool, and warm water species was collected from this mountain stream, including four intolerant taxa (Rock Bass, Tonguetied Minnow, Appalachia Darter, and Rainbow Trout); Central Stonerollers represented 25% of the catch, and the six new species collected were represented by low abundances (maximum of 8 individuals). **1998-2008** -- a total of 18 fish species have been collected from this location, including two species of sucker, four species of sunfish (three of which are warm water exotics, suggesting alteration of the original population), six species of minnow, two darter species, and two trout species; overall, this stream appears healthy, and is supporting a rich community of fish through good quality water and habitats.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HOWARD CR	SR 1328	KB18	08/19/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.244444	-81.650000	10-1-9-(6)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr;HQW	10	3128	6	0.1

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	0	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	19.6
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	100
pH (s.u.)	7.0

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	89

Site Photograph



Substrate mix of boulder, cobble, gravel, sand and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/19/08	10552	---	44	---	2.19	Excellent
08/20/03	9254	---	35	---	2.35	Good
08/17/98	7735	---	40	---	2.64	Excellent
07/13/93	6262	102	52	3.85	2.87	Excellent
07/26/88	4633	---	38	---	3.22	Excellent

Taxonomic Analysis

Howard Creek contains a pollution-intolerant macroinvertebrate community dominated by taxa that one would expect to find in a minimally disturbed small mountain watershed (e.g. *Litobranche recurvata*, *Neophemera purpurea*). Shredders, such as the stoneflies *Tallaperla* and *Pteronarcys proteus*, were abundant in 2008.

Data Analysis

Howard Creek rated Excellent in 2008, an increase from Good in 2003. As noted in the 2003 report, the Good rating was one EPT taxon away from an Excellent rating. Data from 1988 to 2008 show consistently high water quality with a diverse and pollution intolerant macroinvertebrate community. Residential and commercial development appears to be increasing in this watershed but the sampled reach did not appear to be affected by this as of August 2008.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MEAT CAMP CR	SR 1335	05/21/08	KF24	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.271611	-81.658809	10-1-10	Amphibolite Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	10.7	3300	7	0.2	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	80	0	15	5 (road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	13.2
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	42
pH (s.u.)	6.5

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	0
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	75

Site Photograph



Substrate	cobble, gravel, boulder.
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/21/08	2008-47	10	--	Not Rated
06/09/98	98-54	11	--	Not Rated

Most Abundant Species	Mottled Sculpin.	Exotic Species	Rock Bass, Rainbow Trout, Brown Trout.
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Species Change Since Last Cycle	Gains -- Bluehead Chub, Rainbow Trout. Losses -- White Sucker, Northern Hogsucker, Rosyside Dace.
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Data Analysis

This site was moved about 2.7 miles upstream from the SR 1333 crossing (above Rittle Fork and Cobb Creek) to serve as a regional reference site. **Watershed** - a tributary to the South Fork New River that drains part of rural northeast Watauga County. **Habitats** - the 100% riffle habitats are high quality, but there are no functional pools in this 600 foot reach, and the lower 2/3 is completely without a canopy; however, bank stabilities are still good, and the substrates show relatively low levels of embeddedness, which suggests minor amounts of upstream sedimentation. **2008** - a fairly diverse mix of cold and cool water species was collected, including three intolerant taxa (Rock Bass, Kanawha Darter, and Rainbow Trout) and almost four times the abundance was observed at this new location (n=1060 vs. 271); Mottled Sculpin (cold water benthic insectivore) represented 84% of the sample. **1998-2008** - although separated by a few miles and Not Rated, the fish taxa collected at these two locations reflect similar trophic structures (in spite of the high number of Mottled Sculpin at SR 1335); overall, the fish community suggests good water quality characteristics in this catchment.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
MEAT CAMP CR	SR 1333	KB20	08/20/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.264444	-81.621944	10-1-10	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	20	3080	10	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	15.2
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	57
pH (s.u.)	7.0
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	97

Substrate mix of bedrock, boulder, cobble, gravel, sand and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/20/08	10554	---	39	---	2.80	Excellent
08/20/03	9255	---	35	---	2.81	Good
08/17/98	7736	---	39	---	2.69	Excellent
07/13/93	6263	---	31	---	2.52	Good
03/05/90	5205	---	37	---	2.60	Good

Taxonomic Analysis

In 2008 Meat Camp Creek contained 39 EPT taxa, equaling the largest number of taxa collected from this stream. Many of the species collected in 2003 and previous samples were found in 2008. Most of these taxa are sensitive to aquatic pollution. Several taxa appeared for the first time here in 2008. These included the caddisflies *Neophylax consimilis* (abundant in the sample), *Goera fuscula* (common), *Ceratopsyche morosa*, and *Neureclipsis* (both rare in the sample). The pollution-sensitive mayfly *Stenacron pallidum* (common) and *Tricorythodes* (rare) also appeared at this site for the first time in 2008.

Data Analysis

Meat Camp Creek rated Excellent in 2008. The Good rating received in 2003 was only one EPT short of an Excellent bioclassification. The number of EPT collected here during the five collections since 1990 suggest a stable, pollution-sensitive macroinvertebrate community at the site. Riparian habitat along this reach shows little disturbance and a variety of in-stream microhabitats exist for macroinvertebrate colonization despite a large percentage of bedrock. Water temperatures in Meat Camp Creek were the lowest recorded for all sites in this part of the HUC in 2008.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
NORRIS FK	SR 1337	KB21	08/19/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.280000	-81.676667	10-1-10-2	Amphibolite Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	3.3	3320	3	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	50	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	17.5
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	36
pH (s.u.)	6.9

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	3
Total Habitat Score (100)	78

Site Photograph



Substrate	mix of boulder, cobble, gravel, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/19/08	10553	---	35	---	2.11	Good
08/20/03	9256	---	36	---	1.56	Excellent

Taxonomic Analysis

Taxa collected in 2003 that were not found in 2008 included the caddisflies *Fattigia pele*, *Parapsyche cardis*, *Brachycentrus spinae* and *Apatania*. New caddisflies for this site in 2008 included *Ceratopsyche bronta*, *Pycnopsyche gentilis* and a second (unidentified) species of *Pycnopsyche*, *Polycentropus* and *Lype diversa*. The stoneflies *Suwallia* and *Isoperla* nr *holochlora* were present in 2003 though absent in 2008, while *Paragnetina immarginata* was absent in 2003 and present in 2008. These taxa differences resulted in a slightly higher EPT Biotic Index in 2008 compared with 2003. However, overall this site contains a pollution-intolerant macroinvertebrate community.

Data Analysis

Norris Fork at SR 1337 received a classification of Good in 2008, though the addition of a single EPT taxon would have pushed the classification up to Excellent. The difference in the number of EPT taxa between 2003 and 2008 is very small, but the difference in EPT Biotic Index values is relatively large. Many of the rare but highly intolerant taxa collected in 2003 were absent in 2008. Some recent development has occurred upstream of the site. Higher silt levels were seen in 2008 corresponding to ongoing land clearing activities here. A large number of lots were for sale at the time of sampling suggesting that development would continue in the watershed. Despite this, the EPT Biotic Index in Norris Fork was the second lowest in this part the HUC (formerly subbasin 1).

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
PINE ORCHARD CR	SR 1369	KB22	08/20/08	Not Impaired

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
WATAUGA	1	05050001	36.313333	-81.617222	10-1-15-1	Amphibolite Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	2.6	3080	4	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	50	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	16.1
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	46
pH (s.u.)	6.5

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	2
Total Habitat Score (100)	83

Site Photograph



Substrate mix of boulder, cobble, and gravel with a large amount of silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/20/08	10555	---	36	---	2.09	Not Impaired
08/21/03	9260	---	33	---	1.64	Excellent

Taxonomic Analysis

Small differences exist with the taxa collected at the site between 2003 and 2008, but overall the benthic community here remains diverse and pollution-sensitive. *Neophylax consimilis*, a pollution-intolerant case-making caddisfly, was abundant in 2003 and absent in 2008. However, two other taxa, *N. mitchelli* and *N. oligius*, were common in 2008. Abundant taxa collected in 2008 included these pollution-sensitive taxa: the mayfly, *Drunella conestee*; the stonefly *Malirekus hastatus*; and the caddisfly *Dolophilodes*.

Data Analysis

Pine Orchard Creek had the lowest EPT Biotic Index of any stream in this part of the HUC (formerly subbasin 1) indicating a very pollution-intolerant benthic community here. The classification for the site in 2003 was derived using High Quality Small Mountain Stream (HQSMS) criteria, which are used for stream sites with undisturbed drainage areas under 3.5 square miles. Recent aerial photos and streamside observations show the presence of disturbance from residences, agriculture, and state roads and highways in the watershed, therefore HQSMS criteria can not be applied to the site for 2008. Additionally, since no criteria have been completed for stream sites with drainage areas under 3.0 square miles with disturbance present, this site is given a classification of Not Impaired for 2008 (it would have been classified as Good with large-stream criteria). One notable difference in habitat at the site was an increase in silt from 2003 to 2008 (40% in 2008 versus 0% in 2003 by visual estimation).

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
PINE SWAMP CR	OFF SR 1179 AT MOUTH	KB108	08/18/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.312500	-81.464444	10-1-24	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C:+	11	2820	8	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	0	100	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	21.2
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	30
pH (s.u.)	6.4

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	10
Left Bank Stability (7)	2
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	3
Total Habitat Score (100)	66

Site Photograph



Substrate	mix of bedrock, boulder, cobble, gravel, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/18/08	10546	---	34	---	3.82	Good
08/19/03	9253	---	30	---	3.14	Good

Taxonomic Analysis

Macroinvertebrates collected in Pine Swamp Creek differed slightly between 2003 and 2008, with four more EPT taxa collected in the latter year. Taxa abundant in the sample were similar between 2003 and 2008, but rare and common taxa varied. New taxa that appeared in 2008 included the caddisflies *Ceratopsyche bronta*, *C. morosa* and the mayfly *Ephoron leukon*. The stonefly *Isoperla*, common in 2003, was not collected in 2008. The macroinvertebrate community residing in Pine Swamp Creek in 2008 appears to be slightly more pollution-tolerant than in 2003.

Data Analysis

Pine Swamp Creek at SR 1179 rated Good in 2008 despite the lack of a healthy riparian zone upstream. Active cow pastures and tree farms constitute a sizeable portion of the visible watershed upstream of the sampling reach. A large amount of silt was visible in this stream (30% of the substrate by visual estimation). Though more EPT taxa were found in 2008 than 2003, the Biotic Index for these macroinvertebrates was higher, suggesting a response to either chemical or physical stressors at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
S BEAVER CR	SR 1147	KB5	08/18/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.354167	-81.468056	10-1-25-2a	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	3.0	3020	3	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	---	---	---	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	16.3
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	48
pH (s.u.)	6.8

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	2
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	0
Total Habitat Score (100)	75

Site Photograph



Substrate mix of bedrock, boulder, cobble, gravel, sand and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/18/08	10411	---	35	---	2.83	Good
08/21/03	9264	---	31	---	2.68	Good

Taxonomic Analysis

The taxa collected in 2008 from South Beaver Creek were very similar to those collected in 2003. The list of abundant taxa in both years were nearly identical. Additional taxa seen in 2008 were mostly rare in abundance with a few exceptions, such as the mayflies *Stenacron pallidum*, *Maccertium modestum* and *Leucrocota* (all common in the sample). Generally, the macroinvertebrate community residing in this reach is pollution-sensitive and diverse.

Data Analysis

South Beaver Creek rated Good in 2008, the same rating as in 2003. One additional EPT taxon would have resulted in an Excellent bioclassification. Based on only two samples, the macroinvertebrate community at this site appears stable, diverse and pollution-sensitive. Drought conditions in 2008 resulted in most of the root mats being exposed. Typically, this type of habitat is heavily colonized by aquatic macroinvertebrates.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
OBIDS CR	SR 1192	KB6	08/08/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.345278	-81.404444	10-1-27-(2)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV;Tr:+	8.7	2700	5	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	0	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	18.5
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	38
pH (s.u.)	6.3

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	11
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	2
Right Bank Stability (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	71

Site Photograph



Substrate	mostly cobble with some boulder and gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/08	10410	---	31	---	3.28	Good
08/19/03	9252	---	32	---	3.16	Good

Taxonomic Analysis

The EPT taxa collected from Obids Creek in 2008 are very similar to those from the 2003 collection. An exception to this was the baetid mayfly *Baetis tricaudatus*, which was abundant in 2003 and absent in 2008. Despite this, all six other taxa from the mayfly family Baetidae were found here in 2008. Other "missing" taxa in 2008 were the heptageniid mayflies *Maccaffertium pudicum* and *M. ithaca*, which were common and abundant respectively. One rare taxon, *Mystacides nr alafimbriata*, was found in 2008. Only 17 records of this species exist in the BAU database going back to 1985. Four of these records, however, are in the New River drainage. Overall, 31 EPT taxa were found in 2008, one fewer than the number in the 2003 collection.

Data Analysis

Obids Creek rated Good in 2008, the same rating as in 2003. The taxa collected in both years are generally intolerant to aquatic pollution. A slight increase in the EPT Biotic Index reflects the few taxonomic differences and abundances between 2003 and 2008. The open canopy here has resulted in a higher water temperature than other nearby sampled streams of similar size. Additionally, cattle appear to have direct access to the stream which could be limiting in-stream habitat quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
OBIDS CR	SR 1192	05/09/08	KF13	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.345566	-81.4042353	10-1-27-(2)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV; Tr:+	8.3	2710	6	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	75	0	25	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	15.5
Dissolved Oxygen (mg/L)	9.3
Specific Conductance (µS/cm)	37
pH (s.u.)	6.4

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	2
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	84

Site Photograph



Substrate	Cobble, boulder, gravel, and silt
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/09/08	2008-37	17	50	Good

Most Abundant Species	Mottled Sculpin and Central Stoneroller	Exotic Species	Warpaint Shiner, Brown Trout, Rock Bass, Redbreast Sunfish, and Smallmouth Bass
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Species Change Since Last Cycle	N/A
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Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains southeastern Ashe County; no municipalities within the watershed; tributary to South Fork New River, site is ~ 600 ft. upstream from the creek's confluence with the river. **Habitat** -- high gradient riffles and plunge pools; *Rhododendron*- and Eastern Hemlock-lined banks; grasses and pastures in the riparian zones; unstable left bank; livestock with access to the stream. **2008** -- diversity of cyprinids and intolerant species were slightly lower than expected; proximity to the river enables the site to serve as a nursery area for Age 1 Rock Bass (n=124 collected) and Smallmouth Bass (n=26 collected); and two endemic species (Kanawha Darter and Appalachia Darter) were collected.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
ROAN CR	SR 1588	KB7	08/20/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.408056	-81.401944	10-1-31-(2)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
WS-IV; Tr; CA:+	7.0	2660	7	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	0	100	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	21.9
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	41
pH (s.u.)	6.9

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	15
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	76

Site Photograph



Substrate	mix of boulder, cobble, gravel and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/20/08	10558	---	32	---	3.18	Good
08/18/03	9245	---	44	---	3.03	Excellent
08/18/98	7741	---	39	---	2.61	Excellent
07/14/93	6271	---	39	---	3.02	Excellent

Taxonomic Analysis

Most taxonomic differences between 2003 and 2008 pertained to rare taxa. Exceptions to this were: the stone-cased caddisfly *Glossosoma*, which was abundant in 2003 but absent in 2008; the stoneflies *Isoperla* and *Malirekus hastatus* and the caddisfly *Rhyacophila fuscule*, which were all common in 2003 though absent in 2008. The caddisfly *Trienodes ignitus* appeared here in 2008 (and was common in the sample) but had not been found in previous collections.

Data Analysis

Roan Creek declined from Excellent in the first three samples collected here from 1993 through 2003, to Good in 2008. Four additional EPT taxa would be required for the site to attain a classification of Excellent in 2008. The EPT Biotic Index suggests a slightly more pollution-tolerant macroinvertebrate community than in past years. Overall however, the species residing in this reach contribute to a pollution-sensitive macroinvertebrate community. Noticeable amounts of silt in 2008, (30% by visual estimation compared to 0% in 2003) may have reduced the number of EPT taxa residing here by filling benthic interstitial habitat.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
ROAN CR	SR 1588	05/19/08	KF20	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.407949	-81.401772	10-1-31-(2)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV, Tr, CA+	6.7	2694	5	0.3	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	30	15	55	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	12.5
Dissolved Oxygen (mg/L)	10.4
Specific Conductance (µS/cm)	38
pH (s.u.)	6.1

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	8
Pool Variety (10)	8
Riffle Habitat (16)	16
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	77

Site Photograph



Substrate	gravel, cobble, sand, boulder.
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/19/08	2008-41	14	48	Good

Most Abundant Species	Mottled Sculpin	Exotic Species	Rock Bass, Smallmouth Bass, Brown Trout.
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Species Change Since Last Cycle	N/A
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Data Analysis

New basinwide site. **Watershed** -- a tributary to the South Fork New River that drains the southeastern central edge of Ashe County, located southeast of Jefferson. **Habitats** -- good riffles and runs, with one good pool that was holding trout; moderately embedded substrates, but cattle are fenced out of the stream, allowing generally healthy banks; narrow vegetated riparian widths on both sides of the stream and a canopy that provides equal amounts of sun and shade. **2008** -- a very abundant (n=1273), fairly diverse, and trophically balanced community of mostly cool and cold water fish species was collected, including four intolerant taxa (Rock Bass, Smallmouth Bass, Kanawha Darter, and Appalachia Darter); Mottled Sculpin represented 53% of the sample; in light of the agricultural land use in the watershed and lasting drought conditions, this stream appears fairly healthy as indicated by its instream habitats, water parameters, and its abundance of fish.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
NAKED CR	NC 16/88	KB8	08/20/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.408889	-81.433333	10-1-32b	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C:+	7.1	2750	5	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	0	100	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	24.4
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	122
pH (s.u.)	8.4

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	5
Right Bank Stability (7)	3
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	63

Site Photograph



Substrate a mix of boulder, cobble, gravel sand and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/20/08	10557	---	34	---	4.37	Good
08/19/03	9250	70	30	4.92	4.11	Good-Fair
08/18/98	7739	71	32	5.16	4.18	Good-Fair
07/14/93	6269	84	36	4.65	3.77	Good

Taxonomic Analysis

Naked Creek at NC 16-88 contains a typical benthic fauna for this part of the New River Basin. Abundant taxa collected in 2008 (and in most previous years) included the mayflies *Acentrella*, *Baetis flavistriga*, *Maccaffertium ithaca*, and *M. modestum*. Abundant caddisflies were *Ceratopsyche sparna*, *Cheumatopsyche*, *Hydropsyche betteni* and *Leucotrichia pictipes*. A few more EPT taxa were collected in 2008 than in recent samples. New taxa to this location in 2008 were the caddisflies *Neureclipsis*, *Oligostomis*, *Hydatophylax argus* and the stonefly *Pteronarcys proteus*.

Data Analysis

The few additional EPT taxa found in 2008 elevated this sample from Good-Fair to Good. Though this stream reach is entirely within an agricultural area (corn production), the headwaters of some small tributaries to this stream originate in Mount Jefferson State Park. A forested riparian buffer along this section of stream could aid in maintaining the Good bioclassification or possibly improving it.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
NAKED CR	OFF SR 1589 140 METERS UPSTREAM OF MOUTH	KB139	08/21/08	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.412902	-81.406828	10-1-32b	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C:+	13	2650	7	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	0	50	50 (golf course)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	20.8
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	140
pH (s.u.)	6.9
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	8
Riffle Habitat (16)	15
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	73

Substrate mix of boulder, cobble, gravel sand and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/08	10559	79	23	5.44	4.43	Good-Fair

Taxonomic Analysis

A greater number of taxa were collected here in 2008 compared with the former basinwide site in 2003. Coleoptera (beetles) and Gastropoda (snails) were the most notable groups that reflected greater diversity in 2008, with increases of five and four taxa respectively. Overall, most taxa collected in 2003 at the former basinwide site were also found in 2008 at the new site.

Compared with the upstream basinwide site on Naked Creek (at NC 16-88, which received a classification of Good), there were nine fewer EPT taxa. All abundant taxa collected upstream were found here. However, five taxa that were common in the upstream sample were absent at this site off SR 1589: the caddisflies *Neophylax consimilis*, *N. oligus*, and *Glossosoma*; and the mayflies *Epeorus vitreus* and *Maccaffertium pudicum*. The beetle *Cymbiodyta* (Hydrophilidae) was collected here in 2008; this is the first BAU record of the taxon in the New River drainage. This uncommon beetle has only been collected in 25 BAU samples since 1985.

Data Analysis

This site replaces the former basinwide site at SR 1585, which is about one stream-mile upstream. The former site is within a recently established gated community.

Naked Creek off SR 1589 rated Good-Fair in 2008, the same rating received at the former basinwide site at SR 1585 in 2003. The upstream basinwide site on Naked Creek at NC 16-88 rated Good in 2008. A golf course and the outfalls from two minor dischargers (Town of Jefferson WTP, permit NC0083470; Town of Jefferson WWTP, permit NC0021709) are situated between the upstream and downstream basinwide sites, and appear to have an effect on water quality at the downstream site.

According to the 2004 Basinwide Assessment Report, upgrades to the WWTP were ongoing at the time of sampling. The specific conductance measured 140 µmhos/cm in 2008, higher than in 2004 at SR 1585 (102 µmhos/cm). Also, habitat issues remain a problem here with large amounts of silt covering benthic surface and ongoing water withdrawals for lawn and golf course irrigation. At the time of the 2008 sampling event new homes were being constructed on the left side of the stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
NAKED CR	off SR 1589	05/09/08	KF14	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.413027	-81.4070488	10-1-32b	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;+	12.4	2670	8	0.4	No

Visible Landuse (%)	Forested/Wetland	Suburban	Agriculture	Other (describe)
	40	30	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Jefferson WWTP	NC0021709	0.6

Water Quality Parameters

Temperature (°C)	15.6
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	104
pH (s.u.)	6.2
Water Clarity	Turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	6
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	5
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	50

Substrate	Cobble, boulder, gravel, and silt
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/09/08	2008-36	20	36	Fair
06/09/98	98-55	12	34	Fair

Most Abundant Species

Central Stoneroller

Exotic Species

Warpaint Shiner, Brown Bullhead, Brown Trout, Rock Bass, Redbreast Sunfish, Pumpkinseed Sunfish, Smallmouth Bass, and Largemouth Bass

Species Change Since Last Cycle

Gains -- Spotfin Shiner, Warpaint Shiner, Spottail Shiner, Kanawha Rosyface Shiner, Brown Bullhead, Brown Trout, Redbreast Sunfish, Pumpkinseed Sunfish, Smallmouth Bass, Largemouth Bass, and Greenside Darter. Losses -- Blacknose Dace, Creek Chub, and Bluegill.

Data Analysis

1998 site was ~2.2 miles upstream at NC 16/88. **Watershed** -- drains south-central Ashe County, including the Town of Jefferson; golf course residential community is within the immediate watershed; WWTP discharge is ~ 2 miles upstream; tributary to the South Fork New River; site is ~ 700 ft. upstream from the creek's confluence with the river. **Habitat** -- lowest total habitat scores of any fish site in the basin in 2008; runs, riffles, slick periphyton; eroded vertical banks; open canopy within the golf course. **2008** -- diversities of darters, cyprinids, and intolerant species were lower than expected; the percentage of tolerant fish (primarily White Sucker and Redbreast Sunfish) was elevated for a mountain stream; high percentage of Omnivores+Herbivores; proximity to the river enables the site to serve as a nursery area for Age 1 Rock Bass (n=250) and a source of temporary migrants (Spotfin Shiner, Warpaint Shiner, Spottail Shiner, Kanawha Rosyface Shiner, and Greenside Darter); and the most nonindigenous species and the second greatest conductivity at any fish site in the basin in 2008. **1998 & 2008** -- 23 species known from the stream, including 2 endemic and 9 nonindigenous species.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
PEAK CR	OFF SR 1599 350 METERS UPSTREAM OF ORE KNOB BR	KB11	06/19/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.420833	-81.319444	10-1-35-(2)a	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
B;Tr:+	9.0	2700	6	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	75	25	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	18.0
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	38
pH (s.u.)	6.3

Water Clarity	clear
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Site Photograph



Substrate mix of bedrock, boulder, cobble, gravel and sand

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	93

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/19/08	10473	---	44	---	2.32	Excellent
08/18/03	9248	---	31	---	2.53	Good
08/19/98	7746	---	35	---	2.77	Good
04/08/96	7032	74	37*	4.01*	2.47	Excellent
07/15/93	6275	---	35	---	2.61	Good

* values corrected for seasonality

Taxonomic Analysis

A diverse and pollution-sensitive aquatic community resides in this section of Peak Creek (above the confluence of Peak Creek and Ore Knob Branch). In 2008, the number of EPT taxa was higher than in recent collections here (an April 1991 Full Scale sample yielded 50 EPT). Generally, the aquatic macroinvertebrate community was similar to past samples with abundant, pollution-sensitive taxa such as: the mayflies *Drunella cornutella*, *Paraleptophlebia*, *Stenacron pallidum*, and *Heptagenia*; and the caddisflies *Glossosoma*, *Ceratopsyche slossonae*, *Dolophilodes*, and *Neophylax oligius*. In 2008 an extremely rare caddisfly, *Hydropsyche carolina*, was found in Peak Creek. Only one other record exists for this taxon in the North Carolina BAU database going back to 1983.

Data Analysis

This section of Peak Creek rated Excellent in 2008. The second highest EPT totals and the lowest EPT Biotic Index summarize the 2008 sample here and highlight the high water quality conditions in this stream. An undisturbed riparian zone, diverse in-stream benthic surfaces and a mostly forested watershed have resulted in favorable conditions for macroinvertebrate colonization in this stream (as indicated by the high habitat score received).

The location name for this site was formerly "SR 1599."

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
PEAK CR	SR 1599 DOWNSTREAM OF ORE KNOB BRANCH	KB13	08/21/08	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.425000	-81.325000	10-1-35-(2)b	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
B;Tr:+	11	2680	8	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	75	25	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	19.3
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	170
pH (s.u.)	3.1

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	82

Site Photograph



Substrate	mix of bedrock, boulder, cobble, gravel, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/08	10561	---	3	---	2.62	Poor
08/18/03	9247	---	6	---	1.91	Poor
01/13/99	7798	---	5*	---	1.60	Poor
08/19/98	7747	---	23	---	3.10	Good-Fair
04/08/96	7026	30	14*	4.18*	2.10	Fair

* values corrected for seasonality

Taxonomic Analysis

In 2008 only three EPT taxa were collected: *Pycnopsyche gentilis* (one specimen), a second unidentified species of *Pycnopsyche* (three specimens), and *Hydropsyche venularis* (one specimen). Precipitate from acid mine drainage covered the caddisflies and/or their cases. It is quite apparent that the benthic community is very highly stressed at the site.

Data Analysis

This reach of Peak Creek, below the confluence of Ore Knob Branch, received the same classification of Poor in 2008 as in 2003. It appears that in both wet and dry years the highly stressed macroinvertebrate community here borders on extirpation. As seen in the photo, an orange precipitate covered all instream surfaces. The 2004 Basinwide Assessment Report stated that proposed mitigation efforts were planned (in 2004). Unfortunately that work was not initiated, though site stabilization efforts continue at the mine site itself. Approximately one mile upstream of this site is station KB 11, which earned a classification of Excellent in 2008. Despite the diverse aquatic community residing just upstream, this reach continues to suffer from the acid mine drainage received from Ore Knob Branch.

The location name for this site was formerly "BIG PEAK CR RD."

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
L PEAK CR	SR 1595	KB14	08/21/08	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.427778	-81.344444	10-1-35-4	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
B;Tr:+	2.3	2615	3	0.1

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	17.8
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	76
pH (s.u.)	5.9

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	86

Site Photograph



Substrate	mix of boulder, cobble, gravel, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/08	10560	---	7	---	2.12	Poor
08/19/03	9249	---	6	---	1.95	Poor
08/19/98	7744	---	7	---	2.02	Poor
04/08/96	7030	16	6*	3.58*	1.77	Poor
04/16/91	5551	---	5	---	2.01	Poor

*values corrected for seasonality

Taxonomic Analysis

Only seven EPT taxa were found in Little Peak Creek in 2008. Abundant taxa collected here were similar to previous samples (*Leuctra*, *Tallaperla*, and *Diplectrona modesta*). Three larger-bodied case caddisflies were present (all common in the sample): *Hydatophylax*, *Pycnopsyche gentilis*, and a second unidentified species of *Pycnopsyche*. Acid mine drainage from Ore Knob continues to suppress macroinvertebrate diversity and densities here.

Data Analysis

Little Peak Creek rated Poor in 2008, the same rating that it has always received. Acid mine drainage creates a toxic situation for aquatic macroinvertebrates here.

By current BAU protocols this site would not be assigned a classification due to the small drainage area. However, due to the depauperate benthic community, in the judgment of BAU biologists the site is among the worst in the state and the classification is justified.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
CRANBERRY CR	SR 1603	KB15	08/21/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.456389	-81.315000	10-1-37	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
B;Tr:+	35	2585	13	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	22.5
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	41
pH (s.u.)	6.9

Water Clarity	clear
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Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	11
Pool Variety (10)	6
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	75

Substrate	mix of boulder, cobble, gravel, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/08	10562	93	45	3.96	3.07	Excellent
08/18/03	9246	106	52	4.08	3.07	Excellent
08/19/98	7748	79	42	3.78	3.11	Excellent

Taxonomic Analysis

Cranberry Creek contained a large number of aquatic macroinvertebrate taxa in 2008. The species composition was similar to the 1998 and 2003 collections. Abundant taxa at this site in 2008 included: *Dolophilodes*, *Neophylax oligius*, *Paraleptophlebia*, and *Neophemera purpurea*.

Data Analysis

Cranberry Creek rated Excellent in 2008. Total taxa and EPT taxa numbers were similar among all three samples collected here. The Biotic Index indicates a pollution-sensitive community residing in this lower section of Cranberry Creek. This watershed contains a large number of tree farms with some mixed agriculture and residences.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CRANBERRY CR	SR 1600	05/08/08	KF2	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.46944444	-81.32694444	10-1-37	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;+	36.8	2560	14	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	20	55	25	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	15.4
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	39
pH (s.u.)	5.7
Water Clarity	Clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	14
Left Bank Stability (7)	2
Right Bank Stability (7)	3
Light Penetration (10)	0
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	53

Substrate	Cobble, gravel, sand, and boulders
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/08/08	2008-33	22	56	Good
06/30/98	98-59	20	60	Excellent

Most Abundant Species

Mottled Sculpin and Bluehead Chub

Exotic Species

Warpaint Shiner, Redlip Shiner, Tennessee Shiner, Saffron Shiner, Rock Bass, and Smallmouth Bass

Species Change Since Last Cycle

Gains -- Tonguetied Minnow, Warpaint Shiner, Tennessee Shiner, Saffron Shiner, Kanawha Rosyface Shiner, and Creek Chub. **Losses** -- Western Blacknose Dace, White Sucker, Brown Trout, and Greenside Darter.

Data Analysis

Watershed -- drains eastern Ashe County; no municipalities within the watershed; tributary to South Fork New River, site is ~ 1 mile upstream of the creek's confluence with the river. **Habitat** -- straight channel, stream widening is occurring; 100% open canopy; very narrow riparian zones; unstable banks with high erosion potential; and shallow pools; a popular fishing site. **2008** -- more total species, species of cyprinids (15), and intolerant species (9) were collected at this site than at any other site, except for at the South Fork New River (also 22 species). **1998 & 2008** -- twice as many fish collected in 2008 than in 1998; a very diverse fish community is present, 26 species known from the site, including 16 species of cyprinids, 4 species of darters, 6 endemic species (Tonguetied Minnow, New River Shiner, Kanawha Rosyface Shiner, Kanawha Minnow, Kanawha Darter, and Appalachia Darter), and 7 nonindigenous species; and species present in 1998, but absent in 2008 were represented by 1-5 fish/species.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
PRATHERS CR	off SR 1302	05/07/08	KF15	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	1	05050001	36.4967511	-81.3205856	10-1-38	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
B;Tr	13.7	2520	7	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	50	10	40	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

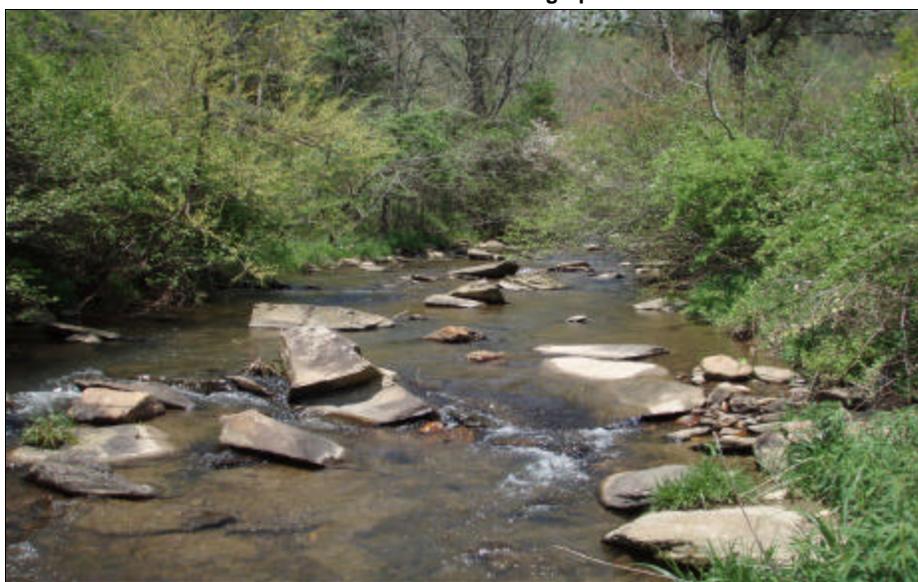
Temperature (°C)	17.2
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	42
pH (s.u.)	7.2

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	14
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	4
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	75

Site Photograph



Substrate	Cobble and boulder
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/07/08	2008-32	19	46	Good-Fair

Most Abundant Species	Central Stoneroller	Exotic Species	Warpaint Shiner, Redlip Shiner, Tennessee Shiner, Saffron Shiner, Brown Trout, Rock Bass, and Smallmouth Bass
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Species Change Since Last Cycle	N/A
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Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains western Alleghany County; no municipalities within the watershed; much of watershed is with livestock pasture, no riparian zones, and an open canopy; tributary to South Fork New River, site is ~ 750 ft. upstream from the creek's confluence with the river. **Habitat** -- high gradient stream, primarily riffles, runs, and some plunge pools; fairly open canopy; narrow riparian zones. **2008** -- Central Stoneroller accounted for 57% of all the fish collected; high percentage of Omnivores+Herbivores, indicative of nonpoint source nutrients and an open canopy; and two endemic species (Kanawha Rosyface Shiner and Kanawha Darter) were present.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
N FK NEW R	SR 1119	05/21/08	KF10	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.407098	-81.681014	10-2-(1)	Southern Crystalline Ridges & Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr,+	23.9	3118	9	0.5	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	60	5	35	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	11.2
Dissolved Oxygen (mg/L)	10.2
Specific Conductance (µS/cm)	59
pH (s.u.)	6.5
Water Clarity	Clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	16
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	4
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	71

Substrate: cobble, gravel, sand, boulder.

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/21/08	2008-46	15	48	Good
06/29/98	98-56	14	50	Good

Most Abundant Species: Western Blacknose Dace. **Exotic Species**: Brown Trout.

Species Change Since Last Cycle: **Gains** -- Bluehead Chub, Bigmouth Chub. **Losses** -- Rosyface Shiner.

Data Analysis

Watershed -- located along the rural west-central edge of the New River basin where Watauga and Ashe Counties meet; this catchment drains the North Fork New River's headwaters plus the main tributaries of Pine Mountain Branch, Brush Fork, and Hoskin Fork. **Habitats** -- primarily riffles and runs with some chutes that were holding trout, and a few silt bottom pools; the reach is mostly sunlit because of the vegetation type along the banks and in the riparian corridor (majority of shrubs and grasses vs. trees); substrates exhibited moderate to high embeddedness. **2008** -- a diverse and abundant population of cool and cold water fish species were present, including three intolerant taxa (New River Shiner, Tonguetied Minnow, and Kanawha Darter); more than twice the total abundance was collected than in 1998 (1368 vs. 552); Western Blacknose Dace (n=553) represented 40% of the sample. **1998-2008** -- very similar species compositions were observed and nearly identical NCIBI metrics were calculated for both monitoring years, indicating that water quality in this headwater catchment has remained good over a ten year period.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
N FK NEW R	SR 1100	KB23	07/31/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.430000	-81.620833	10-2-(12)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C:+	62	2845	13	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	10	90	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	20.3
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	61
pH (s.u.)	6.5

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	15
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	81

Site Photograph



Substrate	mix of boulder, cobble, gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/31/08	10517	119	57	3.67	2.73	Excellent
08/19/03	9222	81	44	3.96	3.51	Excellent
08/17/98	7710	96	52	4.05	3.23	Excellent
07/29/93	6296	102	50	3.95	3.01	Excellent

Taxonomic Analysis

The greatest number of EPT taxa collected at the site occurred in 2008. A few EPT taxa were collected for the first time, including: *Acroneuria carolinensis*, *Hydroptila*, and *Nectopsyche exquisita*.

Data Analysis

The site is 8.2 miles west of Jefferson. This is the site furthest upstream of the three basinwide sites on North Fork New River. The site has consistently received classifications of Excellent following each summer sampling event (a Good was received after a non-summer sampling event in March 1989). No indications of impact are exhibited by the benthic community.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
N FK NEW R	SR 1644	KB27	08/20/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.485556	-81.493889	10-2-(12)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C:+	144	2630	18	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	10	90	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
United Chemi-Con, Inc.	NC0000019	1.018

Water Quality Parameters

Temperature (°C)	24.1
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	80
pH (s.u.)	8.0

Water Clarity clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	15
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	0
Total Habitat Score (100)	65

Site Photograph



Substrate mix of cobble, gravel, sand; some boulder, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/20/08	10541	99	49	3.93	3.31	Excellent
08/21/03	9234	72	45	3.66	3.31	Excellent
08/19/98	7719	87	50	3.77	2.91	Excellent
07/28/93	6294	93	46	4.00	2.94	Excellent

Taxonomic Analysis

EPT Richness at the site has shown very little change for the four summer sampling events between 1993 and 2008. *Helicopsyche paralimnella* has been recorded for the first time from the site; this is only one of five sites in the state so far at which the species has been found by BAU, though undoubtedly more sites will be found.

Data Analysis

The site is 4.6 miles NNW of Jefferson and is directly upstream of the mouth of Big Horse Creek. The town of West Jefferson is almost entirely included in the catchment above the site.

Consistently high EPT Richness and low NCBI values have resulted in classifications of Excellent for each sampling event between 1993 and 2008. The healthy benthic community indicates an absence of stressors at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
N FK NEW R	OLD NC 16	KB135	08/20/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.503889	-81.390278	10-2-(12)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C:+	277	2525	33	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	30	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
United Chemi-Con, Inc.	NC0000019	1.018

Water Quality Parameters

Temperature (°C)	22.2
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	73
pH (s.u.)	7.4

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	5
Riffle Habitat (16)	5
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	1
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	65

Site Photograph



Substrate	primarily cobble and gravel; some sand, silt, boulder
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/20/08	10539	108	55	4.08	3.07	Excellent

Taxonomic Analysis

There is little difference between this new basinwide site and the former upstream basinwide site in terms of richness within the major groups; the number of taxa collected within each group at the new site is within the range of taxa collected at the upstream site with the exception of Lepidoptera (one taxon collected at this site; never collected at the former site) and Oligochaeta (only lumbriculids collected at this site in 2008; at least two taxa collected upstream). However, there were a few EPT taxa collected at Old NC 16 that have not been collected at NC 16 over eight sampling events, including (all rare within the sample except as noted): *Acerpenna pygmaea*, *Heterocloeon anoka* (common), *Anthopotamus distinctus*, *Agnentina*, *Hydroptila*, and *Pycnopsyche lepida* group.

Data Analysis

The site is 7.4 miles northeast of Jefferson and six stream-miles above the confluence with South Fork New River. This is the furthest downstream site of the three basinwide sites on North Fork New River. The town of West Jefferson is almost entirely included in the catchment above the site. This site replaces the basinwide site at NC 16, which is about two stream-miles upstream of this site, due to difficult access to the river at NC 16.

The four summer sampling events in 1989, 1993, 1998, and 2003 resulted in classifications of Excellent at the former basinwide site. There appears to be little difference in water quality either temporally or longitudinally between sampling events on this lower segment of North Fork New River.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HOSKIN FK	OFF NC 88 BELOW WILSON BR	KB26	07/31/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.390480	-81.702190	10-2-7	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	6.7	3125	3	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	10	90	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	17.9
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	85
pH (s.u.)	7.0

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	19
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	75

Site Photograph



Substrate	mix of cobbole, gravel, boulder; some sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/31/08	10514	---	38	---	3.18	Excellent
08/19/03	9221	---	37	---	2.92	Excellent
08/17/98	7709	---	35	---	3.59	Good
07/23/93	6299	---	30	---	3.56	Good

Taxonomic Analysis

The number of EPT taxa identified from the site has increased with each successive sampling event since 1993. A few taxa were collected for the first time at the site, including: *Ephemerella subvaria*, *Serratella deficiens*, *Hexagenia*, *Acroneuria carolinensis*, and *Leucotrichia pictipes*.

Data Analysis

The site is about 1.5 miles east of the closest point on the Tennessee Valley Divide and 0.8 stream-miles from the confluence with North Fork New River.

Increasing EPT richness with each successive sampling event since 1993 is suggestive of improving water quality at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
THREE TOP CR	OFF SR 1100 BELOW LONG HOPE CR	KB138	08/21/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.410710	-81.619600	10-2-13	Amphibolite Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	22	2915	8	0.4

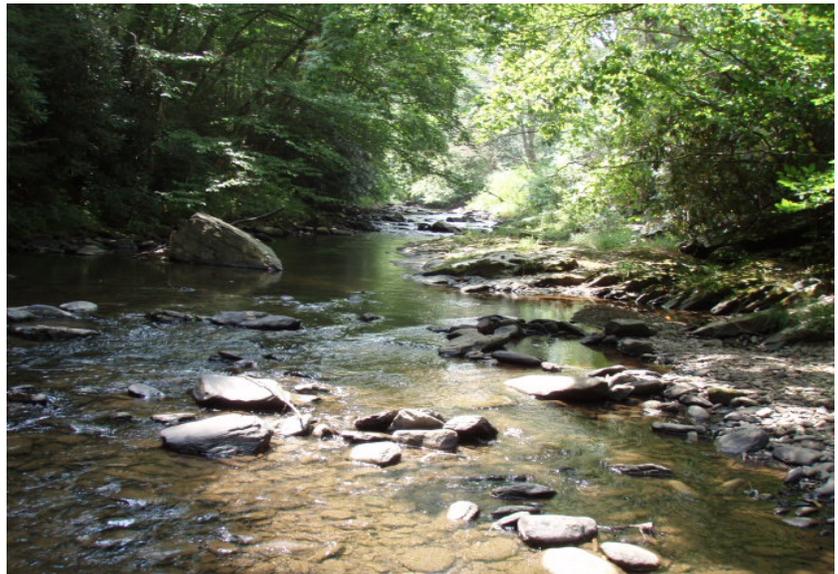
Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	0	10 (road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	18.8
Dissolved Oxygen (mg/L)	8.2
Specific Conductance (µS/cm)	48
pH (s.u.)	---
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	15
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	86

Substrate mostly cobble and boulder; some gravel, bedrock, sand, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/08	10545	---	35	---	2.60	Good

Taxonomic Analysis

A fairly diverse EPT community exists at the site. There are no historical data for the site, so trends in community composition can not be analyzed. A few taxa were collected here that have not been collected at the former basinwide site downstream, including: *Procloeon*, *Maccaffertium pudicum*, *Diplectrona modestum*, *Ceraclea*, and *Chimarra*.

Data Analysis

The site is 8.1 miles west of Jefferson. This new basinwide site is 1.3 stream-miles upstream of the former site at SR 1100. The site was moved to remove the influence of development directly upstream of the old basinwide site, and to locate it in the Amphibolite Mountains ecoregion so that a potential reference site for the ecoregion could be established.

The same number of EPT taxa were recorded for this site in 2008 as were for the former site in 2003. In both cases the additional of a single EPT taxon would have resulted in a classification of Excellent.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
THREE TOP CR	SR 1123	05/20/08	KF23	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.420699	-81.621819	10-2-13	Amphibolite Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	23.1	2900	10	0.4	Yes

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	65	15	5	15 (lumber mill)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	14.4
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	38
pH (s.u.)	6.4

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	85

Site Photograph



Substrate	flat cobble, boulder, bedrock, gravel, sand.
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/20/08	2008-45	15	--	Not Rated

Most Abundant Species	Fantail Darter.	Exotic Species	Rock Bass, Brown Trout.
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Species Change Since Last Cycle	N/A
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Data Analysis

New basinwide site. **Watershed** -- a tributary to the North Fork New River that flows north, draining part of west-central Ashe County. **Habitats** -- high quality instream habitats consisting of riffles and runs with deep chutes that were holding trout, and some small side pools; roads on both sides of the stream prevent broad riparian widths, but the stream's banks were very stable, with some Mountain Laurel on the right bank; the tree canopy provides about 50% shading to the stream. **2008** -- a diverse assemblage of cool and cold water fish fauna were collected from the stream, including four species that are considered to be intolerant to pollution (Rock Bass, Tonguetied Minnow, Kanawha Darter, and Appalachia Darter); Fantail Darters represented 36% of the sample and Mottled Sculpin comprised 29%; overall, the fish community of Three Top Creek appears to be healthy, and suggests no obvious water quality issues.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BIG LAUREL CR	NC 88	KB30	06/19/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.443056	-81.613611	10-2-14	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	29	2805	8	0.4

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	60	0	40	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	14.1
Dissolved Oxygen (mg/L)	9.3
Specific Conductance (µS/cm)	42
pH (s.u.)	7.1

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	13
Pool Variety (10)	4
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	76

Site Photograph



Substrate	mix of cobble, gravel, sand; some boulder, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/19/08	10468	---	53	---	2.62	Excellent
08/19/03	9225	---	38	---	2.92	Excellent
07/17/98	7712	---	40	---	3.49	Excellent
07/29/93	6298	---	48	---	3.29	Excellent

Taxonomic Analysis

The greatest number of EPT taxa collected from the site occurred in 2008. Taxa collected for the first time included: *Eurylophella verisimilis*, *Ephemera*, *Anthopotamus distinctus*, *Brachycentrus appalachia*, *Ceratopsyche slossonae*, *Oecetis persimilis*, and *Triaenodes ignitus*.

Data Analysis

The site is near the confluence with North Fork New River and about eight miles west of Jefferson. The highest EPT richness and the lowest EPT BI values were recorded for the site in 2008. Each time the site has been sampled it has received a classification of Excellent. The benthic community does not exhibit signs of impact.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BIG LAUREL CR	NC 88	05/20/08	KF 22	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.443095	-81.613795	10-2-14	Southern Crystalline Ridges & Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	29	2835	10	0.8	Yes

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	85	10	5	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	13.8
Dissolved Oxygen (mg/L)	9.9
Specific Conductance (µS/cm)	42
pH (s.u.)	6.4

Water Clarity	Turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	8
Riffle Habitat (16)	10
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	71

Site Photograph



Substrate	sand, gravel, cobble, boulder.
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/20/08	2008-44	19	52	Good

Most Abundant Species	Mountain Redbelly Dace.	Exotic Species	Rock Bass, Brown Trout.
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Species Change Since Last Cycle	N/A
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Data Analysis

New basinwide site. **Watershed** -- a tributary to the North Fork New River that drains the northwestern-most edge of Ashe County. **Habitats** -- good instream habitat qualities in this large mountain stream, consisting primarily of runs and some riffles; moderate to high embeddedness of substrates; good bank stabilities and vegetated riparian widths, but shading is limited to the stream's edges. **2008** -- a highly diverse and trophically balanced population of mostly cool and cold water fish species was collected, including seven taxa that are considered intolerant to pollution (Rock Bass, Tonguetied Minnow, New River Shiner, Rosyface Shiner, Kanawha Minnow, Kanawha Darter, and Appalachia Darter); Mountain Redbelly Dace represented 47% of the sample (n=350); two Hellbenders (one adult and one young-of-year) were also collected, suggesting high quality water.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BUFFALO CR	NC 88/194 ABOVE LITTLE BUFFALO CREEK	KB134	08/20/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.432880	-81.511380	10-2-20	Amphibolite Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	13	2785	5	0.2

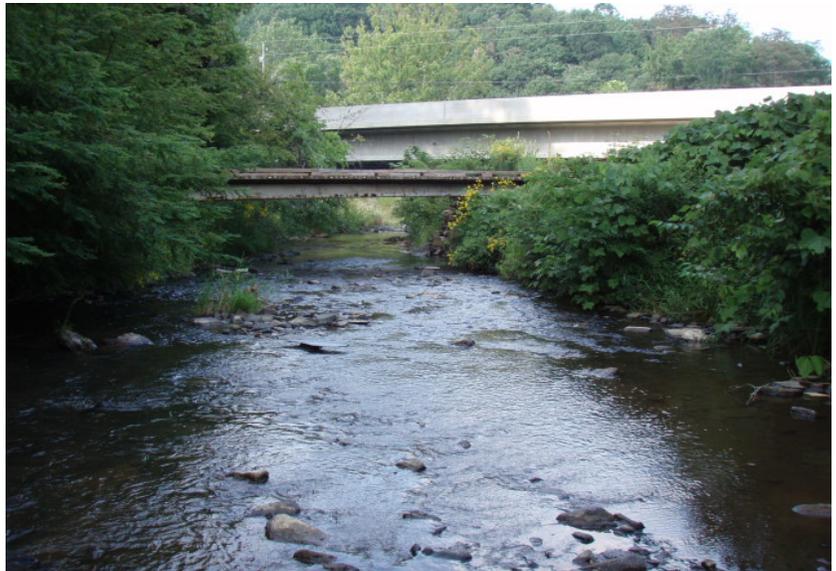
Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	70	20	0	10

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	21.6
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	70
pH (s.u.)	6.7
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	14
Pool Variety (10)	5
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	6
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	82

Substrate mix of cobble, gravel, boulder; some sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/20/08	10542	---	39	---	2.51	Excellent

Taxonomic Analysis

The EPT portion of the benthic community at the site is diverse. *Baetisca berneri*, a mayfly often collected in the New River basin but uncollected at the prior basinwide site on Buffalo Creek, was abundant at this site. The low EPT BI indicates a community intolerant to the presence of pollutants.

Data Analysis

The site is about 2 miles west of Jefferson. The basinwide site for Buffalo Creek was relocated to above the mouth of Little Buffalo Creek to assess conditions in the catchment without the influence of West Jefferson WWTP; the original basinwide site is about 0.4 stream-miles downstream of the present site. At the new location the catchment is mostly forest and pasture with no urban influence.

The high EPT Richness and low EPT BI value indicates a healthy benthic community and the absence of stressors.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BUFFALO CR	NC 88/194	05/19/08	KF 21	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.433146	-81.511071	10-2-20	Amphibolite Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	12.6	2833	7	0.4	Yes

Visible Landuse (%)	Forested/Wetland	Residential/Commercial	Agriculture	Other (describe)
	50	30	5	15 (road - NC 88 and 194)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

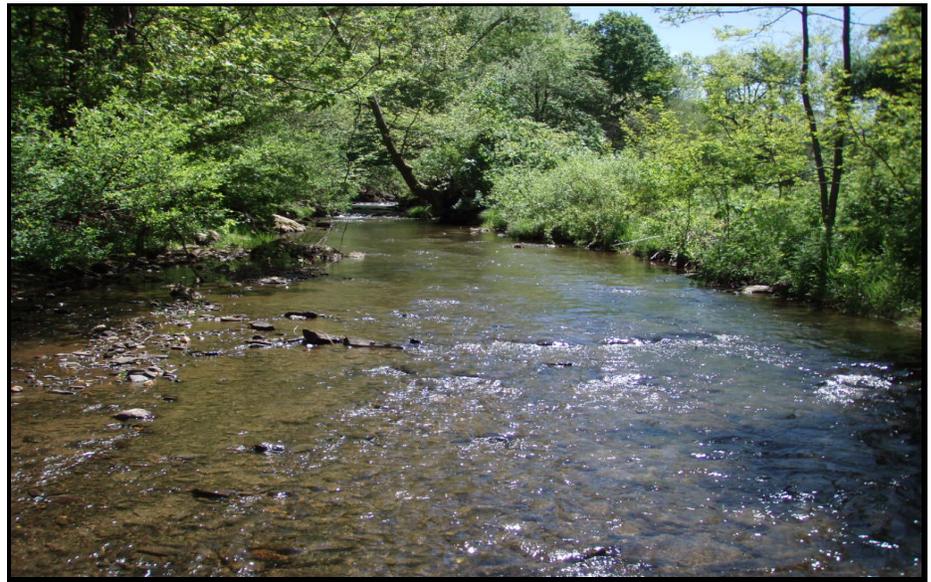
Temperature (°C)	17.0
Dissolved Oxygen (mg/L)	9.3
Specific Conductance (µS/cm)	62
pH (s.u.)	6.9

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	83

Site Photograph



Substrate	flat cobble, gravel, boulder.
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/19/08	2008-42	15	--	Not Rated

Most Abundant Species	Fantail Darter.	Exotic Species	Rock Bass, Bluegill, Saffron Shiner, Rainbow Trout, Brown Trout.
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Species Change Since Last Cycle	N/A
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Data Analysis

New basinwide site. **Watershed** -- a tributary to the North Fork New River that drains part of central Ashe County, just to the west of Jefferson. **Habitats** -- high quality instream habitats including swift riffles and runs with a few chutes and a few shallow side pools that were holding trout; good bank stabilities and vegetated riparian widths; the canopy was providing equal amounts of shade and sunlight to the stream; low to moderate embeddedness of substrates; the Buffalo Meadows WWTP (<1MGD, 100% domestic) located 2.8 miles upstream may be contributing to the slightly elevated conductivity. **2008** -- a diverse and fairly trophically balanced mix of mostly cool and cold water fish taxa was collected, including three species that are considered intolerant to pollution (Rock Bass, Kanawha Darter, and Rainbow Trout); Fantail Darters (intermediately tolerant insectivores) represented 59% of the collected sample; overall, this stream is supporting a reasonably healthy fish population and appears to have no obvious water quality issues.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
L BUFFALO CR	OFF SR 1153	KB32	08/21/08	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.420480	-81.493220	10-2-20-1	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	3.0	2865	2	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	80	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
West Jefferson WWTP	NC0020451	0.5

Water Quality Parameters

Temperature (°C)	18.1
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	276
pH (s.u.)	---

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	18
Bottom Substrate (15)	9
Pool Variety (10)	4
Riffle Habitat (16)	15
Left Bank Stability (7)	5
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	1
Total Habitat Score (100)	66

Site Photograph



Substrate	mix of boulder, gravel, cobble; some sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/08	10543	63	13	6.00	5.00	Fair
08/20/03	9228	22	6	6.40	4.11	Poor
08/18/98	7713	39	14	7.07	5.28	Fair
07/13/93	6265	24	0	8.31	---	Poor

Taxonomic Analysis

The EPT portion of the benthic community has differed significantly with each sampling event. Even for the two sampling events with similar EPT richness (1998 and 2008) only four taxa were in common. In 2008 four EPT taxa were collected that had not been collected during prior sampling events, and three of those (*Maccaffertium pudicum*, *Hydropsyche betteni*, and *Leucotrichia pictipes*) were abundant in the sample.

Data Analysis

The site is one mile west of downtown Jefferson and within 0.9 stream-miles downstream of the West Jefferson WWTP. The stream is on the state's 303(d) list for nutrients and impaired biological integrity.

For the four sampling events since 1993 the lowest NCBI value is shown for 2008, and EPT Richness is close to the high value from 1998. Of the four years that benthic sampling was performed 2008 exhibited the lowest flows for area streams. Dry conditions should increase instream effluent concentrations from the WWTP upstream; the benthic community does not reflect this.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BIG HORSE CR	SR 1350	05/20/08	KF1	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.487395	-81.500386	10-2-21-(7)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr,+	56.2	2681	13	0.7	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	75	10	15	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Lansing WWTP (<1MGD - 1.1 miles upstream)	NC0066028	0.05

Water Quality Parameters

Temperature (°C)	12.5
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	46
pH (s.u.)	6.0

Water Clarity	Slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	4
Light Penetration (10)	2
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	59

Site Photograph



Substrate	sand, cobble, boulder, gravel.
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/20/08	2008-43	15	48	Good
06/29/98	98-57	13	48	Good

Most Abundant Species	Fantail Darter.
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Exotic Species	Rock Bass, Smallmouth Bass, Brown Trout.
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Species Change Since Last Cycle

Gains -- White Sucker, Mottled Sculpin, Kanawha Darter, Smallmouth Bass, Kanawha Minnow, Longnose Dace, Brown Trout. **Losses** -- Rosyside Dace, Bigmouth Chub, Saffron Shiner, New River Shiner, Rosyface Shiner.

Data Analysis

Watershed -- a tributary to the North Fork New River that drains a good portion of the northwestern tip of Ashe County; the site is located just southeast of Lansing. **Habitats** -- low quality instream habitats composed of wide and swift sandy runs with some boulder and cobble, few pools, and very few riffles for a mountain stream; the banks were generally healthy except for a 25 foot area on the right bank that was sloughing into the stream; riparian zones vegetated with mostly grasses, shrubs and very few trees; full sun over most of the stream due to its' width and the lack of canopy trees. **2008** -- a diverse and trophically balanced community of cool and cold water fish species was collected, including six intolerant taxa (Rock Bass, Smallmouth Bass, Tonguetied Minnow, Silver Shiner, Kanawha Minnow, and Kanawha Darter); almost three times the total abundance than in 1998 (652 vs. 242). **1998-2008** -- a total of 20 fish species have been collected from this site; in spite of some habitat issues, this stream is supporting a healthy assemblage of fish, and continues to exhibit good water quality.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BIG HORSE CR	NC 194	KB33	06/10/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.485556	-81.498611	10-2-21-(7)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C:+	56	2635	7	0.4

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	60	10	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	17.7
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	57
pH (s.u.)	7.6

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	13
Pool Variety (10)	4
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	4
Total Habitat Score (100)	75

Site Photograph



Substrate	mix of cobble, gravel, boulder; some sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/10/08	10470	123	60	4.33	2.84	Excellent
08/19/03	9226	89	50	3.95	3.42	Excellent
08/18/98	7715	103	56	4.18	3.14	Excellent
07/28/93	6293	129	56	4.10	2.78	Excellent

Taxonomic Analysis

A large number of EPT taxa have always been collected from the site; the highest number was in 2008. Many taxa were recorded for the first time, including: *Brachycercus*, *Dannella simplex*, *Ephemerella dorothea*, *Eurylophella aestiva*, *Rhithrogena uhari*, *Ceraclea enodis*, and *Neophylax fuscus*. There were several highly tolerant taxa (i.e. with a tolerance value of 8.0 or greater) either common or abundant that helped to drive the NCBI value up: Corixidae; the midges *Chironomus*, *Polypedilum illinoense* group, *Procladius*, *Thienemannimyia* group; and *Nais*, an oligochaete.

Data Analysis

The site is about 4.7 miles NNW of Jefferson and about 0.25 stream-miles above the confluence with North Fork New River.

The site has received a classification of Excellent during each summer sampling event since 1993, in most cases driven by high EPT abundance and richness.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
L HORSE CR	SR 1334	KB63	08/21/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.533056	-81.577778	10-2-21-8	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	4.4	2940	2	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	10	90	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	17.9
Dissolved Oxygen (mg/L)	8.0
Specific Conductance (µS/cm)	47
pH (s.u.)	---

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	15
Left Bank Stability (7)	2
Right Bank Stability (7)	4
Light Penetration (10)	2
Left Riparian Score (5)	0
Right Riparian Score (5)	0
Total Habitat Score (100)	61

Site Photograph



Substrate	mix of cobble, boulder, gravel, sand; some silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/08	10544	---	38	---	2.92	Excellent
08/19/03	9227	---	33	---	3.03	Good
08/18/98	7716	---	35	---	3.62	Good

Taxonomic Analysis

EPT Richness was higher in 2008 than for previous years, improving the classification for the site from Good to Excellent. *Isogenoides hansonii* was identified from the site for the first time in 2008; this is one of 44 sites from which the BAU has collected the stonefly. Leptocerids have not been collected from the site, reflecting the paucity of root mat habitat.

Data Analysis

The site is about 9.7 miles northwest of Jefferson and 3.6 miles south of the Virginia border.

The site attained a classification of Excellent for the first time in 2008. Though the benthic community does not reflect stress, the lack of a riparian zone at the reach sampled is likely limiting the fauna. A canopy over the stream would increase the presence of coldwater stenotherms, root mats provided by trees would diversify benthic habitat, and streamside vegetation would filter pollutants from runoff.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HELTON CR	SR 1536	KB25	08/20/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.535000	-81.422222	10-2-27	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr:+	44	2575	8	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	10	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	16.0
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	69
pH (s.u.)	5.9

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	14
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	5
Left Riparian Score (5)	0
Right Riparian Score (5)	5
Total Habitat Score (100)	82

Site Photograph



Substrate	mostly boulder, cobble; some gravel, sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/20/08	10538	---	37	---	2.93	Excellent
08/18/03	9220	---	40	---	3.12	Excellent
08/18/98	7718	---	37	---	3.14	Excellent

Taxonomic Analysis

Though abundant and common in the sample in 1998 and 2003 respectively, *Tallaperla* was uncollected in August 2008 in spite of ample leafpacks for habitat. The only leptocerid collected during summer sampling was *Setodes* (rare in the sample) in 1998, reflecting the paucity of root mats at the site. *Glossosoma*, which was abundant in 2003, was uncollected in both 1998 and 2008. Otherwise the EPT portion of the benthic community was similar among the three summer sampling events at the site, primarily with taxa rare at the site dropping in and out.

Data Analysis

The site is 8.4 miles NNE of Jefferson, and 1.7 stream-miles from the confluence with North Fork New River.

There has been little change in the benthic community among the three summer sampling events, suggesting stable conditions at the site since 1998.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HELTON CR	SR 1536	05/08/08	KF5	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	2	05050001	36.53472222	-81.42138889	10-2-27	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr,+	43.7	2580	10	0.4	Yes

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	95	5	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	14.9
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	57
pH (s.u.)	7.4
Water Clarity	Clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	4
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	80

Substrate	Cobble, boulder, gravel, and detritus
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/08/08	2008-34	15	---	Not Rated
06/30/98	98-58	15	52	Good

Most Abundant Species	Mountain Redbelly Dace	Exotic Species	Saffron Shiner
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Species Change Since Last Cycle	Gains -- Kanawha Minnow, Mottled Sculpin, and Kanawha Darter. Losses -- Bluntnose Minnow, Rainbow Trout, and Rock Bass.
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Data Analysis

Watershed -- drains southern Grayson County, VA and northern Ashe County; no municipalities within the watershed; tributary to the N Fk New River, site is ~ 2 miles from the creek's confluence with the river. **Habitat** -- runs, riffles, shallow uniform pools, narrow riparian zone on the right; total score in 1998 was 88; bank stability and quality of pools appeared to have declined. **2008** -- Rock Bass+Smallmouth Bass+Trout absent; ~ 60% of the fish were Mountain Redbelly Dace, Bluehead Chub, and Central Stoneroller; Mountain Redbelly Dace were extremely abundant along the stream margins; community is Not Rated pending an evaluation in 2009. **1998 & 2008** -- 18 species known from the site, including the endemic Kanawha Minnow and Kanawha Darter and the nonindigenous Saffron Shiner, Rainbow Trout, and Rock Bass; 2.4 times more fish collected in 2008 than in 1998 (1,388 vs. 581); 10 times more Mountain Redbelly Dace were collected in 2008 than in 1998; species absent in 2008 were represented by 2-4 fish/species in 1998; and fishery is managed by NCWRC as Delayed Harvest Waters, within the reach, eight 230-389 mm TL stocked Brook Trout and Rainbow Trout were collected.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
GRASSY CR	SR 1549	05/08/08	KF16	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ASHE	1	05050001	36.5522927	-81.355517	10-3	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr:+	10.6	2480	8	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	0	10 (South Fork New River)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

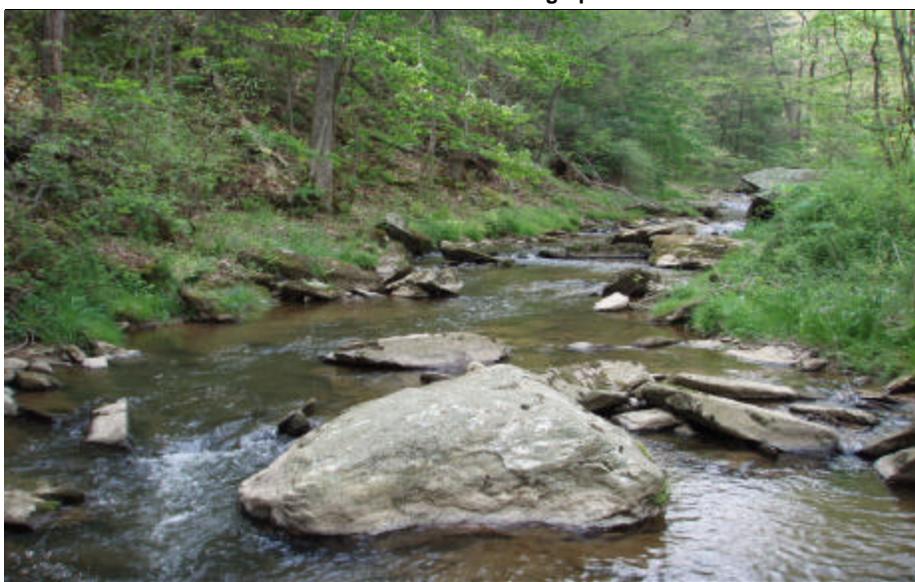
Temperature (°C)	18.0
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	84
pH (s.u.)	7.7

Water Clarity	Very slightly turbid (easily silted)
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	14
Pool Variety (10)	8
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	95

Site Photograph



Substrate	Cobble, boulder, and silts on the rocks
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/08/08	2008-35	18	40	Good-Fair

Most Abundant Species	Bluehead Chub and Central Stoneroller	Exotic Species	Redlip Shiner, Saffron Shiner, Brown Trout, Rock Bass, Green Sunfish, and Smallmouth Bass
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Species Change Since Last Cycle	N/A
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Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains southern Grayson County, VA and northeast corner of Ashe County; no municipalities within the watershed; tributary to the New River, site is ~ 50 ft. from the creek's confluence with the river. **Habitat** -- greatest habitat score of any fish community site in the basin in 2008, although much of the watershed is without canopy cover in pasture with cattle; high gradient boulder plunge pools; site is atypical. **2008** -- 82% of all the fish collected were Bluehead Chub, Central Stoneroller, and Mountain Redbelly Dace; very high percentage of Omnivores+Herbivores were collected, indicative of nonpoint sources of nutrients and open canopy upstream of the reach; proximity to the river enables the site to serve as a nursery area for Age 1 Rock Bass and Smallmouth Bass; one endemic species (Appalachia Darter) was collected; and the greatest pH of any fish community site in the basin in 2008 due to photosynthetic activity by the upstream periphyton.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
ELK CR	SR 1341	05/07/08	KF3	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.5575	-81.2169444	10-6-(2)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;+	17.4	2470	10	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	80	5	15	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

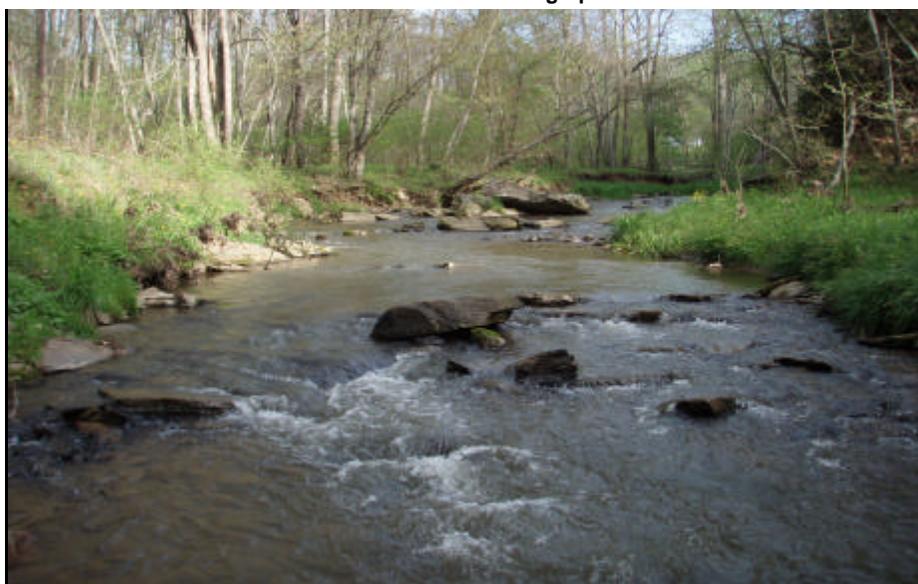
Temperature (°C)	11.9
Dissolved Oxygen (mg/L)	9.6
Specific Conductance (µS/cm)	50
pH (s.u.)	5.8

Water Clarity	Slightly-moderately turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	84

Site Photograph



Substrate	Cobble, boulder, bedrock, and silts and sands in the pools
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/07/08	2008-31	20	48	Good
06/30/98	98-60	17	48	Good

Most Abundant Species	Central Stoneroller
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Exotic Species	Whitetail Shiner, Saffron Shiner, Rock Bass, Redbreast Sunfish, and Smallmouth Bass
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Species Change Since Last Cycle	Gains -- Kanawha Minnow, Redbreast Sunfish, Greenside Darter, and Appalachia Darter. Losses -- Mottled Sculpin.
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Data Analysis

Watershed -- drains northwestern Alleghany County; no municipalities within the watershed; tributary to the New River. **Habitat** -- unstable banks along both shorelines; fairly open canopy; riffles, bedrock shelves, veins, and pools; better habitat downstream than upstream from the bridge; beaver dam upstream from the bridge. **2008** -- Central Stoneroller accounted for 41% of all the fish collected in 2008; high percentage of Omnivores+Herbivores, indicative of nonpoint sources of nutrients. **1998 & 2008** -- almost twice as many fish collected in 2008 than in 1998, the number of Central Stoneroller doubled; 21 species known from the site, including 11 species of cyprinids, 4 endemic species (Kanawha Rosyface Shiner, Kanawha Minnow, Kanawha Darter, and Appalachia Darter), and 5 nonindigenous species; and Mottled Sculpin was represented by only 1 fish in 1998 and was absent in 2008.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
ELK CR	SR 1344	KB35	08/19/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.569722	-81.206944	10-6-(2)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C:+	21	2360	8	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	0	10 (road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	21.9
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	58
pH (s.u.)	6.4

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	19
Bottom Substrate (15)	11
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	84

Site Photograph



Substrate	mix of boulder, cobble; some gravel, sand, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/19/08	10536	---	30	---	3.14	Good
08/18/03	9219	---	34	---	3.52	Good
08/20/98	7723	---	34	---	3.36	Good
07/26/93	6286	---	36	---	3.48	Excellent

Taxonomic Analysis

The site has been sampled on four occasions. The 30 EPT taxa collected in 2008 is the lowest number for the site.

Several taxa were recorded for the first time in 2008, including: *Caenis* (rare in the sample); *Stenacron interpunctatum* (common); and *Apatania* (rare). Neither *Glossosoma* nor *Ceratopsyche morosa* were collected in 2008; both taxa were reported from the first three sampling events at the site.

Data Analysis

The site is 0.4 stream-miles above the confluence with New River and within 0.2 miles of the Virginia border.

The drop in the number of EPT taxa collected between 2003 and 2008 may be indicative of impacts to the benthic community, though that is offset by the decrease in the EPT BI value. As in 2003, periphyton was noted on the boulders and cobbles, which indicates some nutrient enrichment at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
LITTLE R	SR 1128	KB37	08/19/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.467778	-81.133333	10-9-(1)a	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C,Tr	14	2875	9	0.3

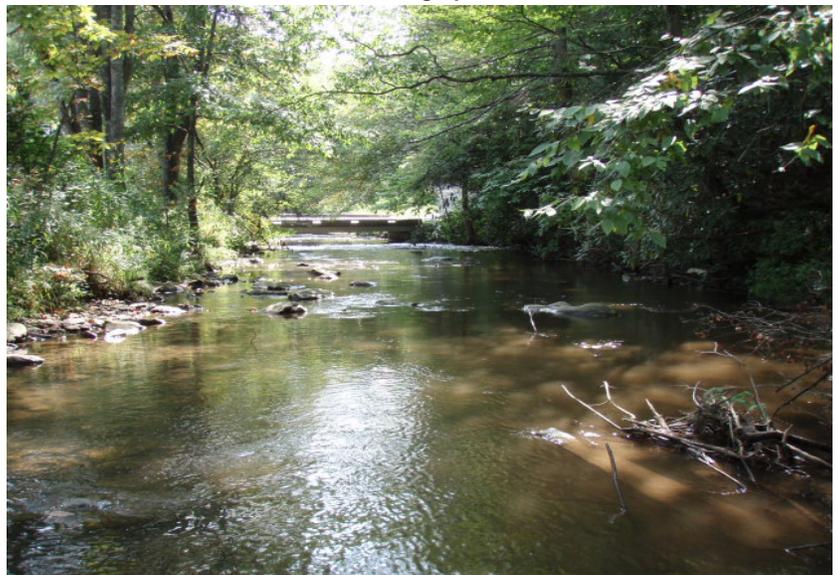
Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	60	0	0	40 (road, firing range)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	17.3
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	40
pH (s.u.)	6.0
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	70

Substrate mostly sand, gravel, silt; some bedrock, boulder, cobble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/19/08	10534	102	42	3.74	3.27	Excellent
04/05/06	9828	103	42*	4.05*	2.32	Excellent
08/18/03	9218	75	36	4.03	3.53	Good
08/20/98	7724	72	37	3.94	3.18	Good
07/26/93	6303	84	45	3.32	2.53	Excellent

* values corrected for seasonality

Taxonomic Analysis

The number of EPT taxa collected in 2008 is significantly higher than in 1998 and 2003, though still lower than in 1993. There are a few notable differences in the EPT taxa present between 1993 and the following years. Two ephemerelellids, *Drunella conestee* and *Serratella serratoides*, were both abundant in the 1993 sample but have not been recorded from any sampling event since. Also, *Drunella cornutella* was abundant in 1993, rare in 1998, and absent in each following sampling event. *Serratella deficiens* was also abundant in 1993 and absent from each summer sampling event since, though it was common in the spring sample collected in 2006.

Data Analysis

The site is 2.7 miles SSW of Sparta, and is the site most upstream of the three basinwide sites on Little River.

The increase in EPT Richness and lower NCBI values in 2008 compared to the prior summer sampling events in 1998 and 2003 suggests better recent water quality. Those changes have improved the classification of the site from Good 1998 and 2003 to Excellent in 2008. However, both EPT Richness and NCBI values have not returned to the standards set in 1993.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
LITTLE R	SR 1128	05/06/08	KF7	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.46777778	-81.13277778	10-9-(1)a	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	14.1	2870	10	0.3	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	0	10

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	9.9
Dissolved Oxygen (mg/L)	10.3
Specific Conductance (µS/cm)	35
pH (s.u.)	5.5
Water Clarity	Clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	10
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	85

Substrate	Cobble and silt
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/06/08	2008-28	16	50	Good
07/01/98	98-61	15	44	Good-Fair

Most Abundant Species

Redlip Shiner and Rosyside Dace

Exotic Species

Highback Chub, Redlip Shiner, Brown Trout, Redbreast Sunfish, and Tessellated Darter

Species Change Since Last Cycle

Gains -- Highback Chub, Mountain Redbelly Dace, and Longnose Dace. **Losses** -- Tonguetied Minnow and Rainbow Trout.

Data Analysis

Watershed -- drains southern Alleghany County; no municipalities within the watershed. **Habitat** -- snags and undercuts; silts along the margins and atop the rocks; cobble riffles and runs; wide riparian zone on the left, but narrow along the right bank; site is a popular fishing spot. **2008** -- diversity of Rock Bass+Smallmouth Bass+Trout and Intolerant species were slightly lower than expected; percentage of tolerant fish (White Sucker, Creek Chub, and Redbreast Sunfish) was slightly greater than expected for a mountain stream; lowest pH of any fish community site in the basin in 2008. **1998 & 2008** -- 18 species known from the site, including 3 endemic species (Tonguetied Minnow, Kanawha Darter, and Appalachia Darter) and 6 nonindigenous species; ~ 6 times more fish collected in 2008 than in 1998 (1,444 vs. 224) ; Mountain Redbelly Dace constituted 9% of the fauna in 2008, but absent in 1998; and species present in 1998, but absent in 2008 were represented by 1 or 3 fish each.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
LITTLE R	SR 1424	KB38	08/18/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.517222	-81.083611	10-9-(6)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	36	2600	16	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	20	0	80	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	20.9
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	61
pH (s.u.)	7.0

Water Clarity clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	4
Left Riparian Score (5)	2
Right Riparian Score (5)	1
Total Habitat Score (100)	76

Site Photograph



Substrate mix of cobble, boulder, gravel, sand; some silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/18/08	10530	111	47	3.90	3.00	Excellent
08/21/03	9232	104	49	4.11	3.23	Excellent
08/20/98	7726	80	41	3.94	2.95	Excellent
07/26/93	6277	98	48	3.98	2.92	Excellent

Taxonomic Analysis

Several taxa were recorded for the first time from the site in 2008, including: *Rhithrogena*, *Anthopotamus distinctus*, *Paragnetina ichusa/media*, *Apatania*, *Ceratopsyche walkeri*, and *Hydropsyche scalaris*.

Data Analysis

The site is 2.2 miles ENE of Sparta, which is entirely included in the catchment above the site.

NCBI values have been very similar between the four most recent sampling events at the site, as have EPT Richness values with the exception of 1998. The site has rated as Excellent following each sampling event since 1993 at the site, though a spring sampling event in 1989 resulted in classification of Fair. Improvements to the Sparta WWTP (permit NC0026913; discharge 0.6 million gallons per day) occurred in 1990 and apparently improved water quality at the site.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
LITTLE R	NC 18	KB100	08/18/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.543056	-81.021389	10-9-(6)	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	99	2410	30	0.4

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	0	50	0

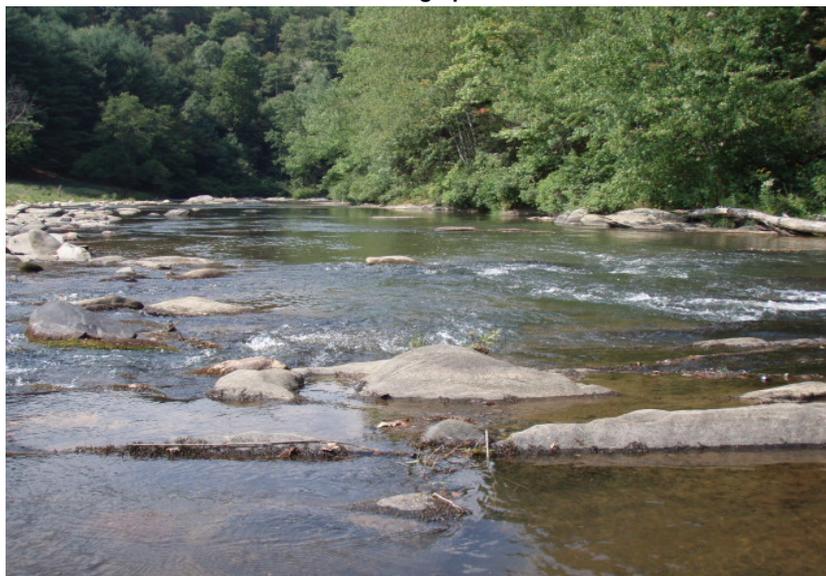
Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	23.4
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	46
pH (s.u.)	7.2

Water Clarity clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	13
Pool Variety (10)	6
Riffle Habitat (16)	12
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	0
Left Riparian Score (5)	5
Right Riparian Score (5)	0
Total Habitat Score (100)	67

Substrate mostly bedrock and boulder; some sand, cobble, gravel, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/18/08	10531	129	59	3.96	2.80	Excellent
08/20/03	9233	89	47	3.96	3.40	Excellent
08/20/98	7727	84	46	3.53	2.72	Excellent
07/27/93	6288	89	49	3.73	2.84	Excellent
07/11/90	5377	93	44	4.36	3.15	Excellent

Taxonomic Analysis

The 59 EPT taxa from 2008 was the most ever recorded for the site, which has been sampled a total of nine times; the previous high for a summer sample was 49, last attained in 1993. The site has received a classification of Excellent following each sampling event except for August 1986, when it received a rating of Good. Several EPT taxa are reported for the first time in 2008: *Heterocloeon anoka*, *Heterocloeon curiosum*, *Maccaffertium exiguum*, *Anthopotamus distinctus*, *Micrasema bennetti*, *Hydropsyche venularis*, *Hydroptila*, an unnamed species of *Nectopsyche*, and *Neophylax fuscus*.

Data Analysis

The site is 2.6 stream-miles upstream of the Virginia border and six miles ENE of the town of Sparta, which is entirely included in the catchment above the site. This is the furthest downstream of the three basinwide sites on Little River. Cattle were present in a pasture on the west side and had unhindered access to the river at the reach sampled.

EPT Richness for the seven summer sampling events at the site prior to 2008 has been rather stable, with a range of 44 to 49 taxa collected, making the 59 EPT taxa recorded for 2008 anomalous. NCBI values have ranged from 3.53 (in 1998) to 4.50 (in 1986 and 1988), putting the 2008 value of 3.96 near the middle of the range.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
PINE SWAMP CR	SR 1128	KB36	08/19/08	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.475556	-81.116667	10-9-5	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	5.3	2805	5	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	20	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	16.1
Dissolved Oxygen (mg/L)	---
Specific Conductance (µS/cm)	38
pH (s.u.)	5.6

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	83

Site Photograph



Substrate	mix of cobble, boulder, bedrock; some gravel, sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/19/08	10533	---	34	---	2.72	Good
04/04/06	9827	---	41*	---	2.69	Excellent
08/18/03	9217	---	26	---	3.63	Good-Fair
08/20/98	7725	---	34	---	3.52	Good
07/27/93	6290	---	33	---	3.45	Good

* value corrected for seasonality

Taxonomic Analysis

A few taxa were collected for the first time in 2008: *Baetisca*, which was rare in the sample; *Chimarra* and *Dolophilodes*, two philopotamid genera, which were common and abundant respectively.

Data Analysis

The site is about two miles south of Sparta and just upstream of the confluence with Little River.

The number of EPT taxa collected in 2008 returned to the previous high of 34 (in 1998) for a summer sampling event at the site. The EPT BI in 2008 was significantly lower than for any prior summer sampling event. There is currently very little evidence for water-quality impacts to the stream at the site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
PINE SWAMP CR	SR 1128	05/06/08	KF19	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.4759215	-81.1166911	10-9-5	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	5.3	2760	7	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	50	30	20	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	12.4
Dissolved Oxygen (mg/L)	10.0
Specific Conductance (µS/cm)	29
pH (s.u.)	6.1
Water Clarity	Clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	13
Pool Variety (10)	8
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	91

Substrate	Cobble, boulder, and angular bedrock
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/06/08	2008-29	16	52	Good

Most Abundant Species	Mountain Redbelly Dace and Rosyside Dace	Exotic Species	Highback Chub, Redlip Shiner, Brown Trout, Rock Bass, Redbreast Sunfish, and Tessellated Darter
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Species Change Since Last Cycle	N/A
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Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains southern Alleghany County; no municipalities within the watershed; tributary to the Little River, site is ~ 60 ft. upstream from the creek's confluence with the river. **Habitat** -- runs, riffles, plunge pools, undercuts, and overhangs; riparian zone of multifloral rose then pasture along the left banks. **2008** -- percentage of tolerant fish (Creek Chub, White Sucker and Redbreast Sunfish) was slightly greater than expected for a mountain stream; one endemic species (Kanawha Darter) was present; and the lowest conductivity of any fish site, along with Brush Creek, in the basin in 2008.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BLEDSOE CR	SR 1172	KB101	08/18/08	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.497222	-81.118611	10-9-7	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	5.6	2795	4	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	10	90	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	20.0
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	72
pH (s.u.)	5.8
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	13
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	0
Right Riparian Score (5)	4
Total Habitat Score (100)	68

Substrate mix of gravel, cobble, sand; some boulder, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/18/08	10532	---	42	---	3.75	Excellent
04/05/06	9831	---	25*	---	3.32	Good-Fair
08/20/03	9231	---	30	---	3.39	Good
08/19/98	7722	---	21	---	4.67	Good-Fair
07/26/93	6287	---	33	---	3.31	Good

* value corrected for seasonality

Taxonomic Analysis

The 42 EPT taxa collected in 2008 greatly surpasses the previous high of 33 collected in 1993. Several taxa were reported for the first time from the site in 2008 (all rare in the sample), including: *Plauditus cestus*, *Baetisca berneri*, *Leucrocuta*, *Tricorythodes*, *Ceratopsyche morosa*, and *Rhyacophila carolina*. There were also a few taxa present in 2008 that had not been recorded from the site since the sampling event in 1993: *Serratella serratoides*, which was abundant in 1993 and common in 2008; *Heptagenia marginalis*, abundant in 1993 and rare in 2008; *Tallaperla*, rare in 1993 and common in 2008.

Data Analysis

The site is in the town of Sparta and 0.8 stream-miles above the confluence with Little River. Despite the location within the town of Sparta, the suboptimum habitat, and a silty cover of *aufwuchs* over the cobbles and boulders, the site attained a classification of Excellent in 2008. Less surprising is the relatively high EPT BI score for a mountain sample not associated with a discharger.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
GLADE CR	SR 1422	05/06/08	KF4	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.49972222	-81.03638889	10-9-9	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	13.6	2520	7	0.5	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	0	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	16.2
Dissolved Oxygen (mg/L)	9.2
Specific Conductance (µS/cm)	32
pH (s.u.)	5.9

Water Clarity	Slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	5
Pool Variety (10)	6
Riffle Habitat (16)	15
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	68

Site Photograph



Substrate	Sand, silt, and bedrock
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/06/08	2008-30	20	52	Good
07/01/98	98-62	19	50	Good

Most Abundant Species

Redlip Shiner and Mountain Redbelly Dace

Exotic Species

Highback Chub, Redlip Shiner, Tennessee Shiner, Brown Trout, Black Crappie, and Tessellated Darter

Species Change Since Last Cycle

Gains -- Tonguetied Minnow, Highback Chub, Black Crappie, and Appalachia Darter. **Losses** -- Bigmouth Chub and Kanawha Rosyface Shiner.

Data Analysis

Watershed -- drains east central Alleghany County; no municipalities within the watershed; tributary to the Little River, site is ~ 0.3 miles above the creek's confluence with the river. **Habitat** -- runs, bedrock riffles, fairly open canopy; sands and silts in the pools; bottom substrate showed evidence of excessive sedimentation from upstream landuse practices. **2008** -- Redlip Shiner and Mountain Redbelly Dace, both common along the silty banks, accounted for almost 60% of the fish collected; percentage of Omnivores+Herbivores was slightly elevated and indicative of nonpoint source nutrient inputs; Rock Bass and Smallmouth Bass were absent. **1998 & 2008** -- ~6 times more fish collected in 2008 than in 1998 (1,862 vs. 297), Redlip Shiner increased almost 16 fold and Mountain Redbelly Dace increased 20 fold; 23 species known from the site, including 14 species of cyprinids, 6 endemic species (Tonguetied Minnow, Bigmouth Chub, Kanawha Rosyface Shiner, Kanawha Minnow, Kanawha Darter, and Appalachia Darter), and 7 nonindigenous species; and species present in 1998, but absent in 2008 were represented by 2 or 4 fish each.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
BRUSH CR	SR 1433	05/05/08	KF17	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.4858811	-81.0049272	10-9-10	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	18.1	2570	10	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	30	0	70	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	17.7
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	29
pH (s.u.)	6.2

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	13
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	75

Site Photograph



Substrate	Cobble, gravel, and soft silts along the banks
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/05/08	2008-27	19	52	Good

Most Abundant Species	Mountain Redbelly Dace	Exotic Species	Highback Chub, Redlip Shiner, Rainbow Trout, Brown Trout, and Tessellated Darter
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Species Change Since Last Cycle	N/A
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Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains the southeastern corner of Alleghany County; no municipalities within its watershed; tributary to the Little River. **Habitat** -- runs, riffles, and swiftly flowing chutes; side snag pools; minimal canopy and riparian zones along both banks. **2008** -- Mountain Redbelly Dace and Bluehead Chub accounted for 39% of all the fish collected; moderate percentage of Omnivores+Herbivores, indicative of nonpoint source nutrients and an open canopy; percentage of tolerant fish (White Sucker and Creek Chub) was slightly greater than expected for a mountain stream; three endemic species (Kanawha Minnow, Kanawha Darter, and Appalachia Darter) were present; and the lowest conductivity of any fish site, along with Pine Swamp Creek, in the basin in 2008.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
BRUSH CR	SR 1422	KB41	10/02/07	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.516111	-81.012500	10-9-10	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	32	2500	8	0.1

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	30	10	60	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

Temperature (°C)	11.9
Dissolved Oxygen (mg/L)	9.4
Specific Conductance (µS/cm)	38
pH (s.u.)	6.2

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	2
Total Habitat Score (100)	69

Site Photograph



Substrate	mix of cobble, sand; some boulder, gravel, silt, bedrock
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
10/02/07	10345	88	36*	4.87*	3.46	Good
08/20/03	9230	83	42	3.94	3.34	Excellent
08/20/98	7728	62	36	4.04	3.56	Good
07/27/93	6289	96	40	4.73	3.38	Good

* values corrected for seasonality

Taxonomic Analysis

Sampling for this site was last done in October of 2007; all other sampling events occurred in July or August. There were four EPT taxa present (rare in the sample) in October that were not present in the summer samples; of those only one taxon (*Isoperla lata*) shows a seasonal distribution in North Carolina mountain stream sites (it has not been recorded from summer mountain samples). EPT Richness was decremented by one to compensate for the seasonality of the species.

There are five EPT taxa that have been identified from each of the three summer samples and not present in the October sample. Of those, four taxa show a moderate to strong seasonal distribution for mountain stream sites with peak occurrence in the summer and much reduced occurrence in the fall: *Serratella serratiodes* (common in 2003); *Epeorus vitreus* (abundant in 2003); *Micrasema wataga* (common in 2003); and *Neophylax oligius* (abundant in 2003). The four taxa have low tolerance values, ranging from 1.2 to 2.6.

Data Analysis

The site is about six miles east of Sparta, 2.9 miles NW of the closest point on the Blue Ridge Parkway, and 5.2 stream-miles above the confluence with Little River.

Seasonal effects are evident when comparing taxa from the October sample from 2007 with samples from summer in prior years. Reduced EPT richness and a higher NCBI value in 2007 compared to 2003 may be due to seasonal effects and not a decline in water quality between the two years.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
LAUREL BR	SR 1105	KB42	08/18/08	Not Impaired

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.420833	-81.008333	10-9-10-2	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C;Tr	2.7	2705	4	0.2

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	40	0	40	20 (road)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	---	---

Water Quality Parameters

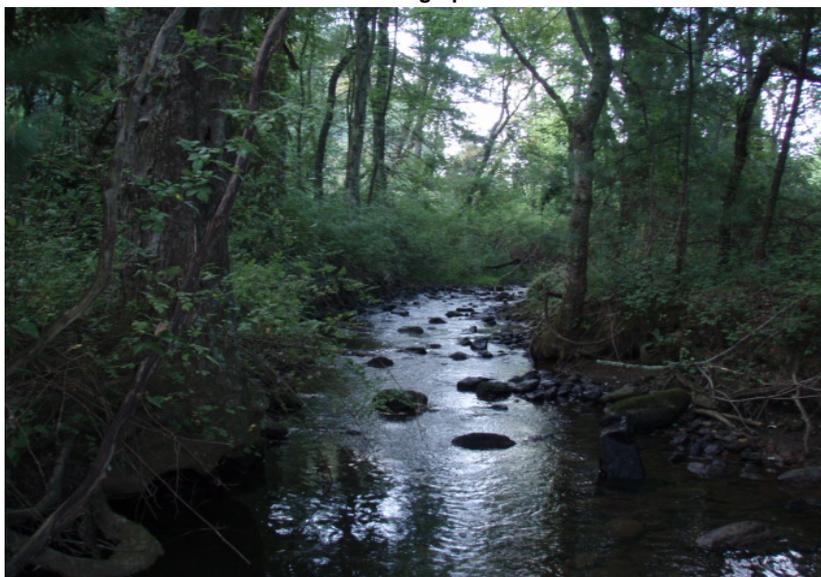
Temperature (°C)	16.0
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	42
pH (s.u.)	5.6

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	19
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	87

Site Photograph



Substrate mix of cobble, boulder, gravel, sand; some silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/18/08	10529	---	26	---	3.51	Not Impaired
04/04/06	9824	100	36*	4.58*	2.73	Good
08/18/03	9216	66	33	4.12	3.53	Good
08/21/98	7729	49	28	3.72	2.91	Good
09/03/92	6008	---	14	---	4.21	Fair

* values corrected for seasonality

Taxonomic Analysis

No unambiguously new taxa were collected in 2008 at the site. The EPT collection method was used in 2008 rather than the Full-Scale method used for the three prior sampling events, complicating comparison of 2008 taxonomic results with those prior events.

Data Analysis

The site is about 8.6 miles southeast of Sparta in southeast Alleghany County, and 0.3 stream-miles from the confluence with Brush Creek.

Current BAU criteria do not allow for classification of stream sites with drainage areas under 3.0 square miles except in unusual circumstances (such as for Little Peak Creek at SR 1595/Ashe County).

Due to the small size of the stream it was decided for the latest sampling effort to use EPT rather than Full-Scale collection methods (as was used for the prior three sampling events at the site); part of the reason for the decrease in EPT Richness between 2008 and the prior summer sampling event in 2003 is certainly due to the different collection methods used. The EPT BI is better for comparison of conditions when those two sampling methods are used; there is no evidence of change in water quality between 2003 and 2008 using that metric.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
CRAB CR	NC 18	05/05/08	KF18	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ALLEGHANY	3	05050001	36.5495584	-81.0023167	10-9-12	New River Plateau

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C;Tr	11.2	2450	8	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	60	10	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	16.1
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	50
pH (s.u.)	6.7

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	2
Left Riparian Score (5)	1
Right Riparian Score (5)	4
Total Habitat Score (100)	77

Site Photograph



Substrate	Slick bedrock, boulders, silts on the substrate
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/05/08	2008-26	14	38	Fair

Most Abundant Species	Mountain Redbelly Dace and Central Stoneroller	Exotic Species	Redlip Shiner, Saffron Shiner, Rainbow Trout, and Tessellated Darter
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Species Change Since Last Cycle	N/A
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Data Analysis

This is the first fish community sample collected at this site. **Watershed** -- drains the northeastern corner of Alleghany County; no municipalities within the watershed; site is ~ 1.5 miles upstream of the creek's confluence with the Little River. **Habitat** -- runs and riffles; side undercuts, bedrock pools; minimal riparian zone along the right shoreline and minimal canopy. **2008** -- more fish were collected at this site (n = 2,368) than at any other site in the basin in 2008; Central Stoneroller, Mountain Redbelly Dace, and Bluehead Chub constituted 65% of all the fish collected; high percentage of Omnivores+Herbivores, indicative of nonpoint source nutrients and an open canopy; diversity metrics lower than expected -- total, cyprinid, Rock Bass+Smallmouth Bass+Trout, and Intolerant diversities; and two endemic species (Kanawha Darter and Appalachia Darter) were present.