

BASINWIDE ASSESSMENT REPORT YADKIN RIVER BASIN



NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT
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BASIN DESCRIPTION

The Yadkin River basin is the second largest basin in North Carolina and covers approximately 7,213 square miles and spans 21 counties (Figure 1). Originating on the eastern slopes of the Blue Ridge Mountains in Caldwell and Wilkes counties, the Yadkin River flows northeasterly for about 100 miles and then turns southeast until it joins the Uwharrie River to form the Pee Dee River. The Pee Dee River continues its southeast course to the North Carolina-South Carolina border and then precedes its flow through the heart of South Carolina before emptying into Winyah Bay (Figure 1).

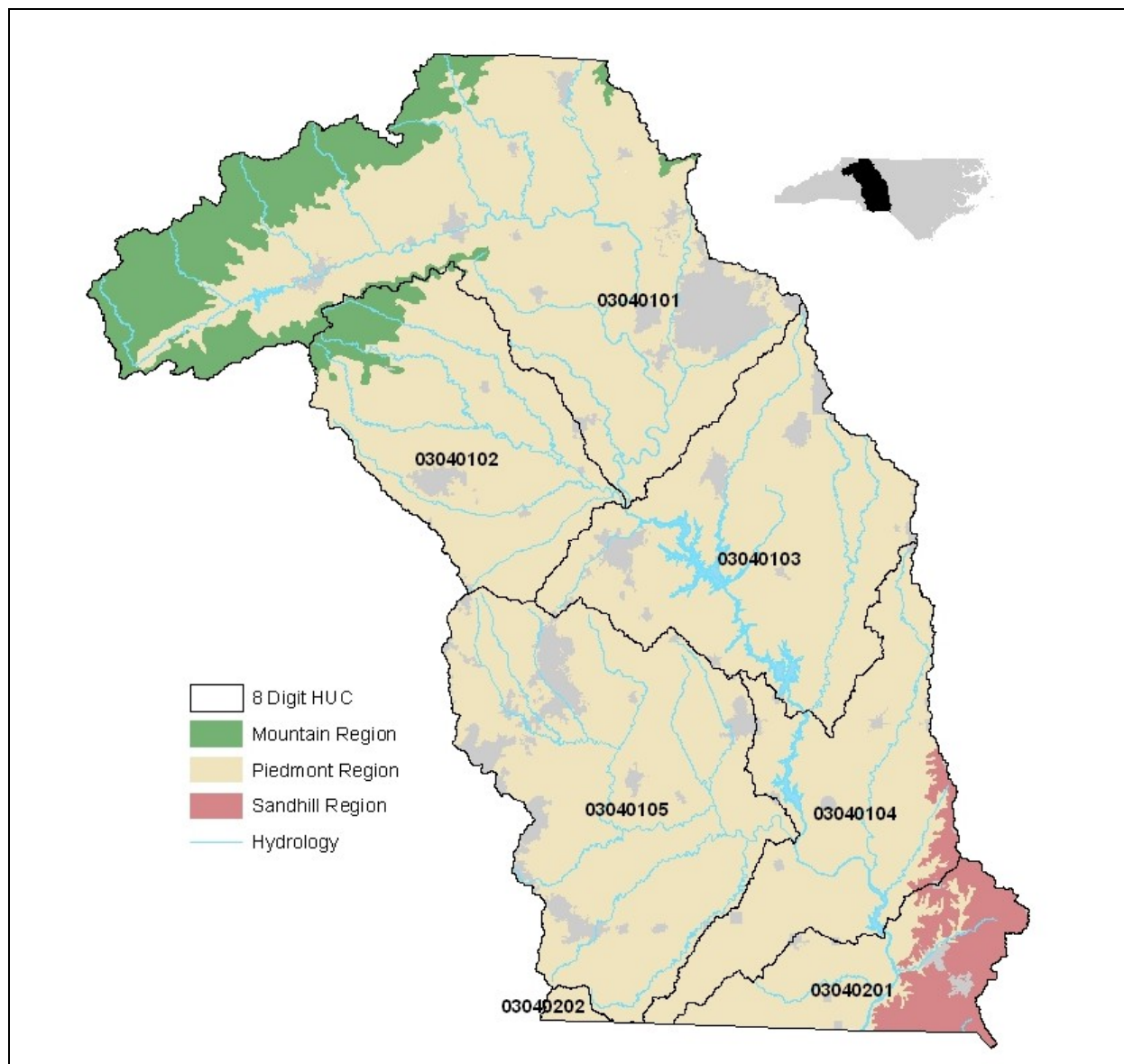


Figure 1. Geographical relationships of the Yadkin River basin.

As would be expected for such a large river basin, there are numerous subcoregions encountered here. The mountain ecoregions includes the Southern Crystalline Ridges and Mountains, and the Eastern Blue Ridge Foothills (Griffith *et al.* 2002). Within the piedmont ecoregions, the subcoregions of the Northern Inner Piedmont, the Triassic Uplands, the Sauratown Mountains, the Southern Outer Piedmont and the Carolina Slate Belt are found (Griffith *et al.* 2002). The lower portion of this basin also includes a small

section of the Sandhills sub ecoregion (Griffith *et al.* 2002). Increasing nutrient enrichment, increasing urbanization of previously rural lands, and impacts from several large NPDES dischargers are the primary impacts to water quality in this basin. Most of these impacts are primarily focused in and around the counties of Forsyth, Rowan, southern and central Iredell, Cabarrus, and Davidson. However, the continuing effects of land conversion from forest and agricultural practices to suburban uses are nearly ubiquitous throughout this basin with only protected natural areas, and steep mountainous terrain escaping these alterations. Despite these areas of concern, there are still streams with very good water quality in this basin although they are restricted to the largely forested, and comparatively undeveloped catchments of northern Wilkes, western Surry, and portions of Montgomery County (Uwharrie National Forest). In fact, of the 51 total ORW (Outstanding Resource Waters) classified streams and rivers in the Yadkin River basin, 72.6% are restricted to subbasin 01 (Wilkes), 19.6% in subbasin 02 (Surry), and 7.8% in subbasin 09 (Montgomery).

YADKIN RIVER HUC 03040101 – YADKIN RIVER HEADWATERS

Description

The Yadkin River Headwaters 8 digit HUC 03040101 contains the Yadkin River subbasins 1, 2, 3, 4 (in part), and 5 (Figure 2). Streams and rivers on the western boundary of the HUC drain the high elevation areas of the Blue Ridge Mountains. Watersheds to the east of the Blue Ridge are primarily located within the Piedmont ecoregions. Streams of the Northern Inner Piedmont generally have rocky substrates, while Southern Outer Piedmont watersheds in the southeast portion of the HUC (around Winston-Salem) have sandier substrates. W. Kerr Scott Reservoir is the first of the Yadkin River chain of lakes, and is the only major impoundment located in this HUC.

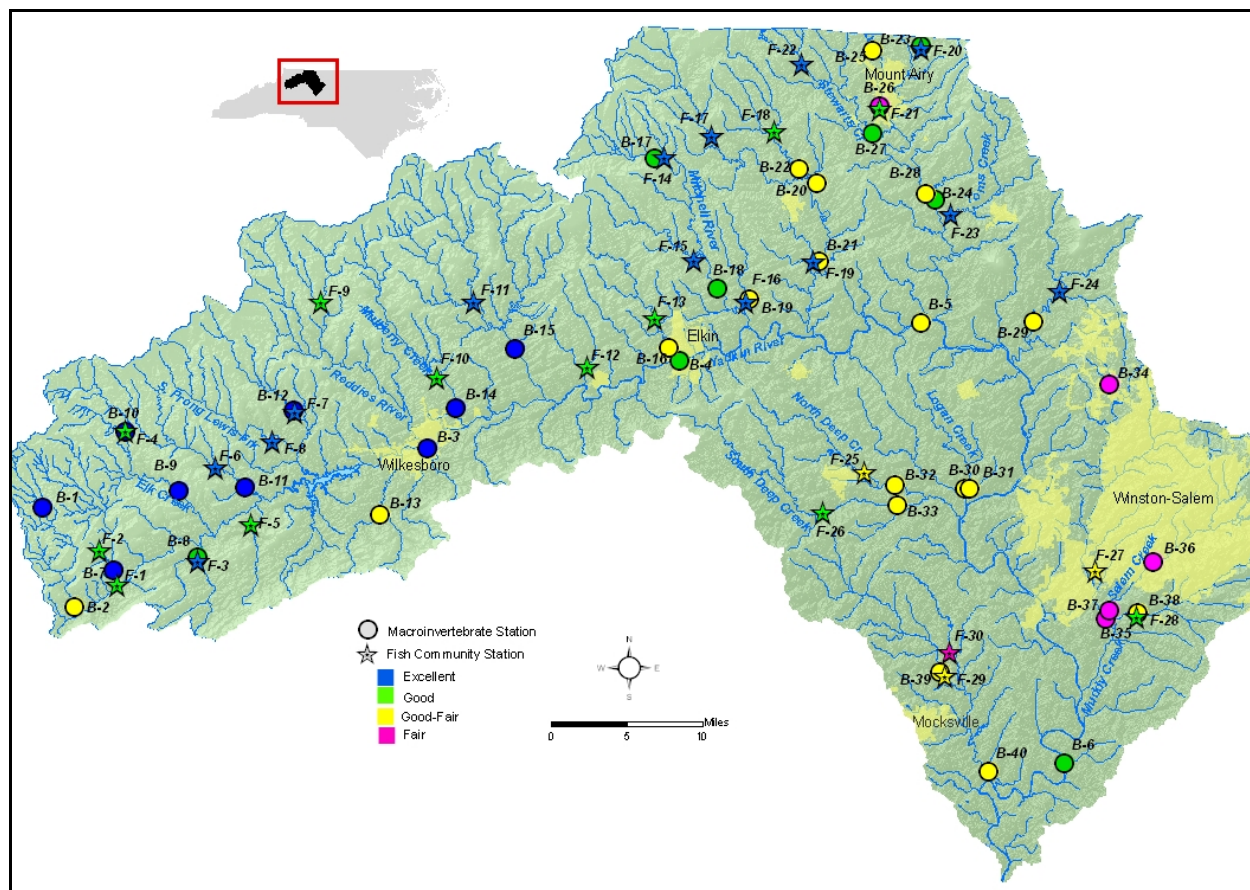


Figure 2. Sampling sites in HUC 03040101 in the Yadkin River Basin. Monitoring sites are listed in Table 1.

Subbasin 01 includes the mountainous headwater reaches of the Yadkin River basin in Watauga, Caldwell and Wilkes Counties. Streams occurring along the northern edge of this subbasin are primarily located within the Southern Crystalline Ridges and Mountain ecoregion where elevations are generally 1200-4500 feet (Griffith *et al.* 2002), stream gradients are high, and landuse is predominantly forest. The major mountain tributaries include Buffalo, Elk, and Stony Creeks, North and South Prong Lewis Forks, Reddies River, Mulberry Creek, and Roaring River, most of which flow south into the Northern Inner Piedmont ecoregion before reaching the Yadkin river. Many of the mountain streams are classified as trout streams, and in terms of their fish communities, are considered mountain cold water, and foothills cool water systems. The Eastern Blue Ridge Foothills ecoregion also occurs along the southern edge of subbasin 01 and includes the Kings and Beaver Creek watersheds. W. Kerr Scott Reservoir is located in this subbasin.

The cities of Wilkesboro and North Wilkesboro are located in subbasin 01, both of which have wastewater treatment plants that discharge to the Yadkin River (4.9 MGD and 2.0 MGD, respectively). The other major discharger is the Louisiana Pacific Corporation ABTCO plant that discharges 1.0 MGD to the Yadkin River, approximately eight river-miles downstream of North Wilkesboro.

Flowing out of its mountainous escarpment in a northeast direction, the Yadkin River then flows through the town of Elkin into subbasin 02 along the Surry and Yadkin County line, before changing direction to the south at the intersection of Surry, Stokes, Forsyth, and Yadkin Counties. The river continues south through this subbasin until just below I-40 in Davie County. Subbasin 02 is located primarily within the Northern Inner Piedmont where elevations and gradients are generally higher and more mountain-like than in other Piedmont ecoregions. The smaller, southern part of the subbasin is located within the Southern Inner Piedmont ecoregion, where streams are characterized by slower flows and sandy substrates. The major tributaries to the Yadkin River in this part of the HUC include the Mitchell, Fisher and Little Yadkin Rivers, Forbush Creek, and Deep Creek. The mountainous section of the Mitchell River watershed above its confluence with the South Fork Mitchell River in western Surry County is classified as ORW.

Landuse in this subbasin is largely forest or used for pasture. The largest residential community in this subbasin is Elkin; others smaller communities include Yadkinville, Dobson, Lewisville, and Clemmons. The three largest NPDES facilities in this subbasin are Chatham Manufacturing Incorporated, which discharges 4.0 MGD into the Yadkin River at Elkin, the Elkin WWTP, which discharges 1.8 MGD into the Yadkin River, and Yadkinville WWTP, which discharges 1.0 MGD into North Deep Creek.

Subbasin 03 lies within the Northern Inner Piedmont ecoregion and originates in the mountains of Virginia. Flowing south, the Ararat River watershed and all of its tributaries drain this entire subbasin before emptying into the Yadkin River to the east of Elkin. The Ararat's main tributaries include Stewarts, Lovills and Flat Shoals Creeks. This watershed is known to have moderate to swift flows throughout the year, with turbidity problems following rainfall events. Outside of the cities of Mt Airy and Pilot Mountain, landuse in this subbasin is mostly forest and pasture. The Mt Airy and Pilot Mountain wastewater treatment plants discharge 7MGD and 1.5 MGD of effluent to the Ararat River, respectively.

The upper portion of Yadkin subbasin 04, approximately bisected north to south by NC 150, includes most of the city of Winston-Salem, one of the largest urban areas in North Carolina. The Muddy Creek watershed is the largest Yadkin River tributary in this subbasin, and receives runoff from almost the entire Winston-Salem vicinity. The major tributaries to Muddy Creek in Winston-Salem include Salem, and South Fork Muddy Creeks. Salem Creek drains a heavily urbanized portion of Winston-Salem. South of Winston-Salem, land use in this lowest part of the HUC is still primarily forest and pasture.

Many streams in Winston-Salem are affected by urban runoff and/or by the city's numerous permitted dischargers, many of which are small residential (i.e. package) plants. Large dischargers in the Muddy Creek drainage include the Winston-Salem Archie Elledge WWTP (Salem Creek, 30 MGD), and Winston-Salem Muddy Creek WWTP (Yadkin River, 21 MGD).

Dutchmans Creek and all of its tributaries, including Cedar Creek (subbasin 05) lies mainly within the Southern Outer Piedmont ecoregion in Davie County. The headwater reaches of Dutchmans Creek originate in small sections of the Northern Inner Piedmont and Triassic Basins ecoregions, along the borders of Yadkin and Iredell Counties. Outside of the town of Mocksville, this area is rural, with the predominant land use in forest and pasture. The Mocksville Town WWTP is the largest permitted NPDES facility in this area, and discharges 0.68 MGD to Dutchmans Creek.

Overview of Water Quality

Overall, there were 40 benthic macroinvertebrate sites sampled in the Yadkin River Headwater HUC (Table 1). Seven of the 36 benthic macroinvertebrate sites previously sampled in the last basinwide cycle had an improvement in bioclassification. The Yadkin River at NC18/268 was the only benthic site that improved by two bioclassifications. Seven of the 36 benthic basinwide sites also declined by one bioclassification.

Table 1. Waterbodies monitored in HUC 03040101 in the Yadkin River basin for basinwide assessment, 2001 and 2006.

Map # ¹	Waterbody	County	Location	2001	2006
B-1	Yadkin R	Caldwell	NC 268, Patterson	Good-Fair	Good-Fair
B-2	Yadkin R	Caldwell	SR 1372	Good	Excellent
B-3	Yadkin R	Wilkes	NC 18/268	Good-Fair	Excellent
B-4	Yadkin R	Yadkin	US 21	Good	Good
B-5	Yadkin R	Surry	SR 1003	Good	Good-Fair
B-6	Yadkin R	Davidson	SR 1447	Good	Good
B-7	Buffalo Cr	Caldwell	SR 1505	Excellent	Excellent
B-8	Kings Cr	Caldwell	SR 1552	---	Good
B-9	Elk Cr	Wilkes	SR 1175	Good	Excellent
B-10	Laurel Cr	Watauga	SR 1508	---	Excellent
B-11	Stony Fk	Wilkes	SR 1135	Excellent (2002)	Excellent
B-12	N Pr Lewis Fk	Wilkes	Near SR 1300	Excellent (2002)	Excellent
B-13	Moravian Cr	Wilkes	NC 18	Good-Fair	Good-Fair
B-14	Mulberry Cr	Wilkes	NC 268	Excellent	Excellent
B-15	Roaring R	Wilkes	SR 1990	Good	Excellent
B-16	Elkin Cr	Surry	NC 268	Good-Fair	Good-Fair
B-17	Mitchell R	Surry	SR 1330	Good	Good
B-18	Mitchell R	Surry	SR 1001	Excellent	Good
B-19	Snow Cr	Surry	SR 1121	Good-Fair	Good-Fair
B-20	Fisher R	Surry	US 601	Good	Good-Fair
B-21	Fisher R	Surry	NC 268	Good	Good-Fair
B-22	L Fisher R	Surry	SR 1480	Good-Fair	Good-Fair
B-23	Ararat R	Surry	NC 104	Good-Fair	Good
B-24	Ararat R	Surry	SR 2019	Good-Fair	Good
B-25	Lovills Cr	Surry	SR 1700	Good-Fair	Good-Fair
B-26	Lovills Cr	Surry	SR 1371	Fair	Fair
B-27	Stewarts Cr	Surry	SR 2258	Good	Good
B-28	Flat Shoal Cr	Surry	SR 2017	---	Good-Fair
B-29	L Yadkin R	Stokes	SR 1102	---	Good-Fair
B-30	Forbush Cr	Yadkin	SR 1570	Good-Fair	Good-Fair
B-31	Logan Cr	Yadkin	SR 1571	Good	Good-Fair
B-32	N Deep	Yadkin	SR 1510	Good-Fair	Good-Fair
B-33	S Deep Cr	Yadkin	SR 1710	Good-Fair	Good-Fair
B-34	Muddy Cr	Forsyth	SR 1898	Good-Fair	Fair
B-35	Muddy Cr	Forsyth	SR 2995	Good-Fair	Fair
B-36	Salem Cr	Forsyth	SR 2902	Fair	Fair
B-37	Salem Cr	Forsyth	SR 2991	Fair	Fair
B-38	S Fk Muddy Cr	Forsyth	SR 2902	Good-Fair	Good-Fair
B-39	Dutchmans Cr	Davie	US 158	Good-Fair	Good-Fair
B-40	Dutchmans Cr	Davie	NC 801	Fair	Good-Fair

Table 1 (continued).

Map # ¹	Waterbody	County	Location	2001	2006
F-1	Yadkin R	Caldwell	NC 268	Good	Good
F-2	Buffalo Cr	Caldwell	SR 1594	Excellent (1999)	Good
F-3	Kings Cr	Caldwell	SR 1552	---	Excellent
F-4	Laurel Cr	Watauga	SR 1508	Good (1999)	Good
F-5	Beaver Cr	Wilkes	SR 1131	Good	Good
F-6	Stony Fk	Wilkes	SR 1170	---	Excellent
F-7	N Prong Lewis Fk	Wilkes	SR 1304	Excellent	Excellent
F-8	S Prong Lewis Fk	Wilkes	SR 1154	Good	Excellent
F-9	N Fk Reddies R	Wilkes	SR 1567	Excellent	Good
F-10	Mulberry Cr	Wilkes	SR 1002	---	Good
F-11	M Prong Roaring R	Wilkes	SR 1002	Excellent	Excellent
F-12	Big Bugaboo Cr	Wilkes	SR 1924	---	Good
F-13	Elkin Cr	Wilkes	SR 2044	---	Good
F-14	Mitchell R	Surry	SR 1330	Good (1999)	Excellent
F-15	S Fk Mitchell R	Surry	SR 1301	---	Excellent
F-16	Snow Cr	Surry	SR 1121	---	Excellent
F-17	Fisher R	Surry	SR 1331	Excellent	Excellent
F-18	Little Fisher R	Surry	SR 1480	Good	Good
F-19	Cody Cr	Surry	US 268	Good (1996)	Excellent
F-20	Ararat R	Surry	NC 104	---	Excellent
F-21	Lovills Cr	Surry	SR 1371	---	Good
F-22	Stewarts Cr	Surry	SR 1622	Excellent	Excellent
F-23	Toms Cr	Surry	SR 2024	Excellent	Excellent
F-24	Little Yadkin R	Stokes	SR 1236	Excellent	Excellent
F-25	N Deep Cr	Yadkin	SR 1605	Good-Fair	Good-Fair
F-26	S Deep Cr	Yadkin	SR 1152	Good	Good
F-27	Silas Cr	Forsyth	SR 1137	Good-Fair (2002) ²	Good-Fair
F-28	S Fk Muddy Cr	Forsyth	SR 2902	Good-Fair	Good
F-29	Dutchmans Cr	Davie	US 158	Good-Fair	Good-Fair
F-30	Cedar Cr	Davie	off SR 1410	---	Fair (2004)

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

²Basinwide site that was resampled as a special study.

In addition, there were 30 fish community sites sampled in the Yadkin River Headwater 8-digit HUC. Four of the 20 fish community sites previously sampled in the last basinwide cycle improved by one bioclassification and two declined by one bioclassification (Table 1).

The Yadkin River basin was experiencing moderate to severe drought conditions in 2001, which had the potential to reduce the impacts from nonpoint sources and magnify the impacts from point source discharges. This below average flow regime in the basin should be considered when looking at changes in the 2006 monitoring cycle.

The upper part of the Yadkin River Headwaters HUC generally has Good or Excellent water quality, as indicated by the basinwide sites (benthic and fish) sampled west of Elkin (Figure 2). Two of the benthic sites in the uppermost part of the HUC (Yadkin River at SR 1372, and Elk Creek at SR 1175) have been showing trends of stable or improving water quality since the 1980's, and had ratings of Good in 2001 that increased to Excellent in 2006. A new benthic site in the upper Elk Creek watershed (Laurel Creek at SR 1508, an established fish community site) was also rated Excellent for its benthic community and Good for fish community. The Yadkin River at NC 268 in Patterson is an exception in this part of the watershed, receiving two consecutive Good-Fair benthic ratings, which may be attributed to runoff from road projects along NC 321. Buffalo Creek received its third Excellent rating for benthic macroinvertebrates at SR 1505, but slipped from its previous fish community rating of Excellent to Good at SR 1594 (further upstream).

The Kings Creek watershed was sampled for the first time in 2006 at SR 1552 for both benthic macroinvertebrates and fish, and received ratings of Good and Excellent, respectively. The Stony Fork and North Prong Lewis Fork tributaries continue to be rated Excellent for both their benthic and fish

communities, and have shown very few discernable water quality stressors. The South Prong Lewis Fork fish community site at SR 1154 also improved in rating from Good to Excellent.

A few miles southwest of Wilkesboro, the benthic site at NC 18 on Moravian Creek has produced three consecutive Good-Fair ratings, and may be showing subtle signs of declining water quality in that agricultural watershed. The benthic site in Wilkesboro (Yadkin River at NC 18/268) has fluctuated between Good-Fair and Good since 1984, and is the only biological monitoring station in the Yadkin River Headwater HUC that improved two whole ratings in 2006; rising to Excellent.

The biological assessments of the Mulberry Creek watershed indicate good water quality. The creek was sampled for the first time for fish in 2006 at SR 1002 and received a rating of Good. Further downstream at NC 268, the stream has been rated Excellent for its benthic community on three occasions, and shows no signs of water quality stressors. The Roaring River at SR 1990 moved from Good to Excellent, and has been showing trends of stable or improving water quality since first sampled in 1983. The Middle Prong Roaring River fish community site rated Excellent for the second time in a row, after an initial 1996 rating of Good in this rural mountain watershed. The fish community of Big Bugaboo Creek just outside of Rhonda at SR 1924 was sampled for the first time in 2006, and earned a rating of Good.

Bound by Elkin and Jonesville, the Yadkin River at US 21 has been sampled for benthic macroinvertebrates on three occasions since 1996. This urban river site has maintained a rating of Good since the 2001 assessment, and has shown slight improvement over a ten-year period. The Elkin Creek tributary just upstream of this site has been sampled for its benthic community at NC 268 and further upstream for fish at SR 2044. The lower site has maintained a Good-Fair rating over three basinwide cycles and continues to show its urban influences. The new fish community site located about three miles upstream at SR 2044 is classified as WS-II; HQW, and was rated Good in 2006. Streams in the northernmost areas of the Yadkin River Headwater HUC and especially the northwest corner of Surry County are typified by rural montane characteristics, and in general, exhibit good water quality. The upper Mitchell River watershed in western Surry County, much of which is classified as ORW (above the South Fork Mitchell confluence), has benefited from extensive restoration and conservation efforts. There are four biological monitoring stations located throughout the Mitchell River watershed.

The upper Mitchell River site at SR 1330 retained its third consecutive Good rating for benthos in 2006, and improved to a rating of Excellent based on the fish community. In fact, water quality (as indicated by the fish community) has shown a steady improvement over three assessments, from Good-Fair in 1996 to Excellent in 2006, and can be attributed to the ongoing conservation and habitat restoration efforts. Further downstream at the SR 1003 crossing, the 2006 benthic assessment of the Mitchell River indicated a return to a previous rating of Good (1987 and 1996) after one Excellent rating in 2001 based on low flows and the lack of nonpoint pollution inputs. The fish community of South Fork Mitchell River was sampled for the first time in 2006 at SR 1301, and was rated Excellent.

Snow Creek is a tributary to the lower Mitchell River that was rated Good-Fair for benthos at SR 1121 in 2001 and 2006 (a decline from a Good rating in 1996). This site however, which drains a primarily forested and agricultural watershed, was rated Excellent for fish in 2006.

The upper Fisher River watershed drains the rural extreme northwest corner of Surry County. The 2006 fish community site located at SR 1331 retained its water quality rating of Excellent, and is showing no discernable signs of stressors. However, the water quality ratings at two benthos sites further downstream (US 601 and NC 268) declined from Good in 2001 to Good-Fair in 2006 based on low flow and sedimentation (upstream residential construction), respectively. Originating in Virginia, the Little Fisher River retained its water quality ratings of Good (as indicated by the fish community) and Good-Fair (as indicated by benthic macroinvertebrates), but was noted as having an increased amount of interstitial sediment than in 2001. Although not sampled since the 1996 basinwide cycle, the fish community of Cody Creek (a tributary to the Little Fisher River) showed a slight water quality improvement, with an increase in rating from Good to Excellent.

The Yadkin River at SR 1003 (just before its turn to the south) has been sampled for benthic macroinvertebrates on three occasions, fluctuating between ratings of Good-Fair and Good since 1996. In 2006 the rating returned to Good-Fair, as the benthic community at this 1,228 square mile site is showing trends towards increasingly tolerant organisms.

Originating in the mountains of Virginia, the Ararat River watershed located in the northeast corner of the Yadkin River Headwaters HUC, comprises the entire Yadkin River subbasin 03, and is almost completely contained within Surry County. At the uppermost monitoring site on the Ararat River (NC 104), nearly the entire drainage flows from Virginia. In 2006, this site was rated Good based on the benthic community (an improvement from the two previous Good-Fair ratings) and Excellent based on the first fish community assessment. Further downstream at SR 2019, the benthic community has shown consistent improvements in water quality since the 1996 assessment (rated Fair). Since then, the site has earned a Good-Fair rating in 2001, then improved to a rating of Good for benthos in 2006, which was likely due to the loss of the textile industry in Mt Airy. All biological monitoring efforts indicate that water quality is improving in this watershed.

Stewarts Creek is a main tributary that drains the western side of the watershed. The fish community site in the upper part of this catchment (SR 1622) was rated Excellent for the third time in 2006, and the benthos site draining western Mt Airy (located just above the Ararat River confluence at SR 2258) earned a second rating of Good. The aquatic biotas at these sites are very stable and there appears to be no discernable water quality stressors in this watershed. There are three monitoring sites on Lovills Creek, which runs through the center of Mt Airy. The benthos site just below the Virginia line (SR 1700) has been rated Good-Fair on three occasions and continues to indicate no specific stressors in that upper part of the catchment. The Lovills Creek site at SR 1371 in southwest Mt Airy has been rated Fair in three consecutive benthos assessments, yet the first fish community sample in 2006 indicated Good water quality, mostly as a result of the extreme number of fish that were collected. In fact, the abundance of aquatic vegetation at this site (due to an open canopy and non-point nutrients) may be enhancing the fish community.

Flat Shoal Creek was sampled for the first time for benthos at SR 2017 in 2006, and earned a rating of Good-Fair. However, the influence of the Ararat River (site 250 feet above the Ararat River confluence) during high flow events may cause this site to be somewhat unrepresentative of the watershed as a whole. The fish community of Toms Creek, the next major downstream tributary to the Ararat River draining Pilot Mountain, was sampled at SR 2024 in 2001 and 2006 and has received its second consecutive rating of Excellent, with no apparent water quality issues.

In general, the areas that lie to the east and southeast of the town of Elkin in the Yadkin River Headwater HUC are dominated by Piedmont topographies. The Little Yadkin River watershed drains the southwest corner of Stokes County and maintained its third Excellent rating (as indicated by the fish community) at SR 1236. Further southwest at the SR 1102 crossing, the Little Yadkin River was rated Good-Fair following its first benthic macroinvertebrate assessment. This rating is reflective of the various land uses in the watershed including agriculture, commercial and residential. Situated between Winston-Salem and Yadkinville, the largely agricultural watershed of Forbush Creek has maintained its water quality rating of Good-Fair at SR 1570 since 1996, and is supporting a stable benthic community that may be showing a slight trend towards more tolerant species. Logan Creek is a tributary to Forbush Creek that has fluctuated between ratings of Good-Fair (1996 and 2006) and Good (2001). The drop in the 2006 rating may not be related to a decline in water quality in this agricultural watershed, but rather may reflect recent high flows that scoured the benthic population. The North Deep Creek watershed has maintained its water quality rating of Good-Fair for both benthos and fish community monitoring sites since it was first sampled in 1993. Water quality in the South Deep Creek watershed (drains the south side of Yadkinville) has also remained stable since 1996, with three ratings of Good (as indicated by the fish community at SR 1152), and three ratings of Good-Fair further downstream (as indicated by benthos at SR 1710).

In general, water quality in and around the Winston-Salem metropolitan area appears to be unchanged since the last basinwide assessment. The benthic site in the upper Muddy Creek watershed (at SR 1898) dropped by one bioclassification to Fair, likely because of a decline in habitat quality (erosion and

sedimentation). Although the monitoring site located further downstream on Muddy Creek at SR 2995 (below its confluence with Salem Creek) also declined by one rating to Fair, the benthic community at this location appears to indicate fairly stable stream conditions. Water Quality in Silas Creek also appears to be unchanged since the last monitoring cycle. This urban site was rated Good-Fair for the second time since 2002, based on its fish community. Both of the benthic sites in the heavily urbanized watershed of Salem Creek also retained their ratings of Fair and indicate stable water quality conditions. As indicated by the increase in the fish community rating at the SR 2902 crossing from Good-Fair to Good, water quality in the South Fork Muddy Creek watershed seems to be improving slightly. Possible reasons include the loss of industrial dischargers, as well as sewer collection system upgrades in Kernersville. However, the benthic macroinvertebrates sampled at this same location indicated no changes in water quality. Despite its location below the Muddy and Salem Creek catchments (about 10 miles downstream from the Muddy Creek confluence), the Yadkin River site at SR 1447 (this crossing is listed as SR 1147 in the 2001 Basinwide Assessment Report) maintained its fifth rating of Good for benthos since 1985. In part, good habitat qualities have been attributed to the stable benthic community at this location.

The US 158 monitoring site in the upper Dutchmans Creek watershed earned its second Good-Fair rating for both benthic macroinvertebrates and the fish community in 2006. As in 2001, low flows at this sandy low gradient site exposed some functional instream habitats (i.e. root mats), which may be affecting these ratings. Further downstream below Mocksville at the NC 810 crossing, the benthic rating for Cedar Creek improved slightly from Fair to Good-Fair because of slight improvements in habitat quality. However, both of these monitoring sites continue to suffer from the same habitat issues including sedimentation from easily eroded banks and instream habitat exposures that occur during periods of drought. The fish community of Cedar Creek (a tributary to Dutchmans Creek) has been sampled on three occasions since 1996, with the most recent sample resulting in a decline in rating from Good in 2001 to Fair in 2006. This stream is also a low flow affected stream that suffers from poor instream habitats during periods of drought.

River and Stream Assessment

Specific site summaries of the 40 benthic macroinvertebrate and 30 fish community samples may be found at this link: [03040101](#).

SPECIAL STUDIES

Benthic Macroinvertebrate Monitoring of Stewarts Creek, Surry County

Stewarts Creek at NC 89 was re-sampled in order to determine if it should be placed on the 303d list, as an earlier 2001 sample resulted in a Fair bioclassification (BAU Memorandum B-021001). The 2002 resample produced a Good-Fair rating. A temporary cofferdam upstream of the sampling location during the 2001 sample restricted flow to the riffle area, and thereby lowered EPT richness and the bioclassification. The dam was removed after the 2001 sample, thereby restoring the riffle and the stream's bioclassification.

Benthic Macroinvertebrate Monitoring of Heatherly Creek, Surry County

Two sites on Heatherly Creek (at NC 268 and US 52) were sampled as part of an upstream/downstream study on the effects of the 1996 removal of the Pilot Mountain WWTP discharge on Heatherly Creek (BAU Memorandum B-040823). This facility used to discharge upstream of the US 52 location. The 2004 samples declined from the 2001 samples. The 2001 samples were collected during drought conditions, and were therefore receiving less polluted runoff from the upstream Town of Mt. Airy. In 2004, normal flows returned and the increased pollutant inputs lowered the bioclassifications from 2001 levels.

Benthic Macroinvertebrate Monitoring of Faulkner Creek, Surry County

Faulkner Creek was sampled at three locations (SR 1742, SR 1756, SR 1827) in order to determine if the stream should remain on the 303d list (BAU Memorandum B-020719). It was determined that the section of Faulkner Creek below SR 1742 should remain listed on the 303d list, as it received a Not Rated bioclassification.

2006 Benthic Macroinvertebrate Monitoring of Winston-Salem Regional Office requested streams, Surry County: Faulkner Creek, Rutledge Creek and Heatherly Creek (BAU Memorandum B-061129)

Two Faulkner Creek sites (SR 1742 and SR 1756) were sampled to determine if the stream should be removed from the 303d list. Both sites received bioclassifications (Good-Fair and Not Impaired) which were sufficient to remove them from the 303d list.

Rutledge Creek was sampled at SR 1774 to monitor the effects of increased development and increased levels of animal operations. Benthic sampling produced a Good bioclassification, and it was suggested this site be added to the basinwide sampling schedule.

Heatherly Creek was sampled at US 52 to determine if it could be removed from the 303d list. It was recommended that this site should be removed from the list as it was borderline Not Rated/Not Impaired, and because DWQ does not currently have small stream bioclassification criteria.

Benthic Macroinvertebrate Monitoring of Reynolds Creek, Forsyth County

Reynolds Creek was sampled in September 2006 at two sites near SR 1156 in Lewisville (above and below WWTP outfall) to ascertain the extent of stream recovery after the removal of the Sequoia WWTP, and for possible removal from the impaired streams list (BAU Memorandum B-070129b). It was determined that the downstream reach has recovered and now rivals the upstream section in regards to water quality. The creek was rated Not Impaired above and below the old outfall, a sufficient rating for removal from the 303(d) list.

303(d) Fish Community Reassessment Study, Forsyth County

Silas Creek at SR 1137 was sampled for a second time on April 24, 2002 to substantiate a potential 303(d) listing for the stream (BAU Memorandum F-20020705). Silas Creek was rated Good-Fair during this assessment, an improvement from the Fair rating obtained during its first basinwide assessment in 2001, and the watershed was not placed on the list of impaired streams. In 2006, this urban site was sampled again as a basinwide site, and received another Good-Fair rating.

Fish Community Urbanization Studies

Several sites were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study (unpublished data). Salem Creek at SR 2902 in Forsyth County drains approximately 60 square miles of central Winston Salem. The total habitat score for this urban creek was 42, and the site was rated Good-Fair, with a total of nine fish species, most of which were tolerant.

Muddy Creek off SR 1632 in Forsyth County drains a small area of northwest Winston Salem. Muddy Creek had an overall habitat score of 58, and was rated Excellent because of its diverse, well-balanced community of fish that included 18 species. Contrary to the Salem Creek site, the fish community of Muddy Creek had a low occurrence of tolerant species (18%) and appeared to be in good health.

Located in a suburb of Winston Salem, Cedar Creek off SR 1410 in Davie County) illustrated the urban nature of this watershed and the site received an NCIBI rating of Fair. Eight species of fish were collected, the majority of which were tolerant (70%). The total habitat score of 50 and a specific conductance of 260 (no NPDES dischargers upstream).

YADKIN RIVER HUC 03040102 – SOUTH YADKIN RIVER

Description

The South Yadkin River HUC 03040102 (subbasin 06) consists of the South Yadkin River watershed and its major tributaries: Hunting, Rocky, Fourth, Third, and Second Creeks (Figure 3). The tributary streams constitute large watersheds in Iredell, Davie, and Rowan counties. Except for a very small portion of the headwater sections of Rocky, Hunting and North Hunting Creeks (in Wilkes and Yadkin counties), which are located in the Eastern Blue Ridge Foothills ecoregion, the majority of the subbasin is located in the Southern Outer Piedmont and Northern Inner Piedmont ecoregions. The watershed includes the I-40 and US 70 corridors from Salisbury westward. The largest metropolitan area in this subbasin is Statesville. Land use is mainly forest and agriculture.

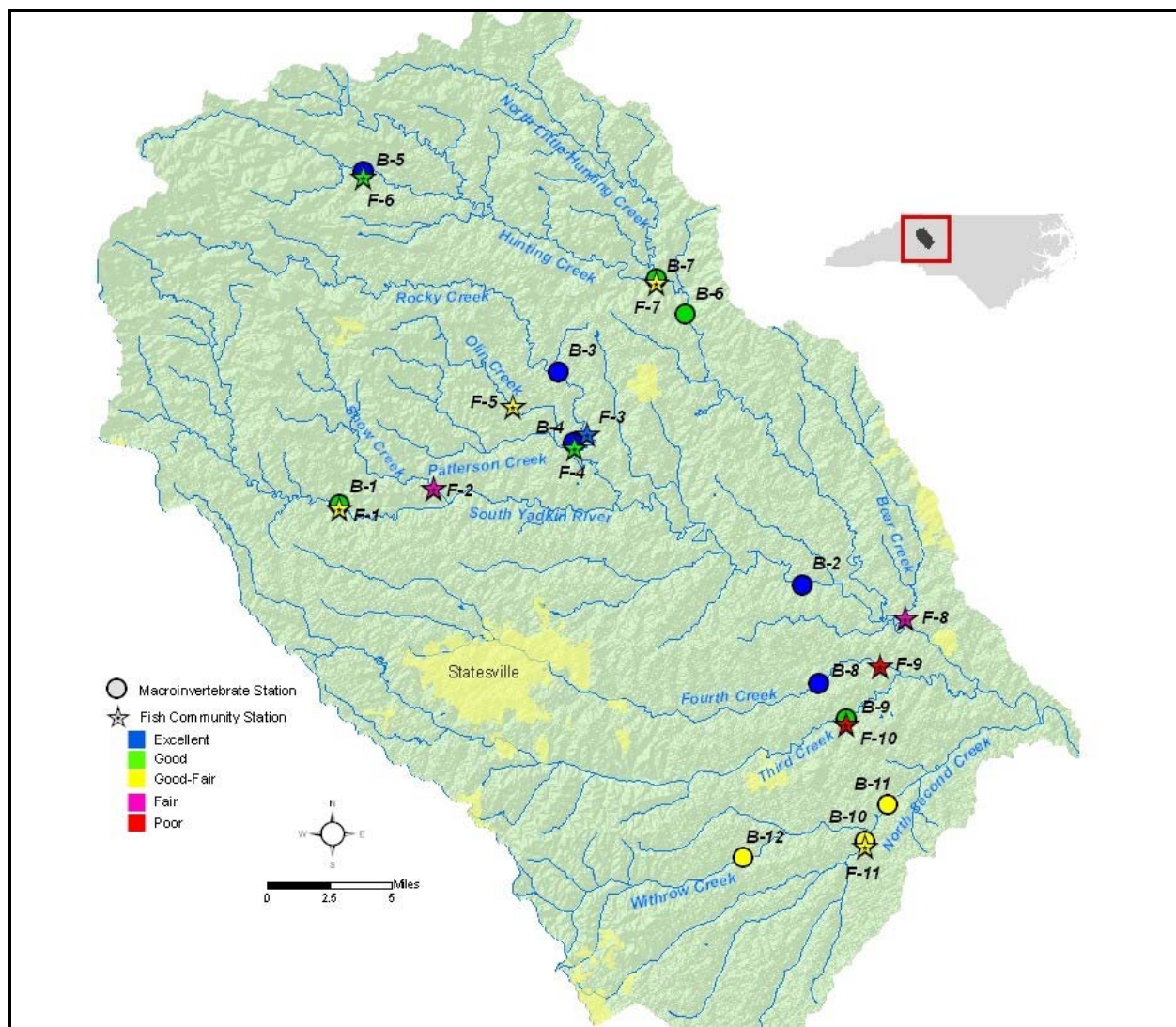


Figure 3. Sampling sites in HUC 03040102 in the Yadkin River basin. Monitoring sites are listed in Table 2.

North Little Hunting, Hunting and Rocky Creeks originate in the foothills of the Brushy Mountains. Hunting and Rocky Creeks flow from southeast Wilkes County south southeastward across the northern third of Iredell County where the land use is mostly forested. North Little Hunting Creek flows southward

from Yadkin County into Iredell County where it joins Hunting Creek in the northeastern corner of Iredell County. Second Creek is on the 303(d) list from its source to the South Yadkin River. Third and Fourth Creeks, which drain much of Statesville, the largest metropolitan area in the subbasin, are 303(d) listed as well. Both Third Creek and Fourth Creek originate above Statesville, in an area of agricultural land use. The streams flow east southeastward across Iredell County through the city of Statesville and receive urban runoff from several small tributaries. Downstream of the city, the catchment is a combination of forest, agricultural and residential land use. The city of Statesville is permitted to discharge up to 6.0 MGD to Fourth Creek and 4.0 MGD to Third Creek.

There are over 25 major and minor dischargers in this HUC of which several have permitted flows > 1 MGD. The facilities that have permitted flows > 1 MGD mainly discharge to the South Yadkin River and Hunting, Second, Third, and Fourth Creeks.

Overview Of Water Quality

Many of the streams in this HUC have moderate to severe bank erosion and are suffering from shifting sandy substrates, channelization, and sedimentation. During benthos sampling most of the streams were slightly turbid to turbid. Table 2 presents the waterbodies monitored in HUC 03040102 for benthos and fish basinwide assessment in 2006. Figure 3 presents the sites monitored for benthos and fish in 2006, depicting the bioclassification for each location.

Table 2. Waterbodies monitored in HUC 03040102 in the Yadkin River basin for basinwide assessment, 2001 and 2006.

Map # ¹	Waterbody	County	Location	2001	2006
B-1	South Yadkin R	Iredell	SR 1561	Good	Good
B-2	South Yadkin R	Davie	SR 1159	Excellent	Excellent
B-3	Rocky Cr	Iredell	SR 1884	Excellent	Excellent
B-4	Patterson Cr	Iredell	SR 1890	Good	Excellent
B-5	Hunting Cr	Wilkes	NC 115	Excellent	Excellent
B-6	Hunting Cr	Iredell	SR 2115	Excellent	Good
B-7	North Little Hunting Cr	Iredell	SR 1829	Excellent	Good
B-8	Fourth Cr	Rowan	SR 1003	Good	Excellent
B-9	Third Cr	Rowan	SR 1970	Good	Good
B-10	North Second Cr	Rowan	SR 1526	Fair	Good-Fair
B-11	North Second Cr	Rowan	US 70	Fair	Good-Fair
B-12	Withrow Cr	Rowan	SR 1547	Good-Fair	Good-Fair
F-1	S Yadkin R	Iredell	SR 1561	Good-Fair	Good-Fair
F-2	Snow Cr	Iredell	SR 1905	---	Fair
F-3	Rocky Cr	Iredell	SR 1890	---	Excellent (2004) ²
F-4	Patterson Cr	Iredell	SR 1890	---	Good (2004) ²
F-5	Olin Cr	Iredell	SR 1892	Fair (1996)	Good-Fair
F-6	Hunting Cr	Wilkes	NC 115	Excellent	Good
F-7	N Little Hunting Cr	Iredell	SR 1829	Good	Good-Fair
F-8	Bear Cr	Davie	SR 1116	---	Fair (2004) ²
F-9	Fourth Cr	Iredell	SR 1985	Poor	Poor (2003)
F-10	Third Cr	Rowan	SR 1970	Poor	Poor
F-11	N Second Cr	Rowan	SR 1526	Good-Fair	Good-Fair

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

²special study site that has become a basinwide site.

Twelve sites were sampled for benthic macroinvertebrates in this HUC in 2006. All the streams sampled for benthos were classified using Piedmont criteria, except for Hunting Creek at NC 115 (Mountain ecoregion). Among these, four sites (Patterson Creek, Fourth Creek, North Second Creek at SR 1526, and North Second Creek at US 70) showed improved bioclassifications compared with 2001 sampling, six sites retained the same bioclassification as 2001, and two sites (Hunting Creek at SR 2115 and North Little Hunting Creek) showed degraded bioclassifications compared to 2001. None of the sites improved or degraded more than one level of bioclassification.

Eleven sites were sampled to evaluate fish populations. One site, Olin Creek, showed an improved bioclassification, four sites retained their 2001 classification, and two sites (Hunting Creek at NC 115 and North Little Hunting Creek) showed degraded classification compared to 2001. Four additional fish sites were added as basinwide sites: Snow Creek, Rocky Creek at SR 1890, Patterson Creek at SR 1890, and Bear Creek.

The watersheds in the northern half of the HUC (north of Statesville) all have Good or Excellent water quality based on benthic macroinvertebrates. The fish communities generally supported the benthos findings with the exception of South Yadkin River and North Little Hunting Creek. The number of fish and the number of fish species collected at these two sites decreased and the number of tolerant fish species collected increased. Conversely, the benthos data showed an increase in the number of intolerant macroinvertebrate species.

The watersheds in the southern half of the HUC (Third Creek, Fourth Creek, North Second Creek, and Withrow Creek) support more tolerant benthic and fish communities than the upper South Yadkin River watershed. The fish community reflected less species diversity than the benthic community, especially in Fourth and Third Creeks, which were rated Poor by the fish but Good or Excellent by the benthos. This may be explained by the lack of good instream habitats in these very sandy streams.

River And Stream Assessment

Fourth Creek was sampled in 2003, which was within the five-year basinwide window. Therefore, the 2003 rating was used to compare with the 2001 rating. Four additional fish sites, of which three were sampled in 2004 and one in 2005, were added to the basinwide schedule and will be sampled as a basinwide site in future assessments.

Specific site summaries of the 12 benthic macroinvertebrate and 11 fish community samples may be found at this link: [03040102](#).

SPECIAL STUDIES

Fish Community Urbanization Study

Rocky Creek at SR 1890 and Patterson Creek at SR 1890 in Iredell County and Bear Creek at SR 1116 in Davie County were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study (unpublished data). The fish communities were rated Excellent, Good, and Fair, respectively.

Fourth Creek Fish Community TMDL Study

Four sites on Fourth Creek (at SR 1930, SR 2320, and SR 2308 in Iredell County and at SR 1985 in Rowan County) were sampled by DWQ in 2003 as part of a Total Maximum Daily Load stressor study (Biological Assessment Unit Memorandum 20031006). The study concluded that flows in the creek are extreme – from as little as 1 cfs during droughts to more than 4,000 cfs during the winter of 2003. The stream also has elevated specific conductance, turbidity, and fecal coliform bacteria, and degraded instream and riparian habitats. The sources of these stressors (causes of impairment) are the historic poor landuse practices in the watershed, the current urban landuse practices surrounding the City of Statesville, the erosive soils throughout the watershed, and the wastewater treatment plant. These stressors have resulted in degraded fish communities where the fish communities were sparse and dominated by species indicative of some nutrient enrichment, tolerance to pollution, variable flows, and degraded instream habitats.

Fourth Creek Benthic Community TMDL Study

As part of the development of a Total Maximum Daily Load Stressor Study for Fourth Creek, the benthic macroinvertebrate communities at seven sites were evaluated during June and July 2003. Ratings ranged from Fair to Excellent. The benthic community did not show extreme degradation except below Statesville's WWTP (Biological Assessment Unit Memorandum B-031006).

Regional Office and Planning Section Requests

The Winston-Salem Regional Office, Mooresville Regional Office and the DWQ Planning Section requested benthic sampling for various water quality and watershed concerns at three locations in the Yadkin Subbasin 06 (Third Creek, Fourth Creek, and Olin Creek) in 2006. Ratings ranged from Good-Fair to Good (Biological Assessment Unit Memorandum B-061114).

303d Resampling

Basinwide sampling in 2001 generated three sites in Yadkin 06 (Fourth Creek at SR 2316, North Second Creek at SR 1526, and North Second Creek at US 70), which at that time required a resample in 2002 to determine if they should be placed on the 303d list. Fourth Creek rated Good-Fair and both North Second Creek locations rated Fair (Biological Assessment Unit Memorandum B-021001).

WAT Training Sites

Two sites (Patterson Cr at SR 1890 and Rocky Cr at SR 1854) were both sampled in December 2003 and in April 2006 for the purpose of training Watershed Assessment Team (WAT) members. Patterson Creek rated Good in 2003 and Excellent in 2006. Rocky Creek rated Excellent for both years. No memorandum is available.

YADKIN RIVER HUC 03040103 - YADKIN RIVER

Description

HUC 03040103 is roughly bounded on the north by High Point, Thomasville, Lexington and South Salisbury. The drainage contains the Yadkin chain lakes High Rock, Tuckertown Reservoir, Badin and the major tributaries of Abbotts Creek and the Uwharrie River (Figure 4). Much of the eastern portion of the HUC drains the relatively undeveloped area forming the Uwharrie National Forest. This HUC contains Yadkin River subbasins 4 (in part), 7, 8 (in part) and 9. The streams in this HUC are mostly located in the Carolina Slate Belt portion of the piedmont ecoregion. These streams usually have a rocky substrate, but may have very low flow during drought conditions.

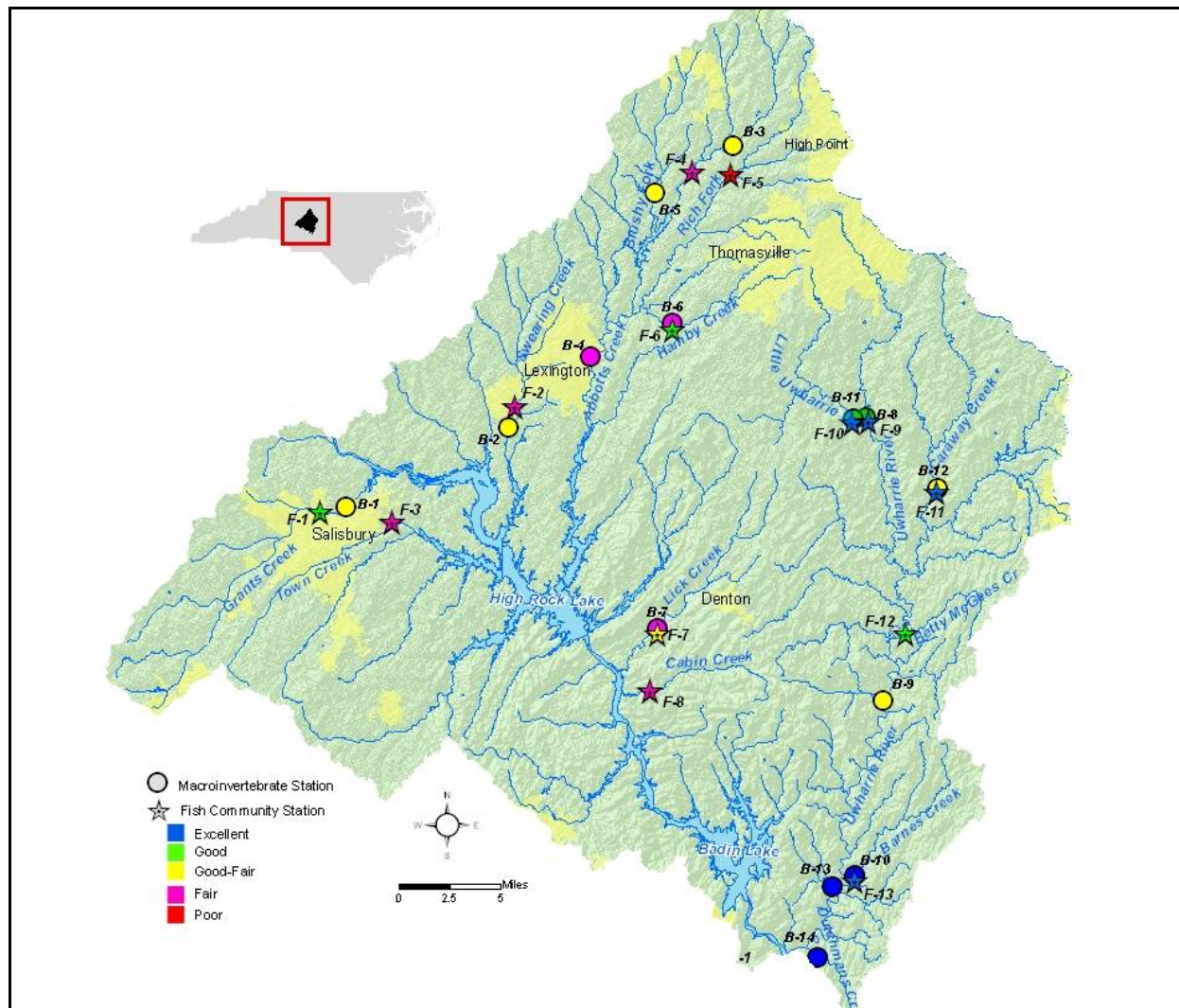


Figure 4. Sampling sites in HUC 03040103 in the Yadkin River basin. Monitoring sites are listed in Table ---.

The lower portion of Yadkin subbasin 4, bisected north/south approximately by NC 150, contains High Rock Lake and the lower portions of Swearing Creek and Abbotts Creek, southwest of Lexington. Agricultural land use affects most streams outside of the urban areas. This area has easily eroded soils. Consequently, streams in areas of urban or agricultural land use are affected by sediment inputs, and have large amounts of coarse sand.

The Abbotts Creek watershed (subbasin 07), starts just south of Kernersville and flows south through Lexington and empties into High Rock Lake. Smaller streams in the watershed are Rich and Hunts Forks and Swearing and Hamby Creeks, which drain High Point, Thomasville, and the west side of Lexington. This watershed is located primarily in Davidson County and is bisected by the industrial and commercial US 64 and I-85 corridors. The largest municipalities in the subbasin are the cities of Lexington, Thomasville, and Highpoint. The largest discharger is the City of High Point's WWTP with a permitted flow of 6.2 MGD into Rich Fork. Other large municipal WWTP dischargers are Thomasville (4 MGD to Hamby Creek) and Lexington (5.5 MGD to Abbotts Creek). Land use is primarily forest and pasture though this watershed contain a high percentage of urban area.

The upper portion of Yadkin subbasin 8 in this HUC contains Tuckertown Reservoir and Badin Lake. Much of the land in this area is used for agriculture and undeveloped gamelands.

Subbasin 9 encompasses the entire Uwharrie River watershed. The upper watershed, primarily in Randolph County, includes portions of the municipalities of High Point, Thomasville, Archdale, Randleman, and Asheboro. The lower portion of the watershed in southern Randolph and northwestern Montgomery counties is within the Uwharrie National Forest. Most of the subbasin is forested. The Uwharrie River is within the piedmont Carolina Slate Belt ecoregion, but some tributaries draining the Uwharrie Mountains have montane characteristics. Certain geological subdivisions of the Carolina Slate Belt appear to have ecological significance. The sandiest streams were observed in the northern portion of the subbasin, where the underlying rocks are metamudstone and metaargillite. More rocky streams were observed in the southern portion of the subbasin where the underlying rocks are metavolcanic.

Overview of Water Quality

Fourteen sites were sampled for benthic macroinvertebrates in this HUC in 2006 (Table 3). Among these, four sites (Grants Creek, Swearing Creek, Little Uwharrie River, and Uwharrie River at SR 1406) showed improved bioclassifications compared with 2001 sampling, seven sites retained the same bioclassification as 2001, and two sites (Lick Creek and Uwharrie River at SR 1143) showed degraded bioclassifications compared to 2001. Dutchmans Creek, not rated in 2001 was rated Excellent in 2006. None of the sites improved or degraded more than one level of bioclassification.

Eleven sites were sampled to evaluate fish populations. No site showed an improved bioclassification, three sites retained their 2001 classification, and three sites (Cabin Creek, Rich Fork, Abbotts Creek) showed degraded classification compared to 2001. Five additional fish sites were sampled for the first time in 2006.

Table 3. Waterbodies monitored in HUC 03040103 in the Yadkin River basin for basinwide assessment, 2001 and 2006.

Map # ¹	Waterbody	County	Location	2001	2006
B-1	Grants Cr	Rowan	SR 1912	Fair	Good-Fair
B-2	Swearing Cr	Davidson	NC 47	Fair	Good-Fair
B-3	Abbotts Cr	Davidson	SR 1755	Good-Fair	Good-Fair
B-4	Abbotts Cr	Davidson	SR 1243	Fair	Fair
B-5	Brushy Fk	Davidson	SR 1810	Good-Fair	Good-Fair
B-6	Hamby Cr	Davidson	SR 2017	Fair	Fair
B-7	Lick Cr	Davidson	NC 8	Good-Fair	Fair
B-8	Uwharrie R	Randolph	SR 1406	Good-Fair	Good
B-9	Uwharrie R	Randolph	SR 1143	Good	Good-Fair
B-10	Uwharrie R	Montgomery	NC 109	Excellent	Excellent
B-11	L Uwharrie R	Randolph	SR 1405	Good-Fair	Good
B-12	Caraway Cr	Randolph	SR 1331	Good-Fair	Good-Fair
B-13	Barnes Cr	Montgomery	SR 1303	Excellent	Excellent
B-14	Dutchmans Cr	Montgomery	SR 1150	Not Rated	Excellent
F-1	Grants Cr	Rowan	SR 2200 (SR 1910)	Good-Fair	Good (2004) ²
F-2	Swearing Cr	Davidson	SR 1104	---	Fair (2004) ²
F-3	Town Cr	Rowan	SR 2118	---	Fair
F-4	Abbotts Cr	Davidson	SR 1800	Good-Fair	Fair
F-5	Rich Fk	Davidson	NC 109	Fair	Poor
F-6	Hamby Cr	Davidson	SR 2017	---	Good
F-7	Lick Cr	Davidson	NC 8	Good-Fair	Good-Fair
F-8	Cabin Cr	Davidson	SR 2536	Good	Fair
F-9	Uwharrie R	Randolph	SR 1406	Excellent (1999)	Excellent
F-10	L Uwharrie R	Randolph	SR 1405	---	Excellent
F-11	Caraway Cr	Randolph	SR 1331	---	Excellent
F-12	Betty McGees Cr	Randolph	SR 1107	Good	Good
F-13	Barnes Cr	Montgomery	SR 1303	Excellent	Excellent

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

²special study site that has become a basinwide site.

River and Stream Assessment

Leonards Creek (Davidson County), previously sampled as a basinwide site in subbasin 07 was not sampled in 2006 due to low flow conditions. Similarly, Rich Fork at Davidson County SR 2005 was not sampled for benthos during 2006 due to excessive depth caused by operations of sand-dipping operations. It is likely that the latter site will therefore be discontinued.

Specific site summaries of the 14 benthic macroinvertebrate and 13 fish community samples may be found at this link: [03040103](#).

SPECIAL STUDIES

UT Second Creek

This stream (near Dutch Creek Rd) in Rowan County was sampled in January 2002 for possible removal from the 303(d) list. This creek was the former site of the Town of Rockwell's WWTP. The WWTP ceased discharging into UT second creek in 1996. Both upstream and downstream segments were rated Not Impaired. (BAU memo B-020328)

Town Creek

A TMDL study was done on Town Creek in June 2004 to characterize the possible stressors impacting the stream. Urban impacts from upstream were characterized as a major cause of degraded water quality. (BAU memo B-040916) The stream was sampled again in September 2006 for possible removal from the impaired streams list. Located below an inactive WWTP outfall in Spencer, NC, it was determined that the stream remains impacted. (BAU memo B-070129a)

Second Creek

Second Creek in Rowan County was sampled in September 2006 to document and characterize the water quality before animal operations are expanded in its watershed. The stream was found to be relatively unimpacted at SR 2370. (BAU memo B-070129a)

Little Creek

Little Creek in Rowan County was sampled in September 2006 for possible removal from the impaired streams list. It was discovered that the stream was erroneously put on the 303(d) list. It has never been sampled for fish and benthic sampling in 1990 resulted in a Not Impaired rating. The stream was assigned a Good-Fair bioclassification as a result of the 2006 benthic collections.

Fish Community Urbanization Study

Grants Creek at SR 1506 and at SR 1910, and Second Creek at SR 2338 in Rowan County, as well as Swearing Creek at SR 1104 (Davidson County), were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study (unpublished data).

Swearing Creek, NC 47, Davidson County

This site was resampled in 2002 to determine whether the stream should be placed on North Carolina's 303(d) list. This site received a Fair rating, which verified the Fair rating it received in 2001. (BAU Memo B-021001)

Hamby Creek TMDL Stressor Study

A TMDL stressor study was conducted at seven sites in the Hamby Creek watershed in Davidson County in May 2003. Results of this study suggest that the cause of impairment in Hamby Creek appears to be chemical and/or physical pollutants in the form of toxic chemicals from urban runoff and nutrient inputs. (BAU Memo B-031016)

Planning Section Requests

Three additional benthic sites were requested by the Planning Section for sampling in 2006. Hunts Fork at SR 1787 and Rich Fork at SR 1755 are on North Carolina's 303d impaired streams list. Samples from these streams were needed to see if impairment is still warranted. In 2006 Hunts Fork received a Fair rating. Rich Fork rated Good-Fair. Hamby Creek at SR 2025 received a Poor bioclassification. (BAU Memorandum B-061114)

Abbotts Creek, SR 1735, Davidson County

At the request of Winston-Salem Regional Office, Abbotts Creek was sampled near the Davidson/Wilkes County line to provide baseline data prior to construction of a Dell computer plant. This site was borderline Good-Fair/Good. (BAU Memo B-061114)

Yadkin Subbasin 07 TMDL Stressor Study

A TMDL stressor study was conducted at eight sites in Subbasin 07 (Davidson County) in May and September 2006. Overall, five of the sites received Good-Fair ratings, two received Fair ratings (Abbotts Creek at SR 1243, Hamby Creek at SR 1717) and one received a Poor rating (Hamby Creek at SR 2025). (BAU Memo B-060108)

Lick Creek TMDL

Two benthic sites were sampled in 2003 because Lick Creek was considered impaired from its source to a point one mile upstream of Davidson County SR 2501, not far above the confluence with the Yadkin River. Both sites received a Good-Fair rating. (BAU Memo B-040212)

Uwharrie River

A site on the Uwharrie River at NC 109 was sampled in March 2005 by both DWQ and Duke Energy biologists as a quality assurance measure comparing methods of both groups.

Uwharrie River EEP Study

Per a request received by the Biological Assessment Unit (BAU) from Ecosystems Enhancement Program (EEP) staff, seven benthos sites were sampled in May 2006. The reference site, Barnes Creek

received a bioclassification of Excellent ; five study sites earned bioclassifications of Good (Uwharrie River at SR 1406 and SR 1564, Little Uwharrie River at SR 1405, Brier Creek at SR 1402, and Caraway Creek at SR 1524 and one site, Caraway Creek at Randolph SR 1331, earned a bioclassification of Good-Fair.

YADKIN RIVER HUC 03040104 – LAKE TILLERY/PEE DEE RIVER

Description

This HUC encompasses subbasins 10, 15, and a portion of 08. The portion of subbasin 08 included in begins at the confluence of the Uwharrie and Yadkin rivers, which forms the Pee Dee River (Figure 5).

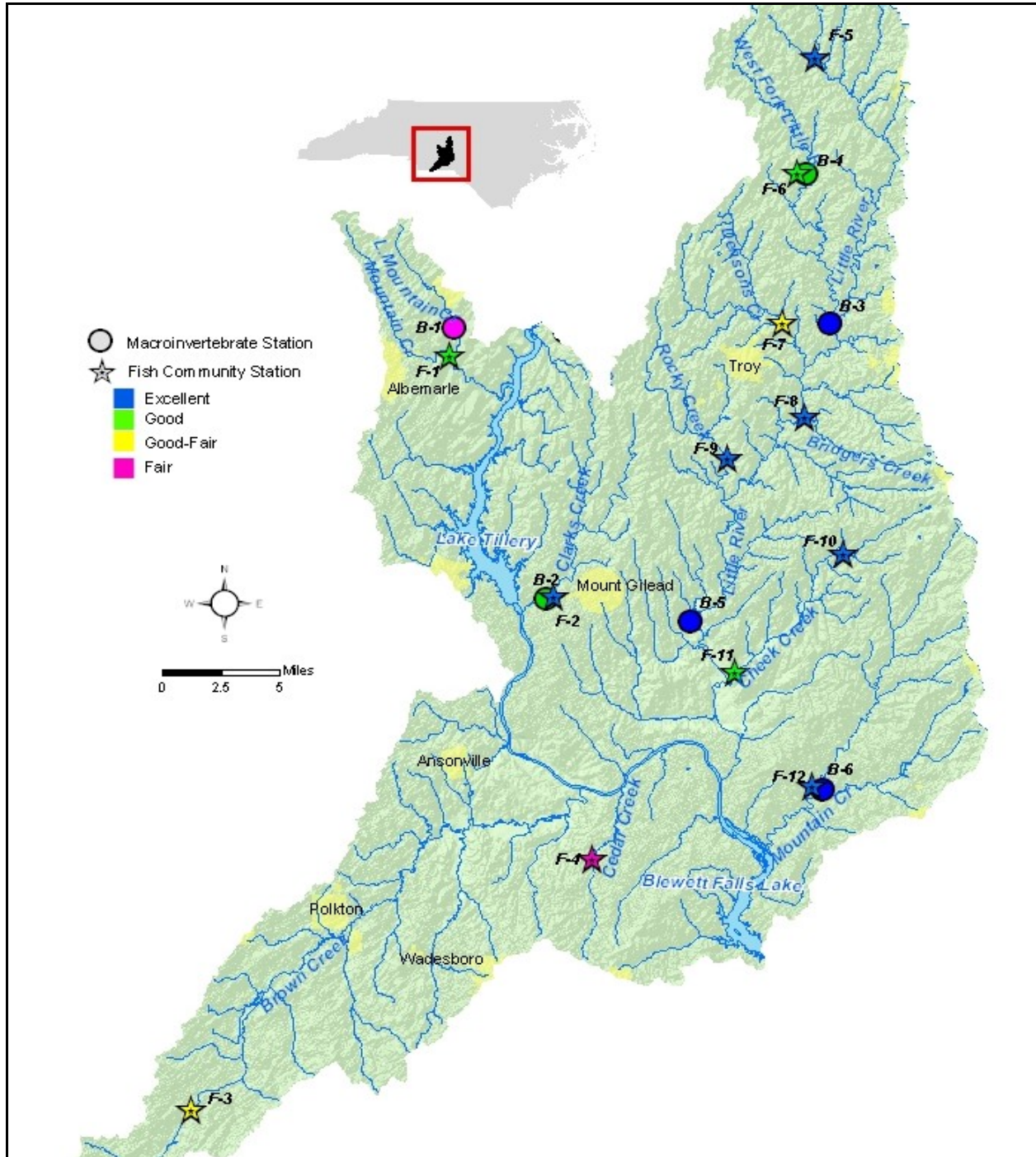


Figure 5. Sampling sites in HUC 03040104 in the Yadkin River basin. Monitoring sites are listed in Table 4.

The Uwharrie River watershed is not included in this HUC. Near this boundary and included in this HUC is the Mountain Creek watershed that flows south of Morrow Mountain and enters the Pee Dee River from the west. This area includes the municipalities of Albemarle (in part) and Norwood. The principle impoundment on the Pee Dee River in this part of the HUC, is Lake Tillery. East and north of this area (formerly subbasin 030715) is the Little River and its tributaries. The Little River itself is a tributary of the Pee Dee River. A large portion of this area of the HUC is located within the Uwharrie National Forest. The land is mostly forested, but with some areas utilized for agriculture and silviculture. The town of Troy is the largest urban area in this northeastern part of HUC 03040104. The Carolina Slate Belt subcoregion dominates the northern part of the HUC. This subcoregion has some of the lowest water yielding geology in the state resulting in the tendency of streams to dry up in summer.

Just south of this area is an approximately 50 mile long and 10 mile wide band of Triassic geology that runs southwest to northeast. Streams in the Triassic subcoregion have low base flows and also tend to stop flowing in summer months. This area consists of the portion of the Pee Dee River and its tributaries from the Rocky River confluence to the dam at Blewett Falls Lake. Land use here is primarily a combination of forest and agriculture with smaller towns like Polkton and Ansonville. The town of Wadesboro is partially contained within this area. Clarks Creek is contained within a narrow portion of Carolina Slate Belt geology that exists in the extreme southeastern part of this HUC.

The Pee Dee River has many permitted dischargers. However, contained within this HUC are less than 10 permitted facilities, none of which are listed as Major dischargers. Several of these are located within watersheds where biological samples were collected for this report. These include Greater Badin WWTP (NC 0074756), discharging up to 0.55 MGD to Little Mountain Creek; Mount Gilead Town WWTP (NC 0021105), 0.85 MGD to Clarks Creek; and Montgomery County WTP (0080322), 0.47 MGD to UT Clarks Creek. Three facilities are located within the Little River Watershed. These are Biscoe Town WWTP (NC 0021504) discharging up to 0.6 MGD to Hickory Branch; Carolina Trace Utilities Inc. (NC 0038831), 0.325 MGD to the Upper Little River; and Troy Town WWTP (NC 0028916), 0.84 MGD to Densons Creek.

One discharger, Ansonville Town WWTP (NC 008125), discharges up to 0.12 MGD directly to the Pee Dee River. Another facility, Stony Gap Fish House (NC 0040801) has ceased discharging up to 0.004 MGD to UT Jacobs Creek before January 2007.

Overview of Water Quality

A total of 18 biological monitoring sites were sampled within HUC 03040104 for basinwide assessment of water quality (Table 4). Of those sites, nine rated Excellent, five Good and two Good-Fair. Two sites were Fair. No sites rated Poor in either 2004 or 2006. The two Fair streams, Little Mountain Creek and Cedar Creek are both affected by naturally low flows typically seen in both Carolina Slate Belt and Triassic Basin ecoregions. Flows in Little Mountain Creek however appear unable to dilute effluent from the upstream Badin WWTP. No anthropogenic influences could be detected that contributed to the naturally low flows at Cedar Creek to cause it to be in an biologically degraded condition.

Water quality in HUC 03040104 appears to be stable between the 2001 to 2006 samplings (Table 4). Of the six benthic sites sampled in 2006, three improved in bioclassification (Little River at NC 731, Mountain Creek at SR 1150 and Clarks Creek at SR 1110); one site declined (West Fork Little River at SR 1311); and two sites remained the same (Little River at SR 1340 and Little Mountain Creek at SR 1720).

There were 12 fish sites sampled in 2006 (or in 2004 as special studies). Compared with the 2001 basinwide sampling effort: four improved in bioclassification (Little River at SR 1127, Bridges Creek at SR 1519, Mountain Creek at SR 1720 and Mountain Creek at SR 1150); three declined (Brown Creek at SR 1230, Cedar Creek at SR 1709 and Cheek Creek at SR 1541); and four remained the same (West Fork Little River at SR 1311, Rocky Creek at SR 1549, Clarks Creek at SR 1110 and Cheek Creek at SR 1563). One site, Densons Creek at SR 1323 was only sampled once (in 2004).

Table 4. Waterbodies monitored in the Yadkin River HUC 03040104 for basinwide assessment, 2001-2006.

Map # ¹	Waterbody	County	Location	2001	2006
B-1	Little Mountain Cr	Stanly	SR 1720	Fair	Fair
B-2	Clarks Cr	Montgomery	SR 1110	Good-Fair	Good
B-3	Little R	Montgomery	SR 1340	Excellent	Excellent
B-4	West Fk Little R	Montgomery	SR 1311	Excellent	Good
B-5	Little R	Montgomery	NC 731	Good	Excellent
B-6	Mountain Cr	Richmond	SR 1150	Good	Excellent
F-1	Mountain Cr	Stanly	SR 1720	Good-Fair	Good (2004)
F-2	Clarks Cr	Montgomery	SR 1188 (SR1110)	Excellent	Excellent (2004)
F-3	Brown Cr	Anson	SR 1230	Good	Good-Fair
F-4	Cedar Cr	Anson	SR 1709	Good-Fair	Fair
F-5	Little R	Randolph	SR 1127	Good	Excellent
F-6	W Fk Little R	Montgomery	SR 1311	Good	Good
F-7	Densons Cr	Montgomery	SR 1323	---	Good-Fair (2004) ²
F-8	Bridgers Cr	Montgomery	SR 1519	Good	Excellent
F-9	Rocky Cr	Montgomery	SR 1549	Excellent	Excellent
F-10	Cheek Cr	Montgomery	SR 1563	Excellent (1999)	Excellent
F-11	Cheek Cr	Montgomery	SR 1541	Excellent	Good
F-12	Mountain Cr	Richmond	SR 1150	Good	Excellent

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

²special study site that has become a basinwide site.

River and Stream Assessment

Mountain Creek (at SR 1720) and Cheek Creek (at SR 1541), benthic sites that were sampled in 2001, were not sampled in 2006. Both streams lacked sufficient flows to enable sampling. In 2001, Mountain Creek rated Good-Fair and Cheek Creek rated Fair. Fish sites that were not sampled in 2006 (or 2004) that were sampled in 2001 included Dumas Creek (at SR 1310) and Hamer Creek (SR 1159). Hamer Creek is within an area of Triassic geology and was not flowing during spring 2006. This site has since been dropped as a basin sampling location. Time restrictions did not permit the sampling of Dumas Creek in 2006.

Specific site summaries of the 6 benthic macroinvertebrate and 12 fish community samples may be found at this link: [03040104](#).

SPECIAL STUDIES

Mountain Creek, Little Mountain Creek and Jacobs Creek, Ecosystem Enhancement Program Study

Three sites were sampled for benthic macroinvertebrates in January 2004 as part of the Memorandum of Agreement between the Division of Water Quality and the North Carolina Ecosystem Enhancement Program in the creation of a Local Watershed Plan for the Mountain Creek planning area.

Bioclassifications ranged from Poor to Good-Fair. The benthic communities at all three sites indicate the low flow conditions naturally present in the Slate Belt ecoregion. See memorandum B-040831 for more information.

Lick Creek TMDL

Two benthic sites were sampled in 2003 because Lick Creek was considered impaired from its source to a point one mile upstream of Davidson County SR 2501, not far above the confluence with the Yadkin River. Both sites received a Good-Fair rating. See memorandum B-040212 for more information.

Small Streams Study

One benthic site, Wood Run at SR 1150, was sampled twice in 2005 as part of the Small Streams Study. It rated Not Impaired on both occasions. No memorandum is available for this site.

Fish Community Ecosystem Enhancement Program Study

The instream and riparian habitats, physical and chemical characteristics, and fish communities of Mountain, Little Mountain, and Jacobs Creeks in Stanly County were evaluated by DWQ in 2004 (Biological Assessment Unit Memorandum 20040501). These streams are downstream from the Towns of Badin and Albemarle and near Morrow Mountain State Park. Nonpoint nutrient runoff from pastures and livestock which have access to the streams contributed to slightly elevated conductivities, abundant periphyton, and an abundance of nutrient indicator species and tolerant fish.

Fish Community Urbanization Study

Clarks Creek at SR 1110 and Densons Creek at SR 1323 in Montgomery County were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study (unpublished data). The fish communities were rated Excellent and Good-Fair, respectively.

YADKIN RIVER HUC 03040105 - ROCKY RIVER

Description

This HUC contains subbasins 11 through 14 (Figure 6). Streams in the uppermost reach of the Rocky River watershed as well as the Coddle Creek catchment are located primarily in the Southern Outer Piedmont ecoregion and are characterized by sandy substrates and generally consistent summer flow regimes (Griffith *et al.* 2002). The Rocky River, the largest tributary of the Yadkin River, flows for approximately 25 river miles from its headwaters near Mooresville in Iredell County to its confluence with Irish Buffalo Creek in Cabarrus County. Outside of this region's numerous urban areas (e.g., Mooresville, Concord, Cornelius, Davidson, Huntersville, eastern Mecklenburg County), landuse is primarily agricultural.

Further downstream are the middle portion of the Rocky River watershed and four of its largest tributaries: Irish Buffalo Creek, Goose Creek, and Crooked Creek. Streams in this area primarily drain the metropolitan areas of Kannapolis and Concord in central Cabarrus County and landuse outside of these urban areas is primarily agricultural. Streams located in western Cabarrus County are contained within the Southern Outer Piedmont (Griffith *et al.* 2002) ecoregion and are characterized by sandy substrates and generally consistent summer flow regimes, while streams located in eastern Cabarrus County (and further south in Union County) are typical Carolina Slate Belt streams characterized by low summer flows, extensive bedrock formations, and the prevalence of boulder and cobble substrate in streams.

Big Bear and Long Creeks are the primary tributaries to the Rocky River in subbasin 13 and the area is encompassed wholly within the Carolina Slate Belt. The predominant landuse is almost evenly divided between forest and pasture and the Town of Albemarle is the only major metropolitan area in this area. The Albemarle WWTP (16.0 MGD) and the Town of Oakboro's WWTP (0.5 MGD) both discharge to Long Creek.

Subbasin 14 is the final subbasin in this HUC and includes the Rocky River and the entire watersheds of Richardson and Lanes Creeks which are large tributaries of the middle reach of the Rocky River. The Towns of Marshville, Wingate, and Monroe (along the US 74 corridor) are the only large urban areas in this subbasin. Landuse in this subbasin is mostly comprised of cultivated cropland, although there are large numbers of swine and poultry operations in this subbasin. Moreover, numerous confined animal operations (CAFOs) are found in the Richardson and Lanes Creeks catchments. These are also Slate Belt streams.

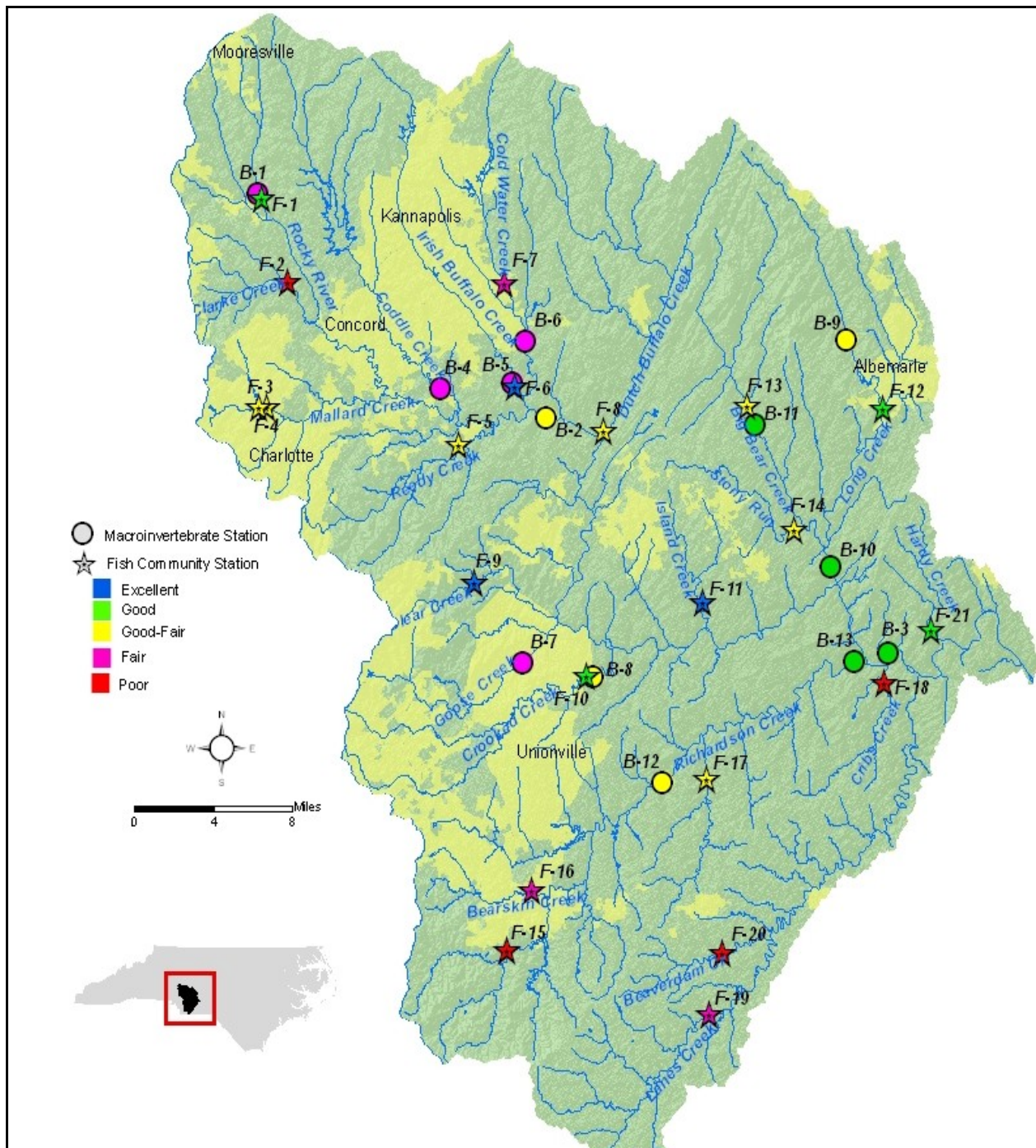


Figure 6. Sampling sites in HUC 03040105 in the Yadkin River basin. Monitoring sites are listed in Table 5.

Overview of Water Quality

In 2006, the Rocky River at SR 2420 location received a Fair benthos bioclassification which was unchanged from the 1996 and 2001 samples. A Fair benthos bioclassification was also assigned to Coddle Creek (NC 49) in 1996, 2001 and 2006. Fish samples included several locations exhibiting drastic changes in bioclassification: Rocky River (SR 1608) was Poor in 1999 but Good in 2006, while Mallard

Creek (SR 2467) was Excellent in 2001 but declined to Good-Fair in 2006. The only other fish site with previous data was Reedy Creek (SR 1136) which was Good-Fair in both 2001 and 2006. Two new fish sites were added and included Mallard Creek (SR 1300) which received a Good-Fair bioclassification and Clarke Creek (SR 1449) which received a Poor rating (Table 5).

Table 5. Waterbodies monitored in HUC 03040105 in the Yadkin River basin for basinwide assessment, 2001 and 2006.

Map # ¹	Waterbody	County	Location	2001	2006
B-1	Rocky R	Mecklenburg	SR 2420	Fair	Fair
B-2	Rocky R	Cabarrus	US 601	Fair	Good-Fair
B-3	Rocky R	Stanly	SR 1943	Good	Good
B-4	Coddle Cr	Cabarrus	NC 49	Fair	Fair
B-5	Irish Buffalo Cr	Cabarrus	SR 1132	Good-Fair	Fair
B-6	Coldwater Cr	Cabarrus	NC 49	Good-Fair	Fair
B-7	Goose Cr	Union	US 601	Poor	Fair
B-8	Crooked Cr	Union	SR 1547	Good-Fair	Good-Fair
B-9	Long Cr	Stanly	SR 1401	Good-Fair	Good-Fair
B-10	Long Cr	Stanly	SR 1917	Good-Fair	Good
B-11	Big Bear Cr	Stanly	SR 1225	Good	Good
B-12	Richardson Cr	Union	SR 1649	Fair	Good-Fair
B-13	Richardson Cr	Anson	SR 1600	Good	Good
F-1	Rocky R	Cabarrus	SR 1608	Poor (1999)	Good
F-2	Clarke Cr	Cabarrus	SR 1449	---	Poor
F-3	Mallard Cr	Mecklenburg	SR 2467	Excellent	Good-Fair
F-4	Mallard Cr	Cabarrus	SR 1300	---	Good-Fair (2004) ²
F-5	Reedy Cr	Cabarrus	SR 1136	Good-Fair	Good-Fair
F-6	Irish Buffalo Cr	Cabarrus	SR 1132	Good	Excellent
F-7	Coldwater Cr	Cabarrus	NC 73	Good-Fair	Fair
F-8	Dutch Buffalo Cr	Cabarrus	SR 2622 (NC 200)	Good	Good-Fair (2004) ²
F-9	Clear Cr	Mecklenburg	SR 3181	---	Excellent (2004) ²
F-10	Crooked Cr	Union	SR 1547	---	Good
F-11	Island Cr	Stanly	SR 1118	Excellent	Excellent
F-12	Long Cr	Stanly	off SR 1900	---	Good (2004) ²
F-13	Big Bear Cr	Stanly	NC 73 (SR 1134)	Good	Good-Fair (2004) ²
F-14	Stony Run	Stanly	SR 1970	---	Good-Fair
F-15	Richardson Cr	Union	NC 207	Good-Fair	Poor
F-16	Bearskin Cr	Union	NC 200	---	Fair
F-17	Salem Cr	Union	SR 1006	Good	Good-Fair
F-18	Cribs Cr	Anson	SR 1610	---	Poor
F-19	Lanes Cr	Union	SR 1929	Fair	Fair
F-20	Beaverdam Cr	Union	SR 1005	---	Poor
F-21	Hardy Cr	Stanly	SR 1934	---	Good

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

²Special study site that has become a basinwide site.

Based upon benthic macroinvertebrate data, the Rocky River at US 601 reverted back to a Good-Fair bioclassification in 2006 (this station received Good-Fair ratings in 1989 and 1996) and was an improvement from Fair bioclassifications received here in 2001 and 2002. Conversely, Irish Buffalo Creek (SR 1132) declined to Fair for the first time in 2006 with all previous samples (1996 and 2001) receiving Good-Fair bioclassifications. This same trend was also noted for Coldwater Creek (NC 49): Fair in 2006, Good-Fair in 1996 and 2001. For 2006, Crooked Creek (SR 1547) maintained its Good-Fair rating from 2001 (which was an improvement from the Fair rating in 1996). Goose Creek (US 601) has been sampled in 1996, 1998, and 2001 with all collections resulting in a Poor bioclassification. In 2006, this station achieved a Fair rating. Five fish sites were sampled in subbasin 12, two of which represent new collections: Clear Creek (SR 3181) received an Excellent bioclassification while Crooked Creek (SR 1547) received a Good rating. Two of the three remaining fish stations in this subbasin declined in bioclassification with Coldwater Creek going from Good-Fair in 2001 to Fair in 2006 while Dutch Buffalo Creek at SR 2622 (NC 200) declined from Good to Good-Fair. Only Irish Buffalo Creek (SR 1132) improved in bioclassification from Good (2001) to Excellent in 2006.

In 2006 Long Creek (SR 1401) received a Good-Fair benthos rating and was unchanged from the 2001 collection. Long Creek (SR 1917) has shown a steady trend of improvement since sampling started at this benthos location with samples in 1983 and 1986 rating Fair, collections in 1989, 1996, and 2001 producing Good-Fair ratings, and the 2006 sample demonstrating additional improvement to a Good bioclassification. The 2006 sample at Big Bear Creek (SR 1225) received a Good bioclassification and was unchanged from the 2001 sample. Three fish stations were also sampled: Long Creek (off SR 1900) received a Good bioclassification while Stony Run (SR 1970) rated a Good-Fair. The only long-term fish site (Big Bear Creek at NC 73/SR 1134) declined from a Good bioclassification in 2002 to Good-Fair in 2006.

For 2006, three long-term benthos stations were sampled in subbasin 14. Rocky River (SR 1943) has been sampled at this location twice with both the 2001 and 2006 samples producing Good bioclassifications. The Rocky River has also been sampled nearby at SR 1935 (just one road crossing downstream of the present SR 1943 location) a total of eight times with two samples producing Good-Fair bioclassifications (1983 and 1986) and six collections resulting in Good bioclassifications: 1984 (two in 1985), 1986, 1988, 1990, and 1996. Richardson Creek (SR 1600) produced a Good bioclassification in both 2001 and 2006 and represented an improvement from the 1996 (Good-Fair) sample. Richardson Creek (SR 1649) received a Good-Fair bioclassification in 2006 improving from the Fair bioclassifications measured at this site in 1987, 1990, 1996, and 2001. There are eight stations monitored for fish community data in subbasin 14 and half of these represent new fish data: Bearskin Creek (NC 200) rated Fair, Cribs Creek (SR 1610) rated Poor, Beaverdam Creek (SR 1005) also received a Poor bioclassification, and Hardy Creek (SR 1934) produced a Good bioclassification. The remaining three fish locations exhibited very disparate patterns of bioclassifications with Lanes Creek (SR 1929) remaining Fair in 2001 and 2006, while Richardson Creek (NC 207) dropped from Good-Fair in 2001 to Poor in 2006 and Salem Creek (SR 1006) dropping from Good in 2001 to Good-Fair in 2006.

River and Stream Assessment

The benthos station on Dutch Buffalo Creek at NC 200 (Cabarrus County) was not successfully sampled in 2006. During the 2006 collection attempt, stream flow at this station actually reversed during the sample as an apparent result of its close proximity to the Rocky River which was very high after thunderstorms. The next week there was not enough flow to sample. Due to the interference with the Rocky River, this location should be dropped as a basin site.

Specific site summaries of the 13 benthic macroinvertebrate and 21 fish community samples may be found at this link: [03040105](#).

SPECIAL STUDIES

Wetlands Restoration Program Rocky River Study

Nearly all of the streams sampled in the Rocky River drainage had highly impervious catchments as a result of their proximity to urban and suburban areas of Charlotte. This highly impervious environment is reflected by the fact that 12 of 14 sites in the Rocky River catchment received Fair bioclassifications, while only 2 out of 6 sites in the less developed Coddle Creek catchment received bioclassifications of Fair or worse.

Many streams in southern Iredell, Rowan Cabarrus and eastern Mecklenburg County (Yadkin Subbasin 11) are experiencing impacts from existing agricultural and urban nonpoint activities in addition to impacts from the 15 minor and major NPDES discharges in this area. The potential deleterious impacts associated with these point and nonpoint sources resulted in the Wetlands Restoration Program (WRP) targeting these catchments for water quality and habitat quality improvement. (BAU Memo-031110)

Resamples of Fair Streams

Basinwide sampling in 2001 generated a number of new Fair ratings, which then required a resample in 2002 to determine if they should be placed on the 303d list. As part of this process, Rocky River at US 601 in Cabarrus County was re-sampled. Low flow at Rocky River (US 601) magnified the influence of upstream dischargers although the specific conductance was high in all years (1996: 680, 2001: 743,

2002: 558). Dominance by Hydropyschidae and Chironomidae indicated organic loading and low dissolved oxygen. There has been a steady shift towards a more tolerant community since 1996. (BAU Memo B-021001)

2006 Regional Office Requests

Samples were collected at three sites: Dye Creek below the Mooresville WWTP in Iredell County, Little Long Creek (Old Charlotte Road) in Albemarle in Stanly County, and Stewarts Creek in Union County. All three sites in this study had degraded benthic macroinvertebrate communities. Dye Creek below the Mooresville WWTP has had a Poor bioclassification since 1985. Though Poor again in 2006, there was a slight improvement in EPT taxa richness and the NCBI value. Little Long Creek is an urban stream that flows through Albemarle in Stanly County. It was given a Fair bioclassification and while lacking in EPT taxa, it did have a fairly diverse, though tolerant overall community. Stewarts Creek in Union County above Lake Twiddy was also rated Fair. This suburban stream is likely affected by both low flows and nonpoint runoff from its urban/suburban watershed. (BAU Memo B-060928)

Benthos Overlap Study—Richardson Creek

Richardson Creek (SR 1600, Anson County) was sampled as an overlap site in 2006. An EPT sample on 8/22/2006 received a Good bioclassification with 21 EPT collected, an EPTBI of 4.2 and an EPT abundance of 141. The 8/23/2006 EPT sample collected by another crew also produced a Good bioclassification with 24 EPT taxa collected, an EPTBI of 4.1, and an EPT abundance of 122. No memorandum is available for this internal study.

Fish Community Urbanization Study

Seven sites in this HUC were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study:

1. Mallard Creek at SR 1300, Cabarrus County, Good-Fair;
2. Coddle Creek at SR 1612, Cabarrus County, Poor;
3. Dutch Buffalo Creek at SR 1006 and at NC 200, Cabarrus County, both Good-Fair;
4. Clear Creek at SR 3181, Mecklenburg County, Excellent;
5. Long Creek, off SR 1900, Stanly County, Good; and
6. Big Bear Creek, SR 1134, Stanly County, Good-Fair (DWQ, unpublished data).

YADKIN RIVER HUC 03040201 – PEE DEE RIVER

Description

HUC 03040201 is Yadkin subbasins 16 and 17 and includes Pee Dee River and its tributaries below Blewett Falls Lake (Figure 7). Much of Anson and Richmond Counties are included in the HUC. Rockingham, Hamlet, and a portion of Wadesboro are the largest urban areas. Most of the land cover is forest. Major active NPDES dischargers are given in Table 6.

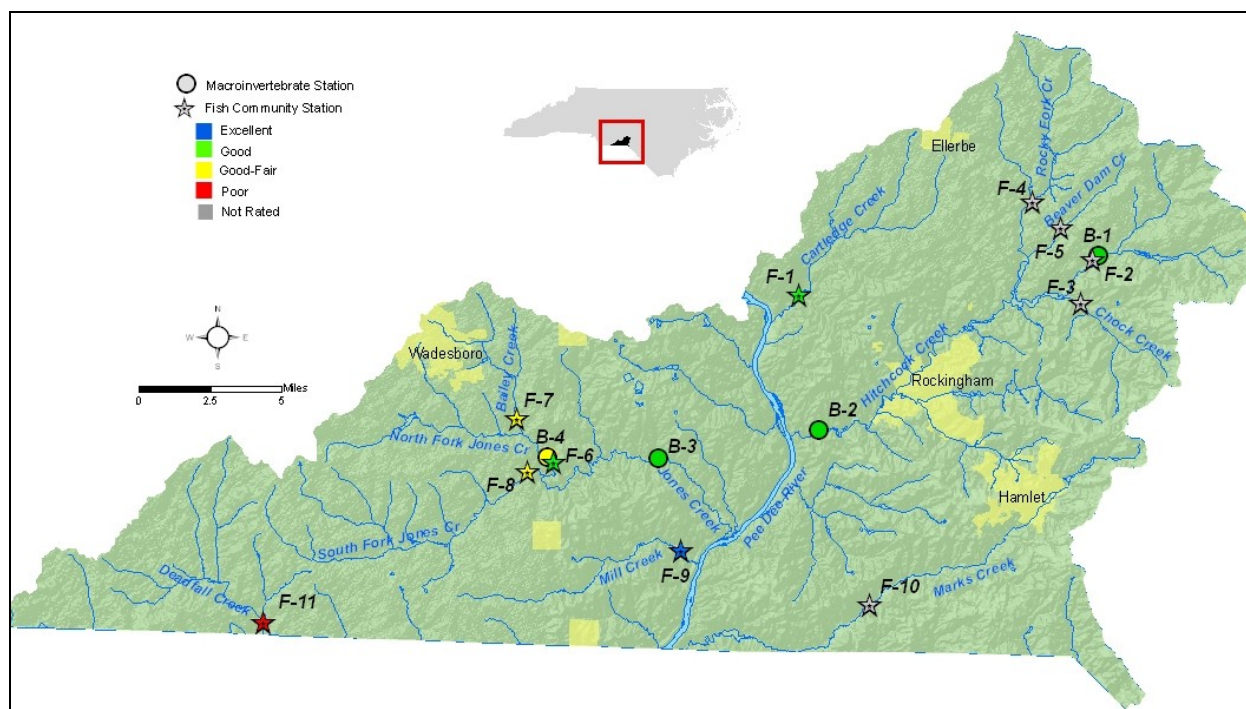


Figure 7. Sampling sites in HUC 03040201 in the Yadkin River basin. Monitoring sites are listed in Table 7.

Table 6. Major NPDES permitted dischargers in HUC 03040201.

Permit	Facility	County	Receiving Waterbody	Permitted Flow (MGD)
NC0043320	Burlington Industries LLC, Richmond Plant	Richmond	Hitchcock Creek	1.2
NC0047562	Hamlet WWTP	Richmond	Marks Creek	1.0
NC0041408	Anson County Regional WWTP	Anson	Pee Dee River	3.5
NC0020427	Rockingham WWTP	Richmond	Pee Dee River	9.0

The HUC straddles the divide between the piedmont and coastal plain and contains portions of three ecoregions as defined by Griffith *et al.* (2002). Far western portions of the HUC fall within a Triassic Basin, which consists of “unmetamorphosed shales, sandstones, mudstones, siltstones, and conglomerates.” Streams with low base flow result from clay soils with little permeability. Stream substrates are generally composed of sands and clays. The remainder of much of the western half of the HUC is in the Carolina Slate Belt. Metavolcanic and metasedimentary rocks make up the slates present in the ecoregion. Boulders and cobbles compose much of the stream substrate. Most of the eastern half of the HUC is in the Sand Hills, “a rolling to hilly region composed primarily of Cretaceous-age marine sands and clays.” Permeable sandy soils allow for a large capacity for infiltration; therefore, streams in the ecoregion rarely dry or flood. Sands make up much of the substrate for streams in the region.

Following an inventory of natural areas in Richmond County by the North Carolina Natural Heritage Program, several stream corridors, watersheds, and ecosystems that fall within the HUC were recognized as significant (Sorrie 2001).

- The upper portions of Rocky Fork, Beaverdam, and Hitchcock Creeks drain the western section of the Sand Hills Game Land (SGL) in Richmond County. SGL is composed of large areas mostly in Richmond and Scotland Counties. SGL contains an ecosystem that is nearly intact, supports a high diversity of flora and fauna, and provides a population pool for longleaf pine.
- The lower 1.5 miles of Hitchcock Creek falls within the Pee Dee River Megasite, and is significant for flowing from the coastal plain to the piedmont (only one of four North Carolina streams to do this), cutting a relatively deep valley before its confluence with Pee Dee River. A floodplain forest is also found on this lower section of Hitchcock Creek.
- Marks Creek shares the unusual characteristic with Hitchcock Creek of flowing from the coastal plain to the piedmont. The lower portion has few road crossings, affording some protection to the beech-dominant hardwood forest in the stream corridor. The coastal plain section of Marks Creek includes a large area of swamp forest dominated by black gum.
- Whites Creek Headwaters includes a large contiguous longleaf pine forest. Waters from the drainage area flow into South Carolina and eventually into Pee Dee River.

Overview of Water Quality

The following stream segments within HUC 03040201 are on the 303(d) impaired waters list for 2004: Pee Dee River from Blewett Falls Dam to the mouth of Hitchcock Creek (low dissolved oxygen; fish advisory for mercury); Hitchcock Creek from source to a point 0.5 mile downstream of SR 1442/Richmond County (fish advisory for mercury); Falling Creek from a point 1.4 miles downstream of SR 1640/Richmond County to the water supply intake for Rockingham (aquatic weeds); and Marks Creek from NC 177 to the state border (impaired biological integrity).

Thirteen basinwide collections were made in 2006 (Table 7). Nine sites were sampled for fish only, two for macroinvertebrates only, and two were sampled for both macroinvertebrates and fish. Fish sites in the Sand Hills ecoregion are not rated because of naturally low flows. Otherwise for fish sites there was one rating of Excellent, two Good, two Good-Fair, and one Poor. For benthic sites three rated as Good, one as Good-Fair. Fish and macroinvertebrate sites sampled in 2006 are given in Table 6.

Table 7. Waterbodies monitored in HUC 03040201 in the Yadkin River basin for basinwide assessment, 2001 and 2006.

Map # ¹	Waterbody	County	Location	2001	2006
B-1	Hitchcock Creek	Richmond	SR 1486	Good	Good
B-2	Hitchcock Creek	Richmond	SR 1109	Good-Fair	Good
B-3	Jones Creek	Anson	NC 145	Good-Fair	Good
B-4	N Fork Jones Creek	Anson	SR 1121	Good-Fair	Good-Fair
F-1	Cartledge Cr	Richmond	SR 1142	Good	Good
F-2	Hitchcock Cr	Richmond	SR 1486	Not Rated	Not Rated
F-3	Chock Cr	Richmond	SR 1475	---	Not Rated
F-4	Rocky Fork Cr	Richmond	SR 1424	Not Rated	Not Rated
F-5	Beaver Dam Cr	Richmond	SR 1486	Not Rated (1996)	Not Rated
F-6	N Fk Jones Cr	Anson	SR 1121	---	Good
F-7	Bailey Cr	Anson	SR 1811	Good	Good-Fair
F-8	S Fk Jones Cr	Anson	SR 1821	Excellent	Good-Fair
F-9	Mill Cr	Anson	SR 1826	---	Excellent
F-10	Marks Cr	Richmond	SR 1104	Not Rated	Not Rated
F-11	Deadfall Cr	Anson	SR 1109	---	Poor

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

The watershed above the fish site on Cartledge Creek at SR 1142/Richmond County drains a portion of Ellerbe at its headwaters. There was little change in the fish community at the site between 2001 and 2006.

The upper portion of the Hitchcock watershed was sampled at four sites for fish in 2006; one of those four sites was also sampled for macroinvertebrates. None of the fish sites received ratings. Three of the fish sites had been collected prior to 2006. The fish site on Rocky Ford Creek at SR 1424/Richmond County experienced a loss in the number of fish species collected between 2001 and 2006, from 14 to 11. Beaverdam Creek at SR 1486/Richmond County saw an increase of species collected, from 6 in 1996 to 8 in 2006. Hitchcock Creek at SR 1486/Richmond County also experienced an increase in number of fish species collected, from 12 in 2001 to 15 in 2006. The benthic data for three sampling events (1996, 2001, and 2006) at Hitchcock Creek at SR 1486/Richmond County indicate stable water quality; the site has maintained a rating of Good for each year sampled. Overall, biological data from the upper Hitchcock watershed indicate constant to slightly improving water quality.

In contrast to the upper portion of the watershed, the macroinvertebrate site on Hitchcock Creek at SR 1109/Richmond County in the lower portion of the watershed has shown a marked improvement over three sampling events in 1996, 2001, and 2006. The site is about 1.5 stream miles above the confluence with Pee Dee River. Improving water quality at the site coincides with the loss of discharge to the stream from Laurel Hill Paper Company beginning in February 1998. Bioclassifications for the site have improved from Poor in 1996, to Good-Fair in 2001, and to Good in 2006.

The watershed above the fish site on Bailey Creek at SR 1811/Anson County includes western portions of Wadesboro. Between sampling events at the site in 1996 and 2001 there was very little change in the number of species collected and in NCIBI values; the site was rated Good for both of those years. A marked drop in the number of species collected and in the NCIBI value resulted in a bioclassification of Good-Fair for 2006. Low flow in 2006 may be influencing the results for the latest collection.

Downstream of the Bailey Creek site there is a shared fish/benthic site on North Fork Jones Creek at SR 1121/Anson County. Fish were collected for the first time from the site in 2006; the resulting fish bioclassification is Good. The site has been collected for benthos using Full-Scale methods in 2001 and 2006. The benthic community in both years was very similar, an indication of stable water quality at the site for those two sampling events. The site rated as Good-Fair in both years.

South Fork Jones Creek drains an area adjacent to and southeast of North Fork Jones Creek. The fish site on South Fork Jones Creek at SR 1821/Anson County is within one stream-mile of the confluence with North Fork Jones Creek. There is a marked difference between the fish collections made in 2001 and 2006. Three fewer species collected and a 10-point drop in the NCIBI value resulted in a drop of two classifications between 2001 and 2006, from Excellent to Good-Fair. As with Bailey Creek, the decline in the fish community at South Fork Jones Creek may be due to low-flow conditions sometime during the year as indicated by the loss of several species of sunfish, which inhabit pools.

At the confluence of the North and South Forks, Jones Creek begins. Slightly downstream of the midpoint of the length of the stream is the benthic site at NC 145. A greater number of EPT taxa collected in 2006 compared to 1996 and 2001 may be reflecting better water quality at the site in 2006 over the prior two sampling events. The site rated as Good in 2006; it has rated as Good-Fair for all other sampling events back to 1987.

Generally for the Jones Creek watershed stable water quality conditions are indicated. Low flows are implicated for reduced fish results on Bailey Creek and South Fork Jones Creek. Slightly better water quality than for previous sampling events may be indicated for the site furthest downstream.

A new fish site was established on Mill Creek at SR 1826/Anson County, and rated as Excellent for 2006. The site was the most species-rich for all fish sites sampled in 2006, and is a new regional fish reference site.

Marks Creek at SR 1104/Richmond County has been sampled for fish in 2001 and 2006. Along with other Sand Hills fish sites, the site was not rated. There was a gain in the number of species collected, from 13 in 2001 to 21 in 2006. High abundance and diversity may be due to enrichment from Hamlet WWTP. Specific conductance at the site is elevated for a Sand Hills stream.

Deadfall Creek at SR 1109/Anson County was sampled for fish for the first time in 2006. The site received a rating of Poor. A lack of diverse habitat and low flow at the site are implicated for low numbers of individuals and species collected.

River and Stream Assessment

Beaver Dam Creek at SR 1486/Richmond County is a basinwide benthic site last sampled in 2001 that was not sampled for invertebrates in 2006. The following basinwide benthic sites have not been sampled since 1996: Carteledge Creek at SR1142/Richmond County; Marks Creek at SR 1812/Richmond County; South Fork Jones Creek at SR 1821/Anson County. Sampling at all benthic basinwide sites should continue during the next cycle for the basin if conditions permit. It was suggested in the prior BAU basinwide report that the benthic site on Marks Creek be investigated as a possible swamp site.

Specific site summaries of the four benthic macroinvertebrate and 11 fish community samples may be found at this link: [03040201](#).

SPECIAL STUDIES

No special studies were conducted in this HUC during this basin cycle.

GLOSSARY

7Q ₁₀	A value which represents the lowest average flow for a seven day period that will recur on a ten year frequency. This value is applicable at any point on a stream. 7Q ₁₀ flow (in cfs) is used to allocate the discharge of toxic substances to streams.
Bioclass or Bioclassification	Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the intolerant groups (EPT) and the Biotic Index value.
cfs	Cubic feet per second, generally the unit in which stream flow is measured.
CHL <i>a</i>	Chlorophyll <i>a</i> .
Class C Waters	Freshwaters protected for secondary recreation, fishing, aquatic life including propagation and survival, and wildlife. All freshwaters shall be classified to protect these uses at a minimum.
Conductivity	In this report, synonymous with specific conductance and reported in the units of $\mu\text{mhos/cm}$ at 25 °C. Conductivity is a measure of the resistance of a solution to electrical flow. Resistance is reduced with increasing content of ionized salts.
Division	The North Carolina Division of Water Quality.
D.O.	Dissolved Oxygen.
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, Trichoptera); as a whole, the most intolerant insects present in the benthic community.
EPT N	The abundance of Ephemeroptera, Plecoptera, Trichoptera insects present, using values of 1 for Rare, 3 for Common and 10 for Abundant.
EPT S	Taxa richness of the insect orders Ephemeroptera, Plecoptera and Trichoptera. Higher taxa richness values are associated with better water quality.
HQW	High Quality Waters. Waters which are rated Excellent based on biological and physical/chemical characteristics through Division monitoring or special studies, primary nursery areas designated by the Marine Fisheries Commission, and all Class SA waters.
Major Discharger	Greater than or equal to one million gallons per day discharge (≥ 1 MGD).
MGD	Million Gallons per Day, generally the unit in which effluent discharge flow is measured.
Minor Discharger	Less than one million gallons per day discharge (< 1 MGD).
NPDES	National Pollutant Discharge Elimination System.

NCBI (EPT BI)	North Carolina Biotic Index, EPT Biotic Index. A summary measure of the tolerance values of organisms found in the sample, relative to their abundance. Sometimes noted as the NCBI or EPT BI.
NCIBI	North Carolina Index of Biotic Integrity (NCIBI); a summary measure of the effects of factors influencing the fish community.
NSW	Nutrient Sensitive Waters. Waters subject to growths of microscopic or macroscopic vegetation requiring limitations on nutrient inputs.
NTU	Nephelometric Turbidity Unit.
ORW	Outstanding Resource Waters. Unique and special waters of exceptional state or national recreational or ecological significance which require special protection to maintain existing uses.
Parametric Coverage	A listing of parameters measured and reported.
SOC	A consent order between an NPDES permittee and the Environmental Management Commission that specifically modifies compliance responsibility of the permittee, requiring that specified actions are taken to resolve non-compliance with permit limits.
Total S (or S)	The number of different taxa present in a benthic macroinvertebrate sample.
UT	Unnamed tributary.
WWTP	Wastewater treatment plant

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

All 17 subbasins were sampled for macroinvertebrates in the Yadkin River Basin in 2006. There are a total of 82 long-term basinwide benthos samples maintained in this basin. Graphical representations of bioclassification trends among the long-term basinwide benthos sites for each of the 17 subbasins and for each of the six HUCs for the periods: 1996, 2001, and 2006 are detailed below in Figures 2-7:

FIGURE 2: Yadkin River Basin HUC 03040101 (Subbasins 01, 02, 03, 04, 05): Long-Term Benthos Sites, Bioclassification Trends: 1996-2006.

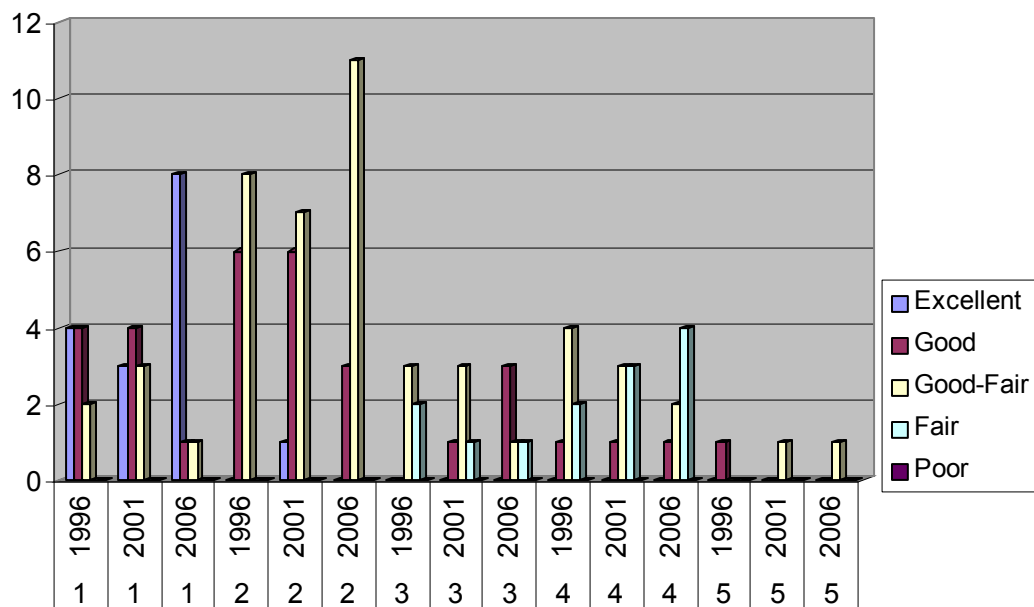


FIGURE 3: Yadkin River Basin HUC 0304102 (Subbasin 06): Long-Term Benthos Sites, Bioclassification Trends: 1996-2006.

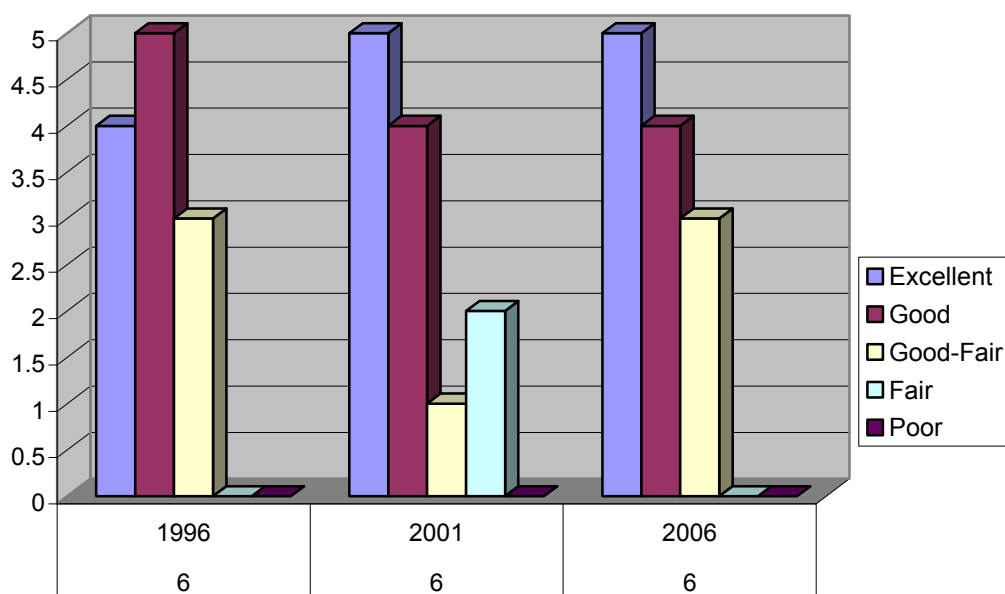


FIGURE 4: Yadkin River Basin HUC 03040103 (Subbasins 07, 08, 09): Long-Term Benthos Sites, Bioclassification Trends: 1996-2006.

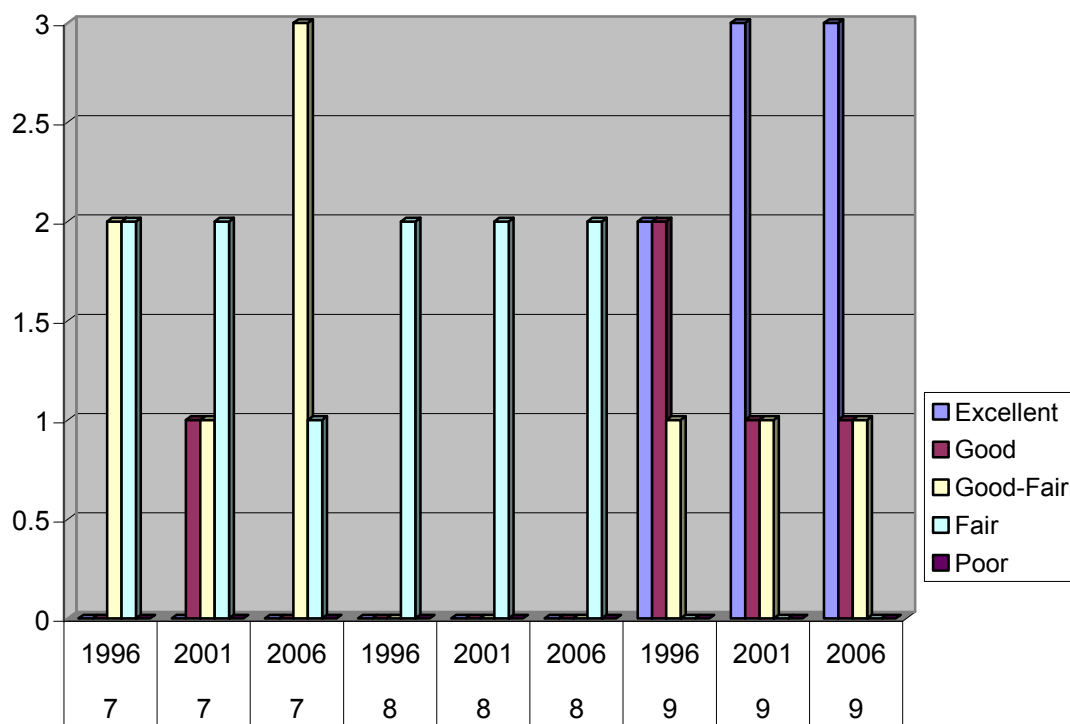


FIGURE 5: Yadkin River Basin HUC 03040104 (Subbasins 10, 15): Long-Term Benthos Sites, Bioclassification Trends: 1996-2006.

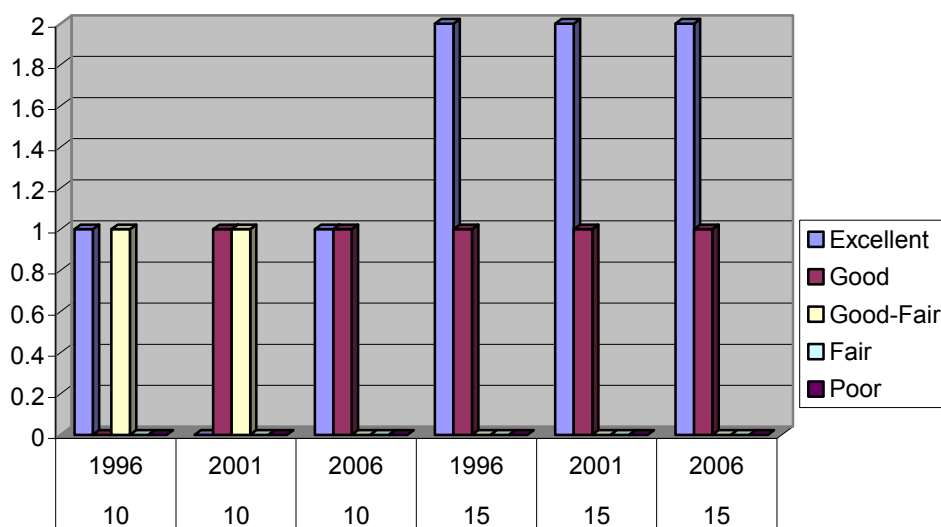


FIGURE 6: Yadkin River basin HUC 0304105 (Subbasins 11, 12, 13, 14): Long-Term Benthos Sites, Bioclassification Trends: 1996-2006.

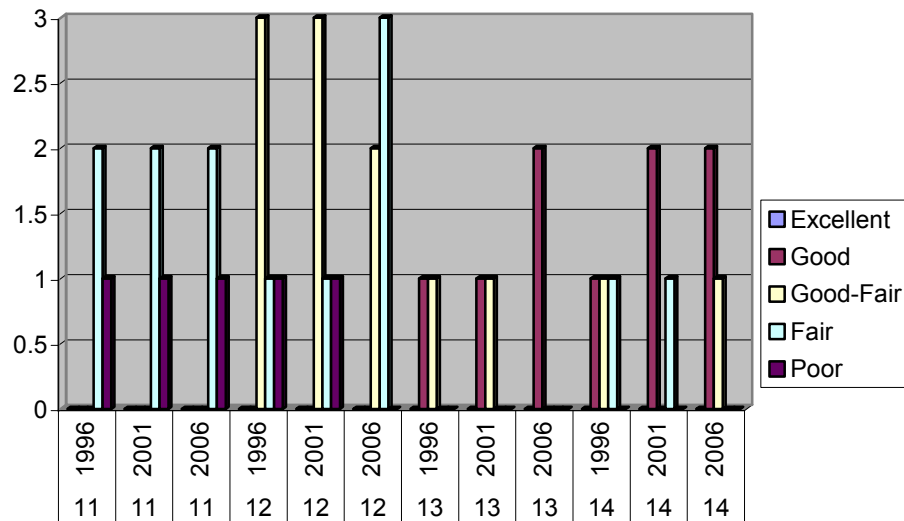
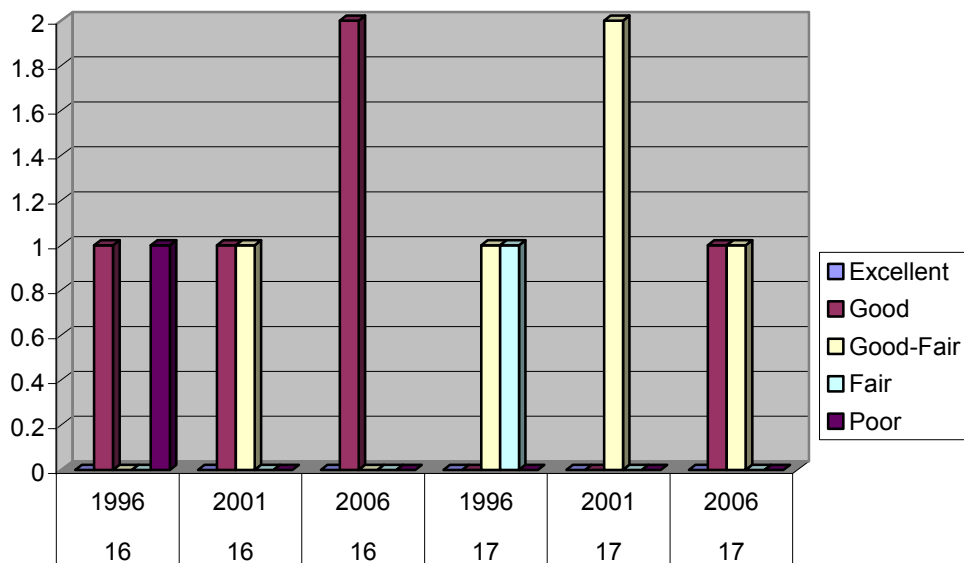


FIGURE 7: Yadkin River Basin HUC 03040201 (Subbasins 16, 17): Long-Term Benthos Sites, Bioclassification Trends: 1996-2006.



In summary, the most significant bioclassification changes in 2006 from previous samples (1996 and 2001) were seen in the following subbasins:

Subbasin 01: The number of Excellent bioclassifications increased from 4 in 1996 and 3 in 2001 to 8 in 2006.

Subbasin 02: The number of Good bioclassifications in 2006 decreased by half from the 6 observed in both 1996 and 2001. A corresponding increase in the number of Fair bioclassifications in 2006 resulted with 11, up from the 8 in 1996 and 7 in 2001.

Subbasin 03: Good bioclassifications in 2006 increased to 3, which represented an increase from zero Good ratings in 1996, and only 1 in 2001. There was a corresponding decrease in Fair samples in 2006 with only 1 observed down from the 3 measured in 1996 and 2001.

Subbasin 04: There were only 2 Good-Fair ratings in 2006, which represented a decrease from 4 in 1996, and 3 in 2001. There was a corresponding increase in Fair bioclassifications were noted in 2006 with 4 collected versus only 2 in 1996 and 3 in 2001.

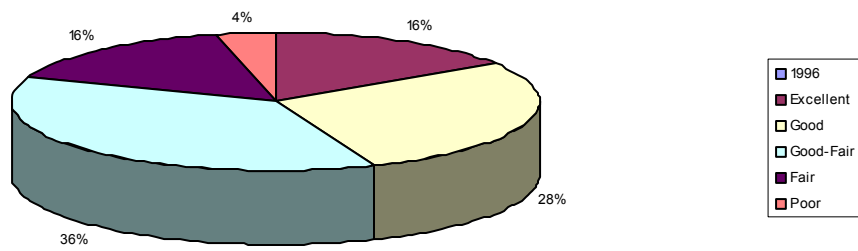
Subbasin 06: In 2006, Good-Fair bioclassifications increased from the 1 seen in 2001, while no Fair ratings were measured in 2006 while 2 were noted in 2001. The 2006 metrics were essentially identical to those measured in 1996.

Subbasin 07: Good-Fair bioclassifications increased to 3 in 2006 up from 2 in 1996 and 1 in 2001. There was a corresponding decrease in Fair rating in 2006 with only 1 noted, down from the 2 observed in 1996 and 2001.

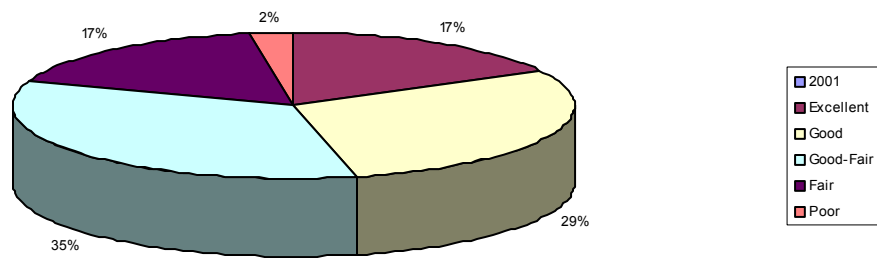
Subbasin 12: For 2006, the number of Fair ratings increased to 3, up from 1 observed in both 1996 and 2001, while there was a corresponding decrease in the number of Poor samples seen in 2006 (zero) while 1 was measured in both 1996 and 2001.

Historic bioclassification trends between the sampling periods 1996, 2001, and 2006 for long-term benthos sites in the Yadkin River Basin are presented below:

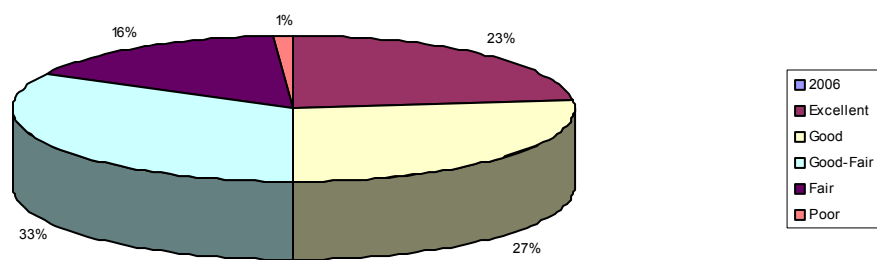
Yadkin River Basin Long-Term Benthos Sites: Total Bioclassifications (1996).



Yadkin River Basin Long-Term Benthos Sites: Total Bioclassifications (2001).



Yadkin River Basin Long-Term Benthos Sites: Total Bioclassifications (2006).



There were numerous significantly rare invertebrate taxa collected in the Yadkin River basin in 2006 (Table 1).

Table 1. Significantly rare invertebrate taxa: Yadkin River Basin, 2006.

Taxon	Total Number of DWQ Collections	Collection Location(s)	First Time Collected in Yadkin Basin?
Mayfly: <i>Leptohyphes dolani</i>	10	Crooked Cr (SR 1547, <i>Union</i>), Little R (SR 1340, <i>Montgomery</i>)	Yes
Mayfly: <i>Cercobrachys sp.</i>	7	Dutchmans Cr (US 158, <i>Davie</i>), South Yadkin R (SR 1159, <i>Davie</i>)	No
Mayfly: <i>Ephemerella needhami</i>	36	Barnes Cr (SR 1303, <i>Montgomery</i>)	No
Mayfly: <i>Eurylophella minimella</i>	21	Yadkin R (NC 268, <i>Caldwell</i>), Yadkin R (NC 268, <i>near</i> SR 1560, <i>Caldwell</i>), Mulberry Cr (NC 268, <i>Wilkes</i>)	No
Mayfly: <i>Eurylophella aestiva</i>	23	Yadkin R (NC 268, <i>Caldwell</i>), Yadkin R (NC 268, <i>Wilkes</i>), Yadkin R (NC 268, <i>near</i> SR 1560, <i>Caldwell</i>), Roaring R (SR 1990, <i>Wilkes</i>), Elk Cr (SR 1175, <i>Wilkes</i>), Mulberry Cr (NC 268, <i>Wilkes</i>)	No
Mayfly: <i>Litobranchia recurvata</i>	35	Buffalo Cr (SR 1505, <i>Caldwell</i>)	Yes
Caddisfly: <i>Hydropsyche mississippiensis</i>	4	Yadkin R (NC 268, <i>Wilkes</i>), Uwharrie R (NC 109, <i>Montgomery</i>)	Yes
Caddisfly: <i>Ceraclea menitea</i>	30	Roaring R (SR 1990, <i>Wilkes</i>), Yadkin R (NC 268, <i>Wilkes</i>)	Yes
Caddisfly: <i>Neophylax fuscus</i>	33	Elk Cr (SR 1175, <i>Wilkes</i>), Roaring R (SR 1990, <i>Wilkes</i>), Yadkin R (NC 18-268, <i>Wilkes</i>), Yadkin R (NC 268, <i>Caldwell</i>), Yadkin R (NC 268, <i>Wilkes</i>), Mitchell R (SR 1001, <i>Surry</i>)	No

Sampling Methods

Standard Qualitative (Full Scale) Method

Benthic macroinvertebrates can be collected from wadeable, freshwater, flowing waters using three sampling procedures. The Biological Assessment Unit's standard qualitative (Full Scale) sampling procedure includes 10 composite samples: two kick-net samples, three bank sweeps, two rock or log washes, one sand sample, one leafpack sample, and visual collections from large rocks and logs (NCDENR 2003). The samples are 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: 1 kick, 1 sweep, 1 leafpack and visual collections (NCDENR 2003). Only EPT taxa are collected and identified and only EPT criteria are used to assign a bioclassification.

Habitat Evaluation

An assessment form has been developed by the Biological Assessment Unit to better 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, and 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

Criteria for bioclassifications for standard qualitative samples in piedmont ecoregions are given below and are based on EPT S and the NCBI.

Tolerance values for individual species and biotic index values have a range of 0 - 10, with higher numbers indicating more tolerant species or more polluted conditions. Water quality scores (5 = Excellent, 4 = Good, 3 = Good-Fair, 2 = Fair and 1 = Poor) assigned with the biotic index numbers are averaged with EPT taxa richness scores to produce a final bioclassification. Criteria for piedmont and coastal plain streams are used for the Neuse River basin. EPT abundance and Total taxa richness calculations also are used to help examine between-site differences in water quality.

EPT S and BI values can be affected by seasonal changes. DWQ criteria for assigning bioclassification are based on summer sampling: June - September. For samples collected outside summer, EPT S can be adjusted by subtracting out winter/spring Plecoptera or other adjustment based on resampling of summer site. The BI values also are seasonally adjusted for samples outside the summer season.

Table 2. Criteria for standard qualitative (Full Scale) samples.

	BI Values	BI Values
Score	Mountain	Piedmont
5	<4.00	<5.14
4.6	4.00—4.04	5.14—5.18
4.4	4.05—4.09	5.19—5.23
4	4.10—4.83	5.24—5.73
3.6	4.84—4.88	5.74—5.78
3.4	4.89—4.93	5.79—5.83
3	4.94—5.69	5.84—6.43
2.6	5.70—5.74	6.44—6.48
2.4	5.75—5.79	6.49—6.53
2	5.80—6.95	6.54—7.43
1.6	6.96—7.0	7.44—7.48
1.4	7.01-7.05	7.49—7.53
1	>7.05	> 7.53

Table 3. Criteria for EPT samples.

	EPT Values	EPT Values
Score	Mountain	Piedmont
Excellent	>35	>27
Good	28-35	21-27
Good-Fair	19-27	14-20
Fair	11-18	7-13
Poor	0-10	0-6

Table 4. Benthic macroinvertebrate data collected from Yadkin River Basin, 2001-2006. Basinwide sites sampled in 2006 are in bold font.

Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPTBI	BioClass
HUC 03040101									
Subbasin: 01									
Yadkin R	Phoebe Ln	Caldwell	12-(1)	6/6/2006	---	43	---	2.8	Excellent
Yadkin R	SR 1372	Caldwell	12-(1)	6/5/2006	---	43	---	2.6	Excellent
		Caldwell		7/27/2001	---	33	---	3.5	Good
Yadkin R	NC 268 at Patterson	Caldwell	12-(1)	6/6/2006	112	33	5.2	4.2	Good-Fair
				8/30/2001	69	24	5.5	4.6	Good-Fair
Yadkin R	NC 268 be Hawkins Cr	Caldwell	12-(1)	6/7/2006	137	53	4.9	3.8	Good
Yadkin R	NC 268 nr Ferguson	Wilkes	12-(1)	6/8/2006	116	53	4.6	3.4	Excellent
Yadkin R	NC 18-268	Wilkes	12-(38)	6/8/2006	114	46	4.6	3.6	Excellent
				7/25/2001	94	32	5.3	4.4	Good-Fair
Buffalo Cr	SR 1504	Caldwell	12-19	6/6/2006	---	42	---	3.1	Excellent
Buffalo Cr	SR 1505	Caldwell	12-19	6/6/2006	---	48	---	3.3	Excellent
				8/30/2001	---	43	---	3.8	Excellent
UT Yadkin R	NC 268	Caldwell	---	4/18/2005	105	51	3.7	2.7	Not Impaired
Kings Cr	SR 1552	Caldwell	12-23	6/7/2006	---	28	---	4.1	Good
Elk Cr	SR 1175	Wilkes	12-24-(10)	6/7/2006	136	62	4.2	3.5	Excellent
				8/29/2001	100	43	4.6	3.6	Good
Laurel Cr	SR 1508	Watauga	12-24-8	6/7/2006	---	47	---	2.8	Excellent
Beaver Cr	SR 1130	Wilkes	12-25	6/11/2002	83	34	4.5	3.8	Good
Stony Fk	SR 1135	Wilkes	12-26-(7)	6/6/2006	---	42	---	3.7	Excellent
				6/11/2002	---	41	---	3.3	Excellent
				7/26/2001	---	44	---	3.6	Excellent
L Pr Stony Fk	SR 1155	Wilkes	12-26-3	6/12/2002	73	44	3.1	2.8	Excellent
Big Warrior Cr	NC 18	Wilkes	12-29-1	6/12/2002	60	25	5.1	4.7	Not Impaired
L Warrior Cr	nr Glenn Carlton Rd	Wilkes	12-29-2-(2)	6/12/2002	76	34	4.7	4.3	Good
N Pr Lewis Fk	SR 1300 ups	Wilkes	12-31-1-(1)	6/10/2002	97	44	3.8	3.3	Excellent
N Pr Lewis Fk	nr SR 1300	Wilkes	12-31-1-(4)	6/6/2006	---	38	---	3.3	Excellent
				6/10/2002	---	42	---	3.4	Excellent
				7/25/2001	---	35	---	3.5	Good
N Pr Lewis Fk	SR 1311	Wilkes	12-31-1-(7.5)	6/10/2002	99	42	4.7	3.8	Good
Little Fk Cr	ab Benny Parsons Rd	Wilkes	12-31-1-5	6/13/2001	69	41	2.5	1.9	Not Impaired
Purlear Cr	ab Mozelles Rd	Wilkes	12-31-1-8-(1)	6/12/2001	50	31	2.4	1.9	Not Impaired
Purlear Cr	Mozelles Rd	Wilkes	12-31-1-8-(1)	6/12/2001	59	35	2.6	2.1	Not Impaired
Purlear Cr	SR 1317	Wilkes	12-31-1-8-(2)	6/11/2002	40	9	6.3	6.0	Not Rated
S Pr Lewis Fk	SR 1305	Wilkes	12-31-2-(6)	6/11/2002	---	36	---	3.3	Good
Naked Cr	SR 1150	Wilkes	12-31-3-(0.5)	6/11/2002	84	31	5.0	3.8	Good-Fair
Fish Dam Cr	SR 1313	Wilkes	12-35	6/11/2002	79	35	5.0	3.9	Good-Fair
Tucker Hole Cr	NR US 421	Wilkes	12-37-(2)	6/12/2002	61	21	5.2	4.6	Not Impaired
Moravian Cr	NC 18	Wilkes	12-39	6/5/2006	---	24	---	4.6	Good-Fair
				7/26/2001	---	25	---	4.9	Good-Fair
M Fk Reddies R	SR 1559	Wilkes	12-40-2	7/26/2001	---	42	---	3.9	Excellent
S Fk Reddies R	SR 1355	Wilkes	12-40-3	7/26/2001	---	33	---	2.8	Good
N Fk Reddies R	SR 1567	Wilkes	12-40-4	7/26/2001	---	34	---	3.5	Good
Tumbling Shoals Cr	nr Mulberry Keys Rd	Wilkes	12-40-6	7/15/2004	29	19	1.8	1.4	Not Rated
UT Tumbling Shoals Cr	nr Mulberry Keys Rd	Wilkes	---	7/15/2004	39	19	2.3	1.2	Good
UT Tumbling Shoals Cr	nr Mulberry Keys Rd be culvert	Wilkes	---	7/15/2004	11	6	2.0	1.9	Not Rated
Mulberry Cr	NC 268	Wilkes	12-42	6/9/2006	---	47	---	3.3	Excellent
				7/25/2001	---	41	---	4.1	Excellent
Long Cr	SR 2334	Wilkes	12-42-9	6/9/2006	38	9	5.6	4.6	Not Rated
				7/25/2001	50	13	5.9	4.6	Not Rated
Roaring R	SR 1990	Wilkes	12-46	6/8/2006	121	50	4.1	3.2	Excellent
				7/25/2001	89	42	4.4	3.4	Good
Subbasin: 02									
Yadkin R	SR 1003	Surry	12-(53)	8/9/2006	78	29	5.3	4.2	Good-Fair
				8/7/2001	65	30	4.5	3.8	Good
Yadkin R	US 21	Yadkin	12-(53)	8/7/2006	82	35	4.9	3.9	Good
				8/6/2001	65	30	4.7	3.8	Good
Elkin Cr	NC 268	Surry	12-54-(4.5)	8/7/2006	24	24	4.0	4.0	Good-Fair
				8/6/2001	20	20	3.7	3.7	Good-Fair
Mitchell R	SR 1330	Surry	12-62-(1)	8/8/2006	97	29	4.6	3.5	Good
				8/6/2001	90	40	4.2	3.1	Good

Table 4 (continued).

Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPTBI	BioClass	
Mitchell R	SR 1001	Surry	12-62-(12)	8/8/2006	104	38	4.4	3.6	Good	
Snow Cr	SR 1121	Surry	12-62-15	8/6/2001	95	45	4.3	3.2	Excellent	
				8/7/2006	25	25	4.4	4.4	Good-Fair	
Fisher R	US 601	Surry	12-63-(7)	8/6/2001	24	24	4.0	4.0	Good-Fair	
Fisher R	NC 268	Surry	12-63-(9)	8/8/2006	27	27	4.7	4.7	Good-Fair	
				8/8/2001	30	30	3.2	3.2	Good	
L Fisher R	SR 1480	Surry	12-63-10 (2)	8/9/2006	93	28	5.4	4.5	Good-Fair	
				8/8/2001	88	39	5.1	3.9	Good	
L Beaver Cr	at mouth	Surry	12-63-13	8/8/2006	25	25	4.4	4.4	Good-Fair	
				8/7/2001	22	22	4.9	4.9	Good-Fair	
L Yadkin R	SR 1236	Stokes	12-77	7/24/2001	67	27	4.0	3.1	Not Impaired	
L Yadkin R	SR 1102	Stokes	12-77	8/8/2001	89	25	5.3	4.4	Good-Fair	
Forbush Cr	SR 1570	Yadkin	12-83-(1.5)	8/9/2006	102	33	5.4	4.5	Good-Fair	
				8/10/2006	22	22	4.8	4.8	Good-Fair	
Logan Cr	SR 1571	Yadkin	12-83-2-(0.7)	8/8/2001	22	22	4.2	4.2	Good-Fair	
				8/11/2006	21	21	5.0	5.0	Good-Fair	
N Deep Cr	SR 1510	Yadkin	12-84-1-(0.5)	8/9/2001	31	31	4.8	4.8	Good	
				8/11/2006	75	26	5.3	4.8	Good-Fair	
S Deep Cr	SR 1710	Yadkin	12-84-2-(5.5)	8/9/2001	76	26	5.4	4.6	Good-Fair	
				8/10/2006	75	24	5.0	3.9	Good-Fair	
					8/9/2001	65	19	5.3	4.4	Good-Fair
Subbasin: 03										
Ararat R	NC 104	Surry	12-72-(1)	7/24/2006	---	29	---	3.8	Good	
Ararat R	SR 2019	Surry	12-72-(4.5)	7/23/2001	---	25	---	4.0	Good-Fair	
				7/25/2006	95	41	4.9	4.2	Good	
Ararat R	SR 2080	Surry	12-72-(4.5)	7/23/2001	77	28	5.5	4.6	Good-Fair	
				7/23/2001	83	35	4.9	3.8	Good	
Faulkner Cr	SR 1742	Surry	12-72-6	7/24/2006	53	20	3.3	2.8	Not Impaired	
				2/26/2002	65	26	4.2	3.4	Not Impaired	
Faulkner Cr	SR 1756	Surry	12-72-6	7/26/2006	---	20	---	4.7	Good-Fair	
				2/26/2002	48	11	5.6	4.2	Not Rated	
Lovills Cr	SR 1700	Surry	12-72-8-(1)	7/24/2006	---	23	---	4.4	Good-Fair	
				7/24/2001	---	26	---	4.1	Good-Fair	
Lovills Cr	SR 1371	Surry	12-72-8-(3)	7/24/2006	73	19	5.6	4.8	Fair	
				7/24/2001	67	14	6.3	4.7	Fair	
Stewarts Cr	SR 2258	Surry	12-72-9-(1)	7/25/2006	110	37	5.3	4.5	Good	
				7/24/2001	78	34	5.3	4.4	Good	
Stewarts Cr	NC 89	Surry	12-72-9-(4)	7/2/2002	78	29	5.2	4.1	Good-Fair	
				7/24/2001	---	18	---	4.6	Fair	
Rutledge Cr	SR 1774	Surry	12-72-10	7/25/2006	---	28	---	3.3	Good	
Flat Shoal Cr	SR 1827	Surry	12-72-13	2/26/2002	69	29	4.1	2.8	Not Impaired	
				7/23/2001	---	20	---	3.4	Not Impaired	
Flat Shoal Cr	SR 2017	Surry	12-72-13	7/25/2006	---	25	---	3.3	Good-Fair	
Heatherly Cr	NC 268	Surry	12-72-14-5	4/19/2004	57	15	5.8	4.7	Not Rated	
				8/29/2001	51	17	5.1	4.8	Not Impaired	
Heatherly Cr	US 52	Surry	12-72-14-5	7/26/2006	50	17	5.2	4.6	Not Rated	
				4/19/2004	44	11	6.5	5.7	Not Rated	
					8/29/2001	44	11	5.8	5.6	Not Rated
Subbasin: 04										
Muddy Cr	SR 1898	Forsyth	12-94-(0.5)	8/7/2006	14	14	5.9	5.9	Fair	
Muddy Cr	SR 2995	Forsyth	12-94-(0.5)	8/6/2001	19	19	5.1	5.1	Good-Fair	
				9/28/2006	58	12	6.3	5.4	Fair	
Reynolds Cr	Above Sequoia	Forsyth	12-94-9	8/7/2001	50	14	6.5	5.8	Good-Fair	
				8/7/2006	51	18	5.2	4.8	Not Impaired	
Reynolds Cr	Below Sequoia	Forsyth	12-94-9	8/7/2006	40	12	5.4	4.4	Not Impaired	
Salem Cr	SR 2657	Forsyth	12-94-12-(1)	8/6/2001	13	13	5.1	5.1	Not Impaired	
Salem Cr	SR 2902	Forsyth	12-94-12-(4)	8/8/2006	58	16	6.6	6.0	Fair	
				8/6/2001	45	9	6.9	6.3	Fair	
Salem Cr	SR 2991	Forsyth	12-94-12-(4)	8/9/2006	51	11	6.7	6.3	Fair	
				8/6/2001	42	10	7.1	6.4	Fair	
S Fk Muddy Cr	SR 2902	Forsyth	12-94-13	8/8/2006	61	17	6.0	5.3	Good-Fair	
				8/6/2001	17	17	5.5	5.5	Good-Fair	
Yadkin R	SR 1447	Davidson	12-(97.5)	8/9/2006	85	33	5.4	4.3	Good	
				9/12/2001	67	29	5.5	4.6	Good	
Tanyard Cr	SR 1166	Davidson	12-104	4/17/2006	67	27	4.6	3.1	Not Impaired	

Table 4 (continued).

Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPTBI	BioClass
Second Cr	SR 2335	Rowan	12-108-2	8/28/2001	75	18	5.9	5.1	Good-Fair
Second Cr	SR 2370	Rowan	12-108-2	8/10/2006	87	23	5.7	5.3	Good
UT Second Cr	Klutz St ab WWTP	Rowan	12-108-21	1/18/2002	16	16	4.4	4.4	Not Impaired
UT Second Cr	nr Dutch Cr Rd be WWTP	Rowan	12-108-21	1/18/2002	15	15	4.3	4.3	Not Impaired
UT Grants Cr	SR 1500	Rowan	12-110	8/28/2001	34	14	5.3	4.6	Not Impaired
Grants Cr	SR 1910	Rowan	12-110	8/9/2006	87	18	6.4	6.0	Good-Fair
				8/7/2001	72	13	6.6	6.3	Fair
Town Cr	I-85	Rowan	12-115-3	8/7/2001	50	8	6.9	6.8	Fair
Town Cr	SR 2118	Rowan	12-115-3	8/9/2006	87	14	6.6	5.9	Fair
				6/16/2004	57	12	6.9	6.0	Fair
Town Cr	SR 2538	Rowan	12-115-3	6/16/2004	40	5	7.9	6.4	Poor
Subbasin: 05									
Dutchmans Cr	US 158	Davie	12-102-(2)	8/10/2006	77	19	6.0	5.5	Good-Fair
				8/7/2001	72	20	6.3	5.5	Good-Fair
Dutchmans Cr	NC 801	Davie	12-102-(2)	8/10/2006	90	23	6.3	5.5	Good-Fair
				8/7/2001	77	17	6.5	5.2	Fair
HUC 03040102 Subbasin: 06									
S Yadkin R	SR 1561	Iredell	12-108-(5.5)	7/25/2006	96	28	5.5	4.5	Good
				9/11/2001	68	21	5.8	4.9	Good-Fair
				7/24/2001	77	25	5.8	5.1	Good
S Yadkin R	SR 1159	Davie	12-108-(14.5)	9/11/2006	77	32	5.2	4.6	Excellent
				7/24/2001	80	32	4.7	3.9	Excellent
Rocky Cr	SR 1854	Iredell	12-108-11	4/4/2006	53	53	3.4	3.4	Excellent
				12/2/2003	36	36	3.1	3.1	Excellent
				6/5/2003	41	41	3.7	3.7	Excellent
Rocky Cr	SR 1884	Iredell	12-108-11	9/28/2006	---	35	---	3.9	Excellent
				7/26/2006	---	44	---	4.2	Excellent
				7/23/2001	---	38	---	3.8	Excellent
Patterson Cr	SR 1890	Iredell	12-108-11-3	7/26/2006	---	32	---	3.9	Excellent
				4/4/2006	---	39	---	3.8	Excellent
				12/2/2003	---	35	---	4.0	Good
				7/23/2001	---	25	---	4.1	Good
Olin Cr	SR 1891	Iredell	12-108-11-3-3	5/9/2006	73	27	5.3	4.8	Good
Hunting Cr	NC 115	Wilkes	12-108-16-(0.5)	7/25/2006	100	43	4.2	3.4	Excellent
				7/30/2001	---	37	---	3.7	Excellent
Hunting Cr	SR 2115	Iredell	12-108-16-(0.5)	9/11/2006	85	34	5.8	4.4	Good
				7/23/2001	74	31	5.1	4.2	Excellent
N Little Hunting Cr	SR 1829	Iredell	12-108-16-6	7/26/2006	87	30	5.2	4.6	Good
				7/23/2001	---	31	---	4.1	Excellent
Fourth Cr	SR 2320	Iredell	12-108-20	6/6/2003	76	17	6.2	5.4	Good-Fair
Fourth Cr	SR 2316	Iredell	12-108-20	7/2/2002	48	14	6.2	5.4	Good-Fair
				9/11/2001	51	13	6.1	5.1	Fair
Fourth Cr	SR 2308	Iredell	12-108-20	6/3/2003	53	11	6.1	5.9	Fair
				9/12/2001	57	12	6.9	6.0	Fair
Fourth Cr	SR 1930	Iredell	12-108-20	5/9/2006	78	24	5.9	4.9	Good-Fair
				6/5/2003	---	20	---	5.1	Good-Fair
Fourth Cr	SR 1003	Rowan	12-108-20	7/26/2006	---	28	---	4.8	Excellent
				9/11/2001	---	21	---	5.3	Good
				7/24/2001	---	20	---	5.3	Good-Fair
Fourth Cr	SR 1985	Rowan	12-108-20	6/6/2003	72	19	5.9	4.9	Good-Fair
UT Fourth Cr	SR 2322	Iredell	12-108-20	6/5/2003	---	2	---	6.8	Not Rated
Morrison Cr	SR 1907	Iredell	12-108-20-3	6/5/2003	---	18	---	4.1	Good-Fair
Third Cr	SR 1521	Iredell	12-108-20-4	5/8/2006	72	23	5.6	4.8	Good-Fair
Third Cr	SR 1970	Rowan	12-108-20-4	7/27/2006	70	24	5.5	4.4	Good
				7/24/2001	52	22	5.2	4.4	Good
North Second Cr	SR 1526	Rowan	12-108-21	7/24/2006	---	18	---	5.0	Good-Fair
				7/2/2002	61	17	6.7	5.4	Fair
				7/24/2001	---	10	---	6.0	Fair
North Second Cr	US 70	Rowan	12-108-21	7/24/2006	75	18	6.3	5.6	Good-Fair
				7/2/2002	65	14	6.8	6.0	Fair
				7/24/2001	66	16	6.8	6.1	Fair

Table 4 (continued).

Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPTBI	BioClass
Withrow Cr	SR 1547	Rowan	12-108-21-3	7/24/2006	19	19	4.7	4.7	Good-Fair
				7/25/2001	---	18	---	4.8	Good-Fair
HUC 03040103									
Subbasin: 07									
Swearing Cr	NC 47	Davidson	12-113	9/11/2006	57	17	6.4	5.5	Good-Fair
				7/3/2002	63	12	6.6	5.7	Fair
				7/25/2001	13	13	5.8	5.8	Fair
Abbotts Cr	SR 1735	Davidson	12-119-(1)	5/10/2006	57	21	5.4	4.8	Good
Abbotts Cr	SR 1755	Davidson	12-119-(1)	9/13/2006	65	17	5.8	5.1	Good-Fair
				9/28/2001	15	15	5.4	5.4	Good-Fair
Abbotts Cr	SR 1800	Davidson	12-119-1	5/10/2006	67	18	6.2	5.1	Good-Fair
Brushy Fk	SR 1810	Davidson	12-119-5-(1)	9/12/2006	61	15	5.9	5.0	Good-Fair
				5/14/2003	79	25	5.8	4.8	Good-Fair
				7/30/2001	53	20	5.4	4.4	Good
Abbotts Cr	SR 1243	Davidson	12-119-(6)	9/12/2006	63	11	6.7	6.2	Fair
				7/25/2001	61	15	6.8	6.2	Fair
Rich Fk	SR 1755	Davidson	12-119-7	5/10/2006	64	18	6.5	5.3	Good-Fair
Rich Fk	SR 2005	Davidson	12-119-7	7/25/2001	65	15	7.0	6.5	Fair
Hunts Fk	SR 1787	Davidson	12-119-7-3	5/10/2006	60	11	7.1	5.9	Fair
				8/28/2001	66	9	7.3	6.5	Not Rated
Hamby Cr	Ferndale Dr	Davidson	12-119-7-4	5/12/2003	53	6	7.4	6.4	Not Rated
Hamby Cr	I-85	Davidson	12-119-7-4	5/13/2003	49	7	6.6	6.1	Fair
Hamby Cr	SR 2025	Davidson	12-119-7-4	5/9/2006	56	4	7.5	5.0	Poor
Hamby Cr	SR 2017	Davidson	12-119-7-4	9/12/2006	51	11	6.9	6.4	Fair
				5/12/2003	60	9	7.2	6.3	Fair
				7/30/2001	58	12	6.5	6.1	Fair
UT Hamby Cr	SR 2010	Davidson	12-119-7-4	5/14/2003	49	13	5.8	4.4	Not Rated
N Hamby Cr	I-85	Davidson	12-119-7-4-1	5/12/2003	44	3	7.3	6.5	Poor
N Hamby Cr	SR 2031	Davidson	12-119-7-4-1	8/28/2001	41	3	7.1	7.0	Poor
Jimmy's Cr	SR 2020	Davidson	12-119-7-4-2	5/13/2003	44	11	6.4	5.5	Not Rated
Leonards Cr	Leonard Cr Farm Rd	Davidson	12-119-8-(3)	7/25/2001	---	17	---	5.2	Good-Fair
Subbasin: 08									
Mountain Cr	SR 1720	Stanly	13-5-(0.7)	8/8/2001	18	18	5.2	5.2	Good-Fair
L Mountain Cr	NC 740	Stanly	13-5-1-(2)	1/20/2004	50	13	6.1	5.2	Fair
L Mountain Cr	SR 1720	Stanly	13-5-1-(2)	8/10/2006	53	10	6.2	5.9	Fair
				1/20/2004	41	5	6.8	6.4	Poor
				8/8/2001	54	12	5.9	5.8	Fair
Wood Run	SR 1150	Montgomery	13-7-(2)	4/7/2006	63	36	3.6	3.2	Not Impaired
				6/16/2005	59	25	4.0	3.4	Not Impaired
				5/11/2005	56	30	3.9	3.2	Not Impaired
Jacobs Cr	SR 1740	Stanly	13-9-(2)	1/20/2004	52	13	5.6	4.5	Good-Fair
Lick Cr	NC 8	Davidson	12-126-(3)	8/11/2006	81	13	6.7	6.6	Fair
				9/8/2003	79	17	6.5	5.7	Good-Fair
				8/7/2001	11	11	6.5	6.5	Fair
Lick Cr	SR 2347	Davidson	12-126-(3)	9/8/2003	84	23	6.2	5.4	Good-Fair
Subbasin: 09									
Uwharrie R	SR 1564	Randolph	13-2-(0.5)	5/17/2006	83	22	5.7	4.9	Good-Fair
Uwharrie R	SR 1406	Randolph	13-2-(0.5)	5/16/2006	72	24	5.8	4.6	Good
				8/9/2001	18	18	5.3	5.3	Good-Fair
L Uwharrie R	SR 1405	Randolph	13-2-1	5/16/2006	75	18	5.6	4.4	Good
				8/9/2001	18	18	4.7	4.7	Good-Fair
Brier Cr	SR 1402	Randolph	13-2-1-1	5/15/2006	67	19	5.7	4.4	Good
Uwharrie R	SR 1143	Randolph	13-2-1-(1.5)	9/27/2006	92	19	5.9	4.2	Good-Fair
				8/9/2001	84	27	5.7	4.9	Good
Caraway Cr	SR 1524	Randolph	13-2-3	5/17/2006	70	21	5.5	4.3	Good
Caraway Cr	SR 1331	Randolph	13-2-3	5/15/2006	74	17	5.9	5.0	Good-Fair
				8/9/2001	18	18	4.4	4.4	Good-Fair
Talbot's Br	SR 1142	Randolph	13-2-5-1	5/2/2005	51	20	5.6	4.9	Not Impaired
Uwharrie R	NC 109	Montgomery	13-2-(17.5)	8/11/2006	118	35	5.2	3.8	Excellent
				3/22/2005	100	34	4.8	3.0	Excellent
				8/8/2001	89	33	5.0	3.9	Excellent
Poison Fk	SR 1306	Montgomery	13-2-18-1	5/4/2005	70	35	4.1	3.6	Not Impaired
Barnes Cr	SR 1303	Montgomery	13-2-18-(2.5)	5/15/2006	95	37	5.0	4.2	Excellent
				9/28/2001	79	38	4.2	3.0	Excellent
				8/9/2001	108	40	4.2	3.5	Excellent

Table 4 (continued).

Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPTBI	BioClass
W Br Maclean Cr	FR 544	Montgomery	13-2-20-1	5/3/2005	58	23	4.5	3.6	Not Impaired
Moccasin Cr	FR 544	Montgomery	13-2-20-1-1	5/3/2005	56	29	4.1	3.5	Not Impaired
Dutchmans Cr	SR 1150	Montgomery	13-2-24	8/24/2006	23	23	3.2	3.2	Good
				8/10/2006	30	30	3.6	3.6	Excellent
				6/16/2005	74	34	4.0	3.5	Excellent
				8/8/2001	26	26	3.0	3.0	Not Rated
HUC 03040104									
Subbasin: 10									
Clarks Cr	SR 1110	Montgomery	13-16	8/22/2006	---	21	---	4.3	Good
				8/8/2001	---	18	---	4.9	Good-Fair
Mountain Cr	SR 1150	Richmond	13-28-1-(0.5)	8/21/2006	---	32	---	4.0	Excellent
				8/8/2001	---	25	---	3.7	Good
Subbasin: 15									
UT Little R	SR 1051	Richmond	13-25-(1)	5/17/2005	18	52	5.0	4.8	Not Impaired
Little R	SR 1340	Montgomery	13-25-(11.5)	8/24/2006	105	34	5.1	3.8	Excellent
				8/13/2001	93	30	4.7	3.5	Excellent
W Fk Little R	SR 1311	Montgomery	13-25-15	8/24/2006	---	26	---	4.0	Good
				8/13/2001	38	26	4.2	4.0	Excellent
Little R	NC 731	Montgomery	13-25-(19)	8/23/2006	85	31	4.7	4.0	Excellent
				8/15/2001	72	29	5.0	4.3	Good
Cheek Cr	SR 1541	Montgomery	13-25-36	8/15/2001	62	9	6.5	6.1	Fair
HUC 03040105									
Subbasin: 11									
Rocky R	SR 2420	Mecklenburg	13-17	8/21/2006	48	9	6.5	6.1	Fair
				8/21/01	41	8	6.7	6.3	Fair
Rocky R	SR 1142	Iredell	13-17	5/8/2002	70	12	6.3	5.0	Not Rated
Rocky R	NC 29	Cabarrus	13-17	7/29/2003	50	9	6.4	5.5	Fair
Rocky R	SR 1132	Cabarrus	13-17	9/15/2003	59	14	6.6	6.0	Fair
Dye Br	SR 1147	Iredell	13-17-2	9/11/01	44	9	6.3	6.2	Not Rated
Dye Br	SR 1142	Iredell	13-17-2	8/21/2006	41	5	6.9	6.4	Poor
				9/11/01	25	2	7.7	6.2	Poor
Mallard Cr	SR 1300	Cabarrus	13-17-5	7/29/2003	42	7	6.5	6.1	Fair
Coddle Cr	SR 1612	Cabarrus	13-17-6-(0.5)	9/15/2003	52	14	5.9	5.1	Good-Fair
				7/29/2003	72	21	6.0	5.1	Good-Fair
Coddle Cr	NC 49	Cabarrus	13-17-6-(5.5)	8/21/2006	65	13	6.3	5.4	Fair
				7/31/2003	48	12	6.5	5.7	Fair
				8/21/01	67	14	6.5	5.7	Fair
Back Cr	SR 2828	Mecklenburg	13-17-7	7/30/2003	33	8	5.9	6.1	Not Rated
Back Cr	SR 1138	Cabarrus	13-17-7	7/30/2003	50	8	7.0	6.6	Fair
Fuda Cr	SR 1158	Cabarrus	13-17-7-1	7/30/2003	47	9	6.9	6.7	Fair
Caldwell Cr	SR 1134	Cabarrus	13-17-8-5	7/29/2003	66	11	6.9	5.9	Fair
Caldwell Cr	SR 1141	Cabarrus	13-17-8-5	7/31/2003	58	14	6.2	6.1	Good-Fair
Clarke Cr	SR 1449	Cabarrus	13-17-4	5/16/2002	57	13	6.8	5.1	Not Impaired
Clarks Cr	SR 2467	Mecklenburg	13-17-5-2	7/31/2003	33	5	6.8	6.8	Fair
Coddle Cr	SR 1150	Iredell	13-17-6-(0.5)	7/29/2003	65	17	6.1	5.2	Good-Fair
Coddle Cr	SR 1153	Iredell	13-17-6-(0.5)	9/15/2003	48	17	5.7	4.8	Not Impaired
Doby Cr	Near SR 2665	Mecklenburg	13-17-5-3	7/30/2003	41	5	6.6	6.6	Fair
E Fk Coddle Cr	SR 1353	Rowan	13-17-6-1	7/29/2003	45	4	6.9	6.5	Poor
McKee Cr	SR 1169	Mecklenburg	13-17-8-4	7/29/2003	43	6	6.8	6.5	Fair
Mill Cr	NC 136	Cabarrus	13-17-6-5-(1)	7/30/2003	56	21	5.6	5.1	Good-Fair
N Pr Clarke Cr	SR 2442	Mecklenburg	13-17-4-1	5/13/2002	48	3	6.7	6.4	Not Rated
Park Cr	SR 1615	Cabarrus	13-17-6-3-(1)	7/30/2003	66	24	5.8	5.2	Good-Fair
Ramah Cr	SR 2427	Mecklenburg	13-17-4-4	5/7/2002	61	16	5.8	4.9	Not Impaired
Ramah Cr	SR 2426	Mecklenburg	13-17-4-4	5/13/2002	47	15	5.6	5.2	Not Impaired
Reedy Cr	Near Rocky R	Mecklenburg	13-17-8	7/30/2003	47	14	5.7	4.8	Not Impaired
Reedy Cr	SR 2826	Mecklenburg	13-17-8	7/30/2003	57	13	6.7	6.2	Fair
Rocky R	SR 1600	Cabarrus	13-17	5/16/2002	52	13	6.3	5.7	Not Impaired
S Pr Clarke Cr	SR 2442	Mecklenburg	13-17-4-2	5/15/2002	61	14	6.2	5.6	Not Impaired
S Pr Rocky R	SR 2693	Mecklenburg	13-17-3-1	5/9/2002	62	12	6.4	5.4	Not Rated
Stony Cr	NC 29	Mecklenburg	13-17-5-5	7/31/2002	34	4	6.9	6.8	Fair
Toby Cr	Near North Loop	Mecklenburg	13-17-5-4	7/30/2003	44	6	7.0	6.1	Fair
UT Clarke Cr	SR 2461	Mecklenburg	13-17-5-2	5/15/2002	36	2	7.8	5.9	Not Rated
W Br Rocky R	SR 1136	Iredell	13-17-3	5/6/2002	62	15	6.5	5.2	Not Impaired
Wolf Meadow Br	Farmwood	Cabarrus	13-17-6-7	9/16/2003	61	14	6.5	5.9	Not Impaired

Table 4 (continued).

Waterbody	Location	County	Index No.	Date	ST	EPT	NCBI	EPTBI	BioClass
Subbasin: 12									
Rocky R	US 601	Cabarrus	13-17	8/29/2006	53	13	6.3	5.5	Good-Fair
				7/2/2002	40	9	6.8	6.4	Fair
				8/22/01	48	15	6.5	5.7	Fair
Irish Buffalo Cr	SR 1132	Cabarrus	13-17-9-(2)	9/29/2006	54	12	6.4	6.1	Fair
				8/21/01	56	15	6.3	5.6	Good-Fair
Coldwater Cr	NC 49	Cabarrus	13-17-9-4-(1.5)	8/22/2006	13	13	5.8	5.8	Fair
				8/21/01	---	15	---	5.1	Good-Fair
Dutch Buffalo Cr	NC 200	Cabarrus	13-17-11-5	8/22/01	79	18	6.6	5.7	Good-Fair
Clear Cr	SR 3181	Mecklenburg	13-17-17	8/22/01	57	15	5.9	5.1	Good-Fair
Goose Cr	US 601	Union	13-17-18	8/22/2006	67	11	6.8	6.6	Fair
				8/22/01	48	5	7.1	5.9	Poor
Crooked Cr	SR 1547	Union	13-17-20	8/23/2006	63	11	6.2	5.7	Good-Fair
				8/22/01	68	18	5.9	5.1	Good-Fair
Subbasin: 13									
Long Cr	SR 1401	Stanly	13-17-31	8/23/2006	---	17	---	4.9	Good-Fair
				8/20/01	---	17	---	5.1	Good-Fair
Long Cr	SR 1917	Stanly	13-17-31	8/23/2006	72	22	5.7	5.0	Good
				8/23/01	70	20	5.8	4.8	Good-Fair
L Long Cr	Old Char Rd	Stanly	13-17-31	8/24/2006	73	11	6.6	5.3	Fair
Big Bear Cr	SR 1225	Stanly	13-17-31-5	8/23/2006	---	22	---	5.0	Good
				8/20/01	---	22	---	4.5	Good
Stony Run Cr	SR 1970	Stanly	13-17-31-5-5	8/20/01	---	12	---	5.5	Fair
Subbasin: 14									
Rocky R	SR 1943	Stanly	13-17	8/29/2006	63	21	5.3	4.4	Good
				8/23/01	62	24	5.0	4.2	Good
Richardson Cr	SR 1006	Union	13-17-36-(5)	8/24/01	48	8	6.7	6.8	Fair
Richardson Cr	SR 1649	Union	13-17-36-(5)	8/23/2006	57	14	5.9	5.4	Good-Fair
				8/23/01	46	10	6.3	6.1	Fair
Richardson Cr	SR 1600	Anson	13-17-36-(5)	8/23/2006	---	24	---	4.1	Good
				8/22/2006	---	21	---	4.2	Good
				8/23/01	---	24	---	3.9	Good
Stewarts Cr	US 601	Union	13-17-36-9-(6)	8/23/2006	---	8	---	6.0	Fair
HUC 03040201									
Subbasin: 16									
Hitchcock Cr	SR 1486	Richmond	13-39-(1)	8/21/2006	---	24	---	3.5	Good
				8/15/2001	---	23	---	3.2	Good
Bones Fork Cr	Off McDonald	Richmond	13-39-5	5/5/2006	63	21	4.3	2.2	Not Impaired
				5/17/2005	47	13	5.4	3.4	Not Impaired
Beaverdam Cr	SR 1486	Richmond	13-39-8-7	8/14/2001	-	24	-	2.3	Not Impaired
Hitchcock Cr	US 74	Richmond	13-39-(10)	8/14/2001	72	21	5.6	4.5	Good
Hitchcock Cr	SR 1109	Richmond	13-39-(10)	8/21/2006	79	32	5.6	4.5	Good
				8/15/2001	71	21	6.0	4.6	Good-Fair
Jennies Br	US 1	Richmond	13-39-13	5/3/2006	32	5	5.8	4.9	Not Impaired
Subbasin: 17									
Jones Cr	NC 145	Anson	13-42	8/21/2006	66	27	5.7	5.2	Good
				8/14/2001	74	18	5.9	4.4	Good-Fair
N Fk Jones Cr	SR 1121	Anson	13-42-1-(0.5)	8/21/2006	64	14	6.2	5.3	Good-Fair
				8/13/2001	63	16	6.1	5.4	Good-Fair

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. The fish in the delineated stretch of stream were then collected using two backpack electrofishing units and usually, two persons netting the stunned fish. A seine was also used where there were substantial riffles. In 2006 Biological Assessment Unit Staff were assisted by staff from the NC DWQ, NC Natural Heritage Program, and a summer intern from North Carolina State University. After collection, all readily identifiable fish were examined for sores, lesions, fin damage, or 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 Analysis

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 classes of factors influencing aquatic faunal communities (water quality, energy source, habitat quality, flow regime, and biotic interactions). While any change in 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 12 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 ---).

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 ≥ 6 m Piedmont streams -- width of the riparian zone along both banks is ≥ 12 m Coastal Plain/Sand Hill streams -- width of the riparian zone along both banks is ≥ 18 m
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 reference sites in the Yadkin River basin.

HUC/Waterbody	Station	County	Level IV Ecoregion
03040101 Yadkin River Headwaters			
Yadkin R	off SR 1372	Caldwell	Southern Crystalline Ridges and Mountains
Buffalo Cr	SR 1594	Caldwell	Southern Crystalline Ridges and Mountains
Laurel Cr	SR 1508	Watauga	Southern Crystalline Ridges and Mountains
N Pr Lewis Fk	SR 1304	Wilkes	Northern Inner Piedmont
S Pr Lewis Fk	SR 1154	Wilkes	Northern Inner Piedmont
M Fk Reddies R	SR 1562	Wilkes	Southern Crystalline Ridges and Mountains
N Fk Reddies R	SR 1501	Wilkes	Southern Crystalline Ridges and Mountains
N Fk Reddies R	SR 1567	Wilkes	Southern Crystalline Ridges and Mountains
M Pr Roaring R	SR 1002	Wilkes	Northern Inner Piedmont
Basin Cr	SR 1730	Wilkes	Southern Crystalline Ridges and Mountains
E Pr Roaring R	SR 1739	Wilkes	Southern Crystalline Ridges and Mountains
E Pr Roaring R	SR 1739	Wilkes	Southern Crystalline Ridges and Mountains
Garden Cr	SR 1739	Wilkes	Southern Crystalline Ridges and Mountains
Mitchell R	SR 1330	Surry	Northern Inner Piedmont
Fisher R	SR 1331	Surry	Northern Inner Piedmont
Ararat R	NC 104	Surry	Northern Inner Piedmont
03040103 Yadkin River			
Betty McGees Cr	SR 1107	Randolph	Carolina Slate Belt
Barnes Cr	SR 1303	Montgomery	Carolina Slate Belt
Dutchmans Cr	SR 1150	Montgomery	Carolina Slate Belt
03040104 Lake Tillery-Pee Dee River			
Clarks Cr	SR 1188	Montgomery	Carolina Slate Belt
Clarks Cr	SR 1110	Montgomery	Carolina Slate Belt
Cedar Cr	SR 1709	Anson	Triassic Basins
W Fk Little R	SR 1311	Montgomery	Carolina Slate Belt
Densons Cr	SR 1323	Montgomery	Carolina Slate Belt
Dumas Cr	SR 1310	Montgomery	Carolina Slate Belt
Bridgers Cr	SR 1519	Montgomery	Carolina Slate Belt
Rocky Cr	NC 24/27	Montgomery	Carolina Slate Belt
Rocky Cr	SR 1549	Montgomery	Carolina Slate Belt
Cheek Cr	SR 1563	Montgomery	Carolina Slate Belt/Triassic Basins
Big Mountain Cr	SR 1319	Richmond	Carolina Slate Belt
Big Mountain Cr	NC 73	Richmond	Carolina Slate Belt
03040201 Pee Dee River			
Beaverdam Cr	SR 1486	Richmond	Sand Hills
Cartledge Cr	SR 1142	Richmond	Carolina Slate Belt
Mill Cr	SR 1826	Anson	Carolina Slate Belt/Sand Hills

Table 3 Scoring criteria for the NCIBI for wadeable streams in the mountain and piedmont ecoregions of the Broad, Catawba, Savannah, and Yadkin River basins with watershed drainage areas ranging between 2.8 and 245 mi².

No.	Metric	Score								
1	No. of species where Y is the number of species in the sample and X is the stream's drainage area in mi ² : Y ≥ 9.5*Log ₁₀ X+1.6 4.8*Log ₁₀ X+0.8 ≤ Y < 9.5*Log ₁₀ X+1.6 Y < 4.8*Log ₁₀ X+0.8	5 3 1								
2	No. of fish <table><tr><td><u>Mountains</u></td><td><u>Piedmont</u></td></tr><tr><td>≥ 300 fish</td><td>≥ 150 fish</td></tr><tr><td>200-299 fish</td><td>100-149 fish</td></tr><tr><td>< 200 fish</td><td>< 100 fish</td></tr></table>	<u>Mountains</u>	<u>Piedmont</u>	≥ 300 fish	≥ 150 fish	200-299 fish	100-149 fish	< 200 fish	< 100 fish	5 3 1
<u>Mountains</u>	<u>Piedmont</u>									
≥ 300 fish	≥ 150 fish									
200-299 fish	100-149 fish									
< 200 fish	< 100 fish									
3	No. of species of darters where Y is the number of species of darters in the sample and X is the stream's drainage area in mi ² . Y ≥ 1.6*Log ₁₀ X 0.8*Log ₁₀ X ≤ Y < 1.6*Log ₁₀ X Y < 0.8*Log ₁₀ X If the drainage area is > 70 mi ² , then ≥ 3 species = 5, 2 species = 3, and 0 or 1 species = 1	5 3 1								
4	No. of species of sunfish, bass, and trout ≥ 3 species 2 species 0 or 1 species	5 3 1								
5	No. of species of suckers ≥ 2 species 1 species 0 species	5 3 1								
6	No. of intolerant species <table><tr><td><u>Mountains</u></td><td><u>Piedmont</u></td></tr><tr><td>≥ 3 species</td><td>≥ 1 species</td></tr><tr><td>1 or 2 species</td><td>(no middle criteria or score)</td></tr><tr><td>0 species</td><td>0 species</td></tr></table>	<u>Mountains</u>	<u>Piedmont</u>	≥ 3 species	≥ 1 species	1 or 2 species	(no middle criteria or score)	0 species	0 species	5 3 1
<u>Mountains</u>	<u>Piedmont</u>									
≥ 3 species	≥ 1 species									
1 or 2 species	(no middle criteria or score)									
0 species	0 species									
7	Percentage of tolerant individuals <table><tr><td><u>Mountains</u></td><td><u>Piedmont</u></td></tr><tr><td>≤ 12%</td><td>≤ 25%</td></tr><tr><td>13-25%</td><td>26-35%</td></tr><tr><td>> 25%</td><td>> 35%</td></tr></table>	<u>Mountains</u>	<u>Piedmont</u>	≤ 12%	≤ 25%	13-25%	26-35%	> 25%	> 35%	5 3 1
<u>Mountains</u>	<u>Piedmont</u>									
≤ 12%	≤ 25%									
13-25%	26-35%									
> 25%	> 35%									
8	Percentage of omnivorous + herbivorous individuals 10-35% 36-50% > 50% < 10%	5 3 1 1								
9	Percentage of insectivorous individuals 60-90% 45-59% < 45% > 90%	5 3 1 1								
10	Percentage of piscivorous individuals ≥ 1.0% 0.25-1.0% < 0.24%	5 3 1								
11	Percentage of diseased fish (DELT = diseased, fin erosion, lesions, and tumors) < 0.75% 0.76-1.25% > 1.25%	5 3 1								
12	Percentage of species with multiple age groups <table><tr><td><u>Mountains</u></td><td><u>Piedmont</u></td></tr><tr><td>≥ 65% of all species have multiple age groups</td><td>≥ 55% of all species have multiple age groups</td></tr><tr><td>45-64% all species have multiple age groups</td><td>35-54% all species have multiple age groups</td></tr><tr><td>< 45% all species have multiple age groups</td><td>< 35% all species have multiple age groups</td></tr></table>	<u>Mountains</u>	<u>Piedmont</u>	≥ 65% of all species have multiple age groups	≥ 55% of all species have multiple age groups	45-64% all species have multiple age groups	35-54% all species have multiple age groups	< 45% all species have multiple age groups	< 35% all species have multiple age groups	5 3 1
<u>Mountains</u>	<u>Piedmont</u>									
≥ 65% of all species have multiple age groups	≥ 55% of all species have multiple age groups									
45-64% all species have multiple age groups	35-54% all species have multiple age groups									
< 45% all species have multiple age groups	< 35% all species have multiple age groups									

Table 4. Tolerance ratings and adult trophic guild assignments for fish in the Yadkin River basin. Species collected in 2006 are highlighted in blue. Common and scientific names follow Nelson, *et al.* (2004), except for *Scartomyzon*.

Family/Species	Common Name	Tolerance Rating	Trophic Guild of Adults
Petromyzontidae	Lampreys		
<i>Petromyzon marinus</i>	Sea Lamprey	Intermediate	Parasitic
Acipenseridae	Sturgeons		
<i>Acipenser brevirostrum</i>	Shortnose Sturgeon	Intermediate	Insectivore
<i>A. oxyrinchus</i>	Atlantic Sturgeon	Intermediate	Insectivore
Lepisosteidae	Gars		
<i>Lepisosteus osseus</i>	Longnose Gar	Tolerant	Piscivore
Amiidae	Bowfins		
<i>Amia calva</i>	Bowfin	Tolerant	Piscivore
Anguillidae	Freshwater Eels		
<i>Anguilla rostrata</i>	American Eel	Intermediate	Piscivore
Clupeidae	Herrings and Shads		
<i>Alosa aestivalis</i>	Blueback Herring	Intermediate	Insectivore
<i>A. sapidissima</i>	American shad	Intermediate	Insectivore
<i>Dorosoma cepedianum</i>	Gizzard Shad	Intermediate	Omnivore
<i>D. petenense</i>	Threadfin Shad	Intermediate	Omnivore
Cyprinidae	Carp and Minnows		
<i>Campostoma anomalum</i>	Stoneroller	Intermediate	Herbivore
<i>Carassius auratus</i>	Goldfish	Tolerant	Omnivore
<i>Clinostomus funduloides</i>	Rosyside Dace	Intermediate	Insectivore
<i>Ctenopharyngodon idella</i>	Grass Carp	Tolerant	Herbivore
<i>Cyprinella analostana</i>	Satinfin Shiner	Tolerant	Insectivore
<i>C. chloristia</i>	Greenfin Shiner	Intermediate	Insectivore
<i>C. labrosa</i>	Thicklip Chub	Intolerant	Insectivore
<i>C. lutrensis</i>	Red Shiner	Tolerant	Insectivore
<i>C. nivea</i>	Whitefin Shiner	Intermediate	Insectivore
<i>C. pyrrhomelas</i>	Fieryblack Shiner	Intolerant	Insectivore
<i>C. sp. cf. zanema</i>	Thinlip Chub	Intolerant	Insectivore
<i>Cyprinus carpio</i>	Common Carp	Tolerant	Omnivore
<i>Hybognathus regius</i>	Silvery Minnow	Intermediate	Herbivore
<i>Hybopsis hypsinotus</i>	Highback Chub	Intolerant	Insectivore
<i>Luxilus coccogenis</i>	Warpaint Shiner	Intermediate	Insectivore
<i>Lythrurus ardens</i>	Rosefin Shiner	Intermediate	Insectivore
<i>Nocomis leptoccephalus</i>	Bluehead Chub	Intermediate	Omnivore
<i>Notemigonus crysoleucas</i>	Golden Shiner	Tolerant	Omnivore
<i>Notropis alborus</i>	Whitemouth Shiner	Intermediate	Insectivore
<i>N. altipinnis</i>	Highfin Shiner	Intermediate	Insectivore
<i>N. amoenus</i>	Comely Shiner	Intermediate	Insectivore
<i>N. chiliticus</i>	Redlip Shiner	Intermediate	Insectivore
<i>N. cummingsae</i>	Dusky Shiner	Intermediate	Insectivore
<i>N. hudsonius</i>	Spottail Shiner	Intermediate	Omnivore
<i>N. maculatus</i>	Taillight Shiner	Intolerant	Insectivore
<i>N. petersoni</i>	Coastal Shiner	Intermediate	Insectivore
<i>N. procne</i>	Swallowtail Shiner	Intermediate	Insectivore
<i>N. scepcticus</i>	Sandbar Shiner	Intermediate	Insectivore
<i>Phoxinus oreas</i>	Mountain Redbelly Dace	Intermediate	Herbivore
<i>Pimephales promelas</i>	Fathead Minnow	Tolerant	Omnivore
<i>Rhinichthys obtusus</i>	Western Blacknose Dace	Intermediate	Insectivore
<i>Semotilus atromaculatus</i>	Creek Chub	Tolerant	Insectivore
<i>S. lumbee</i>	Sandhills Chub	Intolerant	Insectivore
Catostomidae	Suckers		
<i>Carpionodes sp. cf. cyprinus</i>	(no common name)	Intermediate	Omnivore
<i>C. sp. cf. velifer</i>	(no common name)	Intermediate	Insectivore
<i>Catostomus commersonii</i>	White Sucker	Tolerant	Omnivore
<i>Erimyzon oblongus</i>	Creek Chubsucker	Intermediate	Omnivore
<i>Hypentelium nigricans</i>	Northern Hogsucker	Intermediate	Insectivore
<i>Ictiobus bubalus</i>	Smallmouth Buffalo	Intermediate	Omnivore
<i>I. cyprinellus</i>	Bigmouth Buffalo	Intermediate	Insectivore
<i>Minytrema melanops</i>	Spotted Sucker	Intermediate	Insectivore
<i>Moxostoma collapsum</i>	Notchlip Redhorse	Intermediate	Insectivore
<i>M. macrolepidotum</i>	Shorthead Redhorse	Intermediate	Insectivore
<i>M. pappilosum</i>	V-Lip Redhorse	Intermediate	Insectivore
<i>M. robustum</i>	Robust Redhorse	Intolerant	Insectivore
<i>M. sp. cf. erythrurum</i>	Carolina Redhorse	Intolerant	Insectivore

Table 4 (continued).

Family/Species	Common Name	Tolerance Rating	Trophic Guild of Adults
<i>Scartomyzon rupiscartes</i>	Striped Jumprock	Intermediate	Insectivore
<i>S. sp. cf. lachneri</i>	Brassy Jumprock	Intermediate	Insectivore
Ictaluridae	North American Catfishes		
<i>Ameiurus brunneus</i>	Snail Bullhead	Intermediate	Insectivore
<i>A. catus</i>	White Catfish	Tolerant	Omnivore
<i>A. melas</i>	Black Bullhead	Tolerant	Insectivore
<i>A. natalis</i>	Yellow Bullhead	Tolerant	Omnivore
<i>A. nebulosus</i>	Brown Bullhead	Tolerant	Omnivore
<i>A. platycephalus</i>	Flat Bullhead	Tolerant	Insectivore
<i>Ictalurus furcatus</i>	Blue Catfish	Intermediate	Piscivore
<i>I. punctatus</i>	Channel Catfish	Intermediate	Omnivore
<i>Noturus gyrinus</i>	Tadpole Madtom	Intermediate	Insectivore
<i>N. insignis</i>	Margined Madtom	Intermediate	Insectivore
<i>Pylodictis olivaris</i>	Flathead Catfish	Intermediate	Piscivore
Esocidae	Pikes		
<i>Esox americanus</i>	Redfin Pickerel	Intermediate	Piscivore
<i>E. niger</i>	Chain Pickerel	Intermediate	Piscivore
Umbridae	Mudminnows		
<i>Umbra pygmaea</i>	Eastern Mudminnow	Intermediate	Insectivore
Salmonidae	Trouts and Salmon		
<i>Oncorhynchus mykiss</i>	Rainbow Trout	Intolerant	Insectivore
<i>Salmo trutta</i>	Brown Trout	Intermediate	Piscivore
<i>Salvelinus fontinalis</i>	Brook Trout	Intolerant	Insectivore
Aphredoderidae	Pirate Perches		
<i>Aphredoderus sayanus</i>	Pirate Perch	Intermediate	Insectivore
Atherinopsidae	New World Silversides		
<i>Labidesthes sicculus</i>	Brook Silverside	Intermediate	Insectivore
Fundulidae	Topminnows		
<i>Fundulus lineolatus</i>	Lined Topminnow	Intermediate	Insectivore
<i>F. rathbuni</i>	Speckled Killifish	Intermediate	Insectivore
Poeciliidae	Livebearers		
<i>Gambusia holbrooki</i>	Eastern Mosquitofish	Tolerant	Insectivore
Moronidae	Temperate Basses		
<i>Morone americana</i>	White Perch	Intermediate	Piscivore
<i>M. chrysops</i>	White Bass	Intermediate	Piscivore
<i>M. saxatilis</i>	Striped Bass	Intermediate	Piscivore
Centrarchidae	Sunfishes		
<i>Acantharchus pomotis</i>	Mud Sunfish	Intermediate	Insectivore
<i>Ambloplites cavifrons</i>	Roanoke Bass	Intermediate	Piscivore
<i>A. rupestris</i>	Rock Bass	Intolerant	Piscivore
<i>Centrarchus macropterus</i>	Flier	Intermediate	Insectivore
<i>Enneacanthus chaetodon</i>	Blackbanded Sunfish	Intermediate	Insectivore
<i>E. gloriosus</i>	Bluespotted Sunfish	Intermediate	Insectivore
<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>L. marginatus</i>	Dollar Sunfish	Intermediate	Insectivore
<i>L. microlophus</i>	Redear Sunfish	Intermediate	Insectivore
<i>L. punctatus</i>	Spotted Sunfish	Intermediate	Insectivore
<i>Lepomis sp.</i>	Hybrid Sunfish	Tolerant	Insectivore
<i>Micropterus dolomieu</i>	Smallmouth Bass	Intolerant	Piscivore
<i>M. punctulatus</i>	Spotted bass	Intermediate	Piscivore
<i>M. salmoides</i>	Largemouth Bass	Intermediate	Piscivore
<i>Pomoxis annularis</i>	White Crappie	Intermediate	Piscivore
<i>P. nigromaculatus</i>	Black Crappie	Intermediate	Piscivore
Percidae	Darters and Perches		
<i>Etheostoma collis</i>	Carolina Darter	Intermediate	Insectivore
<i>E. flabellare</i>	Fantail Darter	Intermediate	Insectivore
<i>E. fusiforme</i>	Swamp Darter	Intermediate	Insectivore
<i>E. olmstedii</i>	Tessellated Darter	Intermediate	Insectivore
<i>E. serrifer</i>	Sawcheek Darter	Intolerant	Insectivore
<i>Perca flavescens</i>	Yellow Perch	Intermediate	Piscivore
<i>Percina crassa</i>	Piedmont Darter	Intolerant	Insectivore
<i>Sander vitreus</i>	Walleye	Intermediate	Piscivore

Table 5. Revised scores and classes for evaluating the fish community of a wadeable stream using the North Carolina Index of Biotic Integrity in the Inner Piedmont, Foothills, and Eastern Mountains of the Broad, Catawba, Savannah, and Yadkin River basins.

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

Criteria and ratings applicable only to wadeable streams in the mountain and piedmont regions of the Yadkin River basin are the same as those for the Broad, Catawba, and Savannah River basins (Tables 3 and 5). The definition of mountain and piedmont for these four river basins is based on a map of North Carolina watersheds by Fels (1997). Metrics and ratings should not be applied to non-wadeable streams nor to small, wadeable Southern Appalachian type trout streams in each of these basins. General characteristics of Southern Appalachian type trout streams include gradient (high), 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 (will vary from basin to basin), and stream order (1st – 3rd). These streams, along with streams draining the Sandhills ecoregion in the southeast corner of the Yadkin River basin, 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. Although heavy, acute infections can be fatal, especially to small fish, 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).

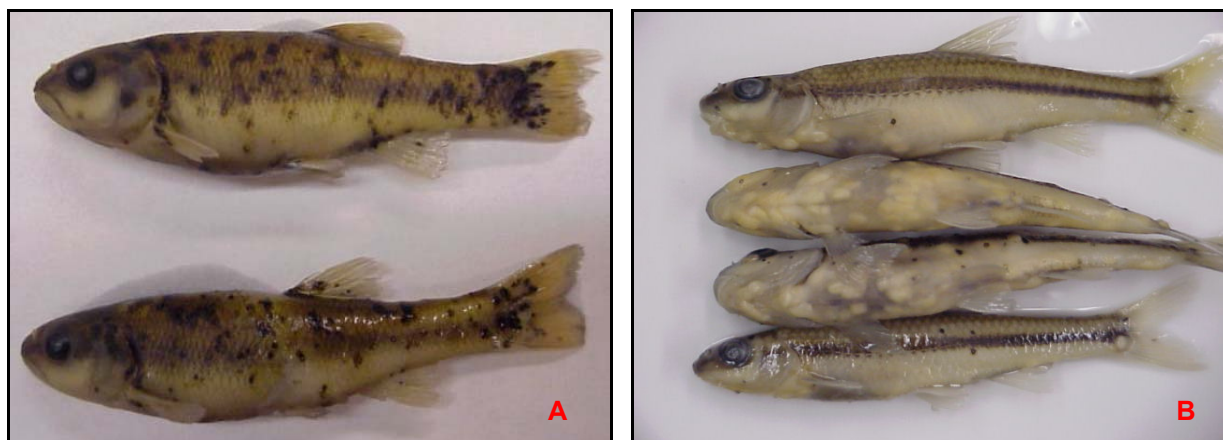


Figure 1. Heavy infestation of blackspot disease in creek chub (A) and yellow grub in bigeye chub (B).

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.

Monitoring efforts from 2002 to 2006 can be summarized as:

- From April – August 2006, 83 sites were sampled as part of the Yadkin River basinwide monitoring cycle.
- Twenty-two of the 83 sites had not been previously sampled. Some of these sites were in rural watersheds where there were no NPDES dischargers and were selected as potential candidates for fish community regional reference sites (e.g. Stony Fork, Mulberry Creek, and Big Bugaboo Creek). Only the Ararat River and Mill Creek possessed the instream, riparian, and watershed characteristics of exceptionally high quality to qualify the sites as new fish community regional reference sites (Appendices F-1 and F-6).
- The remaining 61 sites had been sampled during the last basinwide cycle in 2001, during the first basinwide cycle in 1996, or as part of special studies conducted in 1998 and 1999 (Appendix F-3).
- Six sites were scheduled to be sampled in 2006, but were not:
 - Yadkin River HUC -- Flat Swamp, NC 47, Davidson County (insufficient time).
 - Lake Tillery-Pee Dee River HUC -- Dumas Creek, SR 1310, Montgomery County (insufficient time), Savannah Creek, SR 1704, Anson County (no flow), and Goulds Fork, SR 1652, Anson County (no flow and beaver dams).
 - Pee Dee River HUC -- Hitchcock Creek, SR 1109, Richmond County (too big and too much flow) and Solomons Creek, SR 1103, Richmond County (deep, no flow, and beaver dams).
- Fifteen streams sampled in 2006 were on the 2004 impaired waters list (NCDENR 2005):
 - Yadkin River (from source to mouth in W. Kerr Scott Reservoir)
 - Lovills Creek (from Town of Mount Airy Water Supply Dam to Ararat River)
 - Town Creek (from source to Crane Creek)
 - Third Creek (from SR 2359 to SR 1970)
 - North Second Creek (from source to South Yadkin River)
 - Rich Fork (from source to Abbotts Creek)
 - Hamby Creek (from source to Rich Fork)
 - Lick Creek (from East Branch Lick Creek to Tuckertown Lake)
 - Clarke Creek (from source to Rocky River)
 - Rocky River (from source to mouth of Reedy Creek)
 - Crooked Creek (from source to Rocky River)
 - Irish Buffalo Creek (from Kannapolis Water Supply Dam to Rocky River)
 - Lanes Creek (from source to Marshville Water Supply Dam)
 - Hitchcock Creek (from source to a point 0.5 miles downstream of Richmond County SR 1442)
 - Marks Creek (from NC 177 Richmond County to NC-SC state line).
- From 2002 to 2006, 28 sites were sampled as part of special studies (Appendix F-3):
 - 1 site (Yadkin River) sampled in 2006 as part of a water supply classification study.
 - 19 sites sampled in 2004 as part of a larger study on the impact of urbanization on aquatic communities in the Piedmont of North Carolina.
 - 3 sites sampled in 2004 in the Mountain Creek watershed (Stanly County) for the Ecosystems Enhancement Program.
 - 4 sites sampled in the Fourth Creek watershed (Iredell and Rowan counties) for the development of a Total Maximum Daily Load model.
 - 1 site (Silas Creek) sampled in 2002 as verification of 2001 basinwide results.
- The drainage areas of the assessed watersheds in 2006 ranged from 4.5 to 96.6 square miles (Appendix F-4).
- The most widely distributed species were the Redbreast Sunfish, Bluehead Chub, and Tessellated Darter. The numerically most abundant species were the Bluehead Chub, Redlip Shiner, and Redbreast Sunfish (Appendix F-5).

- Several intolerant species are absent or have restricted distributions in the small streams in the Southern Outer Piedmont and in the very low flow, small streams that drain the Carolina Slate Belt:
 - Highback Chub is absent in Davidson, Union, and Anson counties;
 - Fieryblack Shiner is absent in Davie, Davidson, Cabarrus, Stanly, Union, and Anson counties; and
 - Piedmont Darter is absent in Davie, Rowan, Davidson, Union, and Anson (Brown and Lanes creeks) counties.
- All Mountain and Piedmont streams (n = 78) 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 26 to 60 and the NCIBI ratings ranged from Poor to Excellent (Figures 1 and 2); 63 of the 78 sites were rated Good-Fair or better. The Ararat River and Mill Creek, new regional fish community reference sites, rated Excellent.

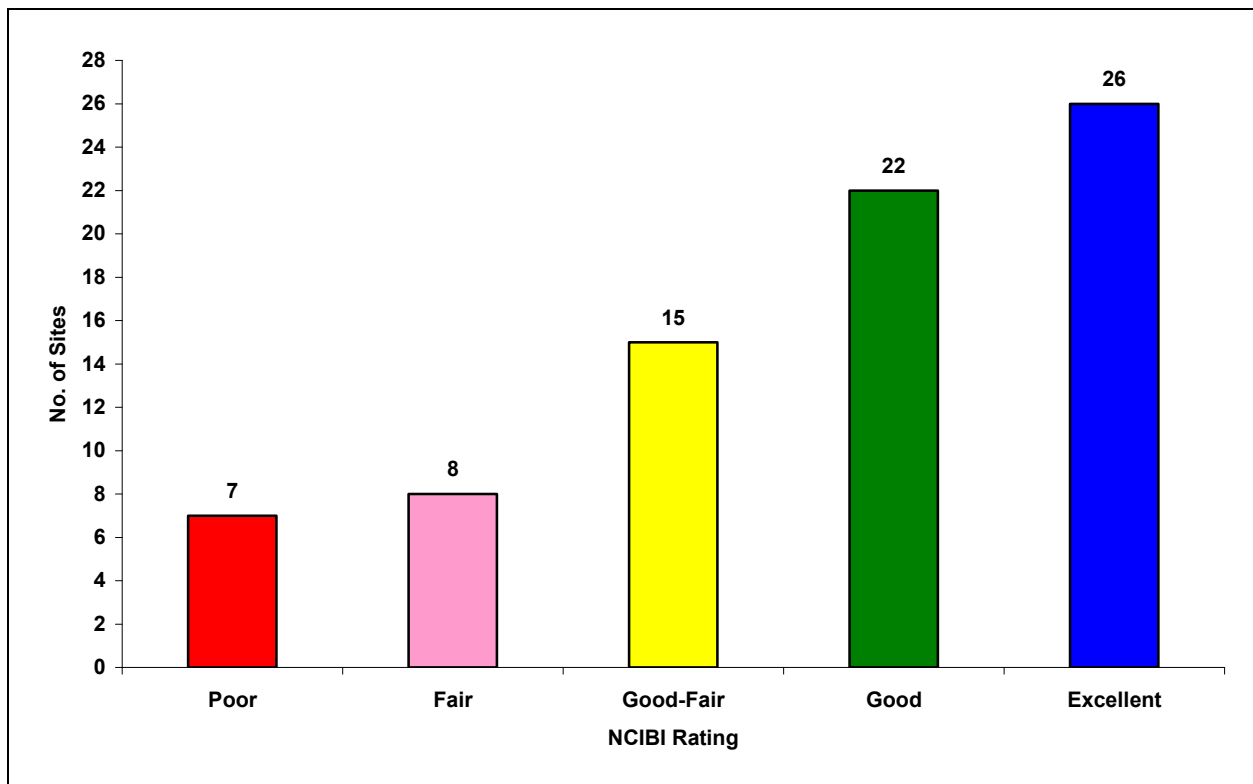


Figure 1. Distribution of the ratings of 78 fish community basinwide sites in the Mountains and Piedmont regions of the Yadkin River basin, 2006.

- Nine sites may qualify as new High Quality Waters, if so petitioned. These sites were North Prong Lewis Fork, Middle Prong Roaring River, Little Yadkin River, Stewarts Creeks, Toms Creek, Uwharrie River, Island Creek, Clarks Creek, and Cheek Creek.
- Sites rated Excellent or Good were generally found in the upper part of the basin (Yadkin River Headwaters HUC) or in the Carolina Slate Belt region in the Uwharrie National Forest area (Lake Tillery-Pee Dee River HUC) (Figure 2).
- Sites rated Good-Fair, Fair, or Poor were found in areas receiving nonpoint source runoff from urban/suburban or agricultural areas or below wastewater treatment plants.

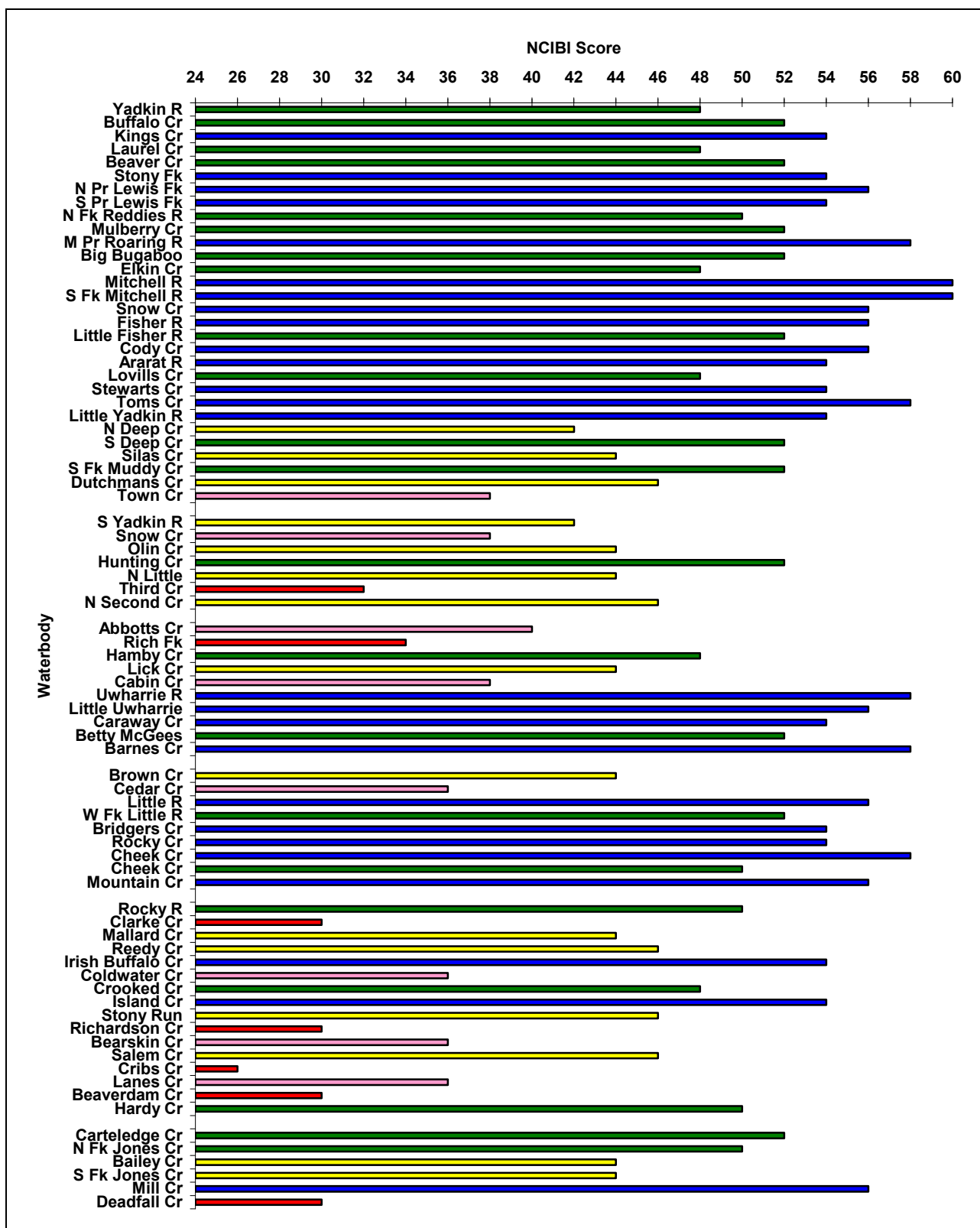


Figure 2. NCIBI scores and ratings of 78 fish community basinwide sites in the Mountains and Piedmont region of the Yadkin River basin, 2006. Blue = Excellent, Green = Good, Yellow = Good-Fair, Rose = Fair, and Red = Poor sites

- Some sites rated Good-Fair, Fair, or Poor were found in areas in the Carolina Slate Belt ecoregion (e.g., Deadfall Creek in Pee Dee River HUC and in the Rocky River HUC at Richardson, Bearskin, Cribs, Lanes, and Beaverdam creeks) where the stream flow becomes very low or non-existent during low flow and prolonged droughts (e.g. the 1998 – 2002 drought) (Figure 2). The fewer number of fish and lowered diversity, along with the loss of age classes, were usually noted. The Green Sunfish, a tolerant, introduced species, was often abundant. The instream and riparian habitats at these sites was usually of moderate quality, although there were losses of deep water, root mats, and riffle habitats. The water was clear, but filamentous algae and periphyton were often abundant. **Note: The NCIBI ratings were naturally low and not the result of degraded water quality. Such ratings should not be used in Use Support assessments by the Division of Water Quality. For Use Support determinations, those streams rated Fair or Poor because of low flow conditions (refer to the site-specific write-ups for more details) should be classified as “Not Rated”. To ensure that these streams are not used for use support, the fish community database was changed to Not Rated for the above six sites in March 2007.**
- Thirty-four of the 83 sites had been sampled more than once, either in the previous two basinwide monitoring cycles or as special studies (Figure 3). Of these 34 sites, 19 sites had no appreciable change in their score or NCIBI rating; 8 sites had scores or ratings that increased; and 7 sites had scores or ratings that decreased over the 10 year period. The improvements in scores and ratings were most pronounced at the Mitchell River site where Clean Water Management Trust Fund monies have been spent on watershed improvement projects and at the Rocky River site where an upstream wastewater treatment plant discharge contains the effluent from fewer textile mills than in years past. The most pronounced declines were noted at the Coldwater Creek and Mallard Creek sites which are located in increasingly urban areas.
- The instream and riparian habitat assessment scores at the 83 sites ranged from 37 to 97 (Appendix F-6). Fish communities rated Excellent or Good were found where the habitats were of moderate to high quality; communities rated Good-Fair, Fair, or Poor were found where the habitats were of lower quality.
- Dissolved oxygen concentrations were less than the water quality standard of 5 mg/L at 3 of the 83 sites (Clarke Creek, Richardson Creek, and Beaverdam Creek (Union County)).
- Specific conductance ranged from 18 $\mu\text{S}/\text{cm}$ at Hitchcock Creek (a Sand Hills stream) to 473 $\mu\text{S}/\text{cm}$ at Crooked Creek (in the Carolina Slate Belt and below a wastewater treatment plant). Elevated readings were associated with dischargers from upstream wastewater treatment plants or from nonpoint sources in urban areas. Conductivity was generally lower in streams draining more forested watersheds in the Yadkin River Headwaters HUC and in the Sand Hills ecoregion and greater in streams draining more agricultural and developed watersheds.
- The pH was less than 6.0 s.u. at 18 of the 83 sites; four of these sites were in the Sand Hills ecoregion and have naturally low pH measurements.

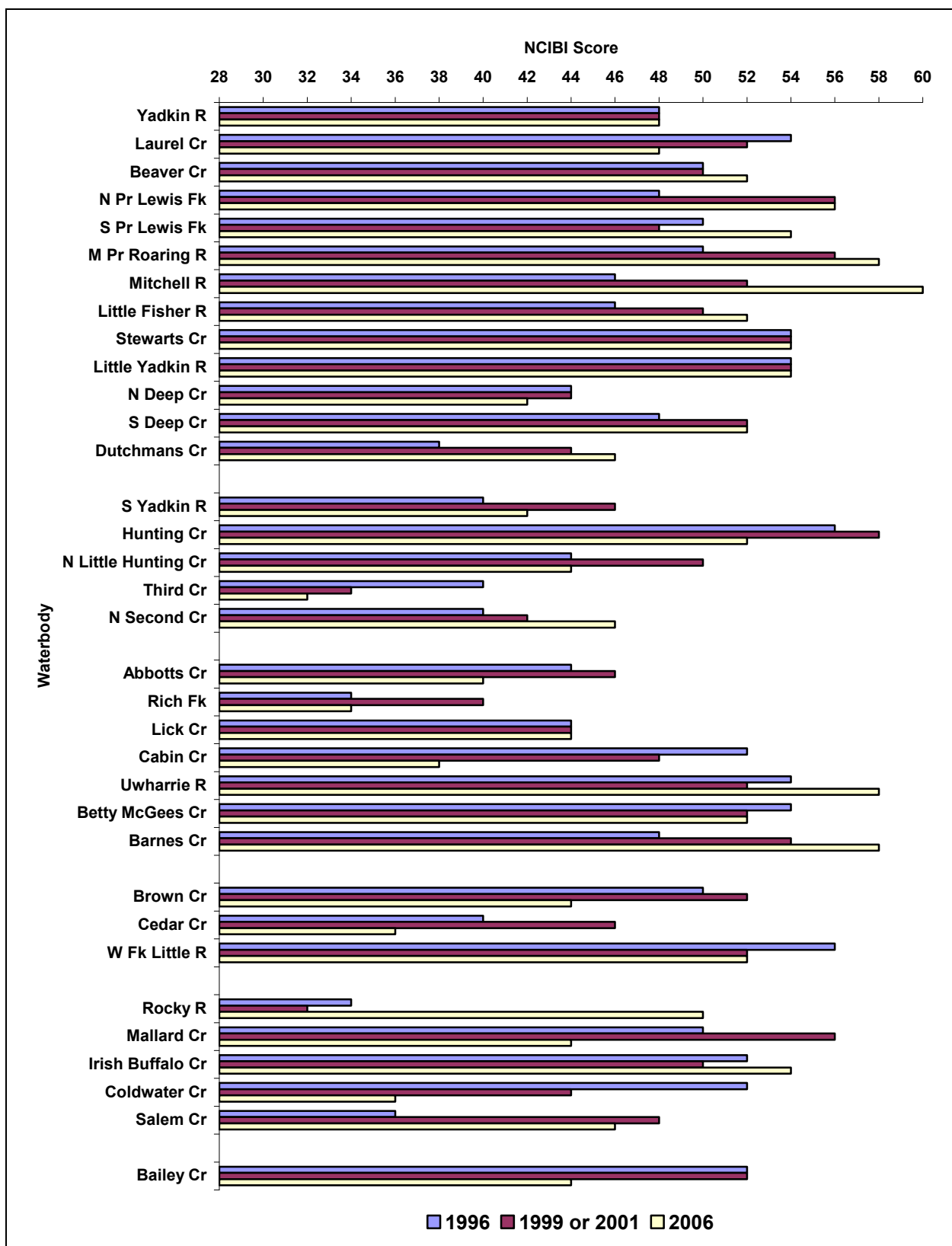


Figure 3. NCIBI scores and ratings of 34 repeat fish community sites in the Yadkin River basin, 1996 - 2006.

Appendix F-3. Fish community data collected from the Yadkin River basin, 1992 – 2006.
Basinwide sites sampled in 2006 are in bold font.

HUC/Waterbody	Station	County	Index No.	Date	NCIBI Score	NCIBI Rating
03040101 Yadkin River Headwaters						
Yadkin R	off SR 1372	Caldwell	12-(1)	08/02/06	---	Not Rated
Yadkin R	NC 268	Caldwell	12-(1)	08/02/06	48	Good
				06/18/01	48	Good
				05/23/96	48	Good
Dennis Cr	SR 1372	Caldwell	12-7	05/23/96	---	Not Rated
Buffalo Cr	SR 1594	Caldwell	12-19	08/03/06	52	Good
				06/08/99	56	Excellent
Kings Cr	SR 1552	Caldwell	12-23	06/23/06	54	Excellent
Laurel Cr	SR 1508	Watauga	12-24-8	08/03/06	48	Good
				05/05/99	52	Good
				10/01/98	54	Excellent
				05/23/96	54	Excellent
Beaver Cr	SR 1131	Wilkes	12-25	06/22/06	52	Good
				06/18/01	50	Good
				05/21/96	50	Good
Stony Fk	SR 1170	Wilkes	12-26-(7)	06/23/06	54	Excellent
N Pr Lewis Fk	SR 1304	Wilkes	12-31-1-(7.5)	08/03/06	56	Excellent
				06/19/01	56	Excellent
				05/21/96	48	Good
S Pr Lewis Fk	SR 1154	Wilkes	12-31-2-(7)	08/04/06	54	Excellent
				06/19/01	48	Good
				05/21/96	50	Good
M Fk Reddies R	SR 1562	Wilkes	12-40-2	05/06/99	58	Excellent
N Fk Reddies R	SR 1501	Wilkes	12-40-4	05/05/99	50	Good
				05/22/96	52	Good
N Fk Reddies R	SR 1567	Wilkes	12-40-4	08/04/06	50	Good
				06/19/01	56	Excellent
				05/05/99	58	Excellent
Cub Cr	SR 1001	Wilkes	12-41	06/18/01	46	Good-Fair
Mulberry Cr	SR 1002	Wilkes	12-42	06/23/06	52	Good
M Pr Roaring R	SR 1002	Wilkes	12-46-2-(6)	08/04/06	58	Excellent
				06/20/01	56	Excellent
				05/22/96	50	Good
Basin Cr	SR 1730	Wilkes	12-46-2-2	05/22/96	58	Excellent
E Pr Roaring R	SR 1739	Wilkes	12-46-4-(1)	10/21/98	52	Good
E Pr Roaring R	SR 1739	Wilkes	12-46-4-(5)	10/20/98	58	Excellent
E Pr Roaring R	SR 1739	Wilkes	12-46-4-(5)	10/20/98	54	Excellent
Garden Cr	SR 1739	Wilkes	12-46-4-6	05/22/96	54	Excellent
Big Bugaboo Cr	SR 1924	Wilkes	12-48-(0.7)	06/22/06	52	Good
Elkin Cr	SR 2044	Wilkes	12-54-(0.5)	06/22/06	48	Good
Mitchell R	SR 1330	Surry	12-62-(1)	06/21/06	60	Excellent
				05/26/99	52	Good
				05/16/96	46	Good-Fair
S Fk Mitchell R	SR 1301	Surry	12-62-13	06/21/06	60	Excellent
Snow Cr	SR 1121	Surry	12-62-15	06/07/06	56	Excellent
Fisher R	SR 1331	Surry	12-63-(1)	06/21/06	56	Excellent
				06/20/01	60	Excellent
Little Fisher R	SR 1480	Surry	12-63-10-(2)	06/20/06	52	Good
				06/20/01	50	Good
				05/16/96	46	Good-Fair
Cody Cr	US 268	Surry	12-63-14	06/07/06	56	Excellent
				05/16/96	52	Good
Ararat R	NC 104	Surry	12-72-(1)	06/20/06	54	Excellent
Lovills Cr	SR 1371	Surry	12-72-8-(3)	06/19/06	48	Good
Stewarts Cr	SR 1622	Surry	12-72-9-1	06/20/06	54	Excellent
				06/21/01	54	Excellent
				05/17/96	54	Excellent
Toms Cr	SR 2024	Surry	12-72-14-(4)	06/19/06	58	Excellent
				06/21/01	56	Excellent
Little Yadkin R	SR 1236	Stokes	12-77-(1)	06/19/06	54	Excellent
				06/21/01	54	Excellent
				05/17/96	54	Excellent

Appendix F-3 (continued).

HUC/Waterbody	Station	County	Index No.	Date	NCIBI Score	NCIBI Rating
03040101 Yadkin River Headwaters						
N Deep Cr	SR 1605	Yadkin	12-84-1-(0.5)	06/07/06	42	Good-Fair
				06/21/01	44	Good-Fair
				05/15/96	44	Good-Fair
S Deep Cr	SR 1152	Yadkin	12-84-2-(1)	06/06/06	52	Good
				06/22/01	52	Good
				05/15/96	48	Good
Muddy Cr	off SR 1632	Forsyth	12-94-(0.5)	07/07/04	58	Excellent
Muddy Cr	SR 1891	Forsyth	12-94-(0.5)	04/30/01	38	Fair
				05/14/96	34	Poor
Silas Cr	SR 1137	Forsyth	12-94-10	06/05/06	44	Good-Fair
				04/24/02	44	Good-Fair
				04/30/01	40	Fair
Salem Cr	SR 2902	Forsyth	12-94-12-(4)	07/07/04	42	Good-Fair
Salem Cr	off SR 1120	Forsyth	12-94-12-(4)	04/30/01	30	Poor
S Fk Muddy Cr	SR 2902	Forsyth	12-94-13	06/05/06	52	Good
				04/30/01	42	Good-Fair
Dutchmans Cr	US 158	Davie	12-102-(2)	06/05/06	46	Good-Fair
				05/04/01	44	Good-Fair
				05/13/96	38	Fair
Cedar Cr	SR 1437	Davie	12-102-13-(2)	05/04/01	50	Good
				05/13/96	46	Good-Fair
Cedar Cr	off SR 1410	Davie	12-102-13-(2)	07/26/04	40	Fair
03040102 South Yadkin River						
S Yadkin R	SR 1561	Iredell	12-108-(5.5)	06/06/06	42	Good-Fair
				05/03/01	46	Good-Fair
				05/14/96	40	Fair
Snow Cr	SR 1905	Iredell	12-108-9-(0.6)	06/06/06	38	Fair
Rocky Cr	SR 1890	Iredell	12-108-11	07/26/04	54	Excellent
Patterson Cr	SR 1890	Iredell	12-108-11-3	07/09/04	52	Good
Olin Cr	SR 1892	Iredell	12-108-11-3-3	06/05/06	44	Good-Fair
				05/14/96	36	Fair
Hunting Cr	NC 115	Wilkes	12-108-16-(0.5)	06/22/06	52	Good
				05/03/01	58	Excellent
				05/15/96	56	Excellent
				06/16/92	52	Good
Hunting Cr	SR 2423	Wilkes	12-108-16-(0.5)	06/16/92	46	Good-Fair
N Little Hunting Cr	SR 1829	Iredell	12-108-16-6	06/06/06	44	Good-Fair
				05/03/01	50	Good
				05/14/96	44	Good-Fair
Bear Cr	SR 1116	Davie	12-108-18-(1)	07/09/04	40	Fair
Fourth Cr	SR 1930	Iredell	12-108-20	07/30/03	32	Poor
Fourth Cr	SR 2320	Iredell	12-108-20	07/29/03	42	Good-Fair
Fourth Cr	SR 2308	Iredell	12-108-20	07/29/03	32	Poor
Fourth Cr	SR 1985	Rowan	12-108-20	07/29/03	34	Poor
				06/03/03	26	Poor
				05/02/01	28	Poor
				04/26/96	32	Poor
Third Cr	SR 1970	Rowan	12-108-20-4	05/11/06	32	Poor
				05/02/01	34	Poor
				04/25/96	40	Fair
N Second Cr	SR 1526	Rowan	12-108-21	05/11/06	46	Good-Fair
				05/02/01	42	Good-Fair
				04/25/96	40	Fair
03040103 Yadkin River						
Grants Cr	SR 1506	Rowan	12-110	07/08/04	42	Good-Fair
Grants Cr	SR 2200	Rowan	12-110	05/02/01	42	Good-Fair
Grants Cr	SR 1910	Rowan	12-110	07/08/04	48	Good
Swearing Cr	SR 1104	Davidson	12-113	07/08/04	40	Fair
Town Cr	SR 1526	Rowan	12-115-3	04/25/96	40	Fair
Town Cr	off SR 2118	Rowan	12-115-3	05/11/06	38	Fair
Second Cr	SR 2338	Rowan	12-117-2	07/26/04	42	Good-Fair

Appendix F-3 (continued).

HUC/Waterbody	Station	County	Index No.	Date	NCIBI Score	NCIBI Rating				
03040103 Yadkin River										
Abbotts Cr	SR 1800	Davidson	12-119-(4.5)	05/10/06	40	Fair				
				05/01/01	46	Good-Fair				
				04/24/96	44	Good-Fair				
Rich Fk	NC 109	Davidson	12-119-7	05/10/06	34	Poor				
				05/01/01	40	Fair				
				04/25/96	34	Poor				
Hamby Cr	SR 2017	Davidson	12-119-7-4	05/10/06	48	Good				
				Lick Cr	NC 8	Davidson	12-126-3	05/10/06	44	Good-Fair
								04/19/01	44	Good-Fair
Cabin Cr	SR 2536	Davidson	12-127-(2)	04/23/96	44	Good-Fair				
				05/11/06	38	Fair				
				05/01/01	48	Good				
Uwharrie R	SR 1406	Randolph	13-2-(0.5)	04/24/96	52	Good				
				05/02/06	58	Excellent				
				10/26/99	52	Good				
Little Uwharrie R	SR 1405	Randolph	13-2-1	06/15/99	56	Excellent				
				04/14/99	58	Excellent				
				04/24/96	54	Excellent				
Caraway Cr	SR 1331	Randolph	13-2-3	05/02/06	56	Excellent				
				05/08/06	54	Excellent				
				Betty McGees Cr	SR 1107	Randolph	13-2-5	05/08/06	52	Good
Barnes Cr	SR 1303	Montgomery	13-2-18-(0.5)	04/16/01	52	Good				
				04/18/96	54	Excellent				
				05/09/06	58	Excellent				
Dutchmans Cr	SR 1150	Montgomery	13-2-24	04/16/01	54	Excellent				
				10/17/97	44	Good-Fair				
				04/22/96	48	Good				
03040104 Lake Tillery-Pee Dee River						Not Rated				
Mountain Cr	SR 1720	Stanly	13-5-(0.7)	04/22/96	---					
				03/22/04	50	Good				
				04/17/01	46	Good-Fair				
Little Mountain Cr	SR 1798	Stanly	13-5-1-(1)	04/18/96	50	Good				
				03/22/04	44	Good-Fair				
				Jacobs Cr	SR 1740	Stanly	13-9-2	03/22/04	50	Good
Clarks Cr	SR 1188	Montgomery	13-16	04/12/01	54	Excellent				
				SR 1110	Montgomery	13-16	06/24/04	54	Excellent	
				Brown Cr	SR 1230	Anson	13-20	04/12/06	44	Good-Fair
Cedar Cr	SR 1709	Anson	13-21	04/10/01	52	Good				
				04/16/96	50	Good				
				04/10/06	36	Fair				
Little R	SR 1135	Randolph	13-25-(1)	04/10/01	46	Good-Fair				
				06/10/96	40	Fair				
				04/13/99	52	Good				
Little R	SR 1127	Randolph	13-25-(1)	05/08/06	56	Excellent				
				04/14/99	52	Good				
				04/13/99	52	Good				
W Fk Little R	NC 134	Randolph	13-25-(1)	05/09/06	52	Good				
				SR 1311	Montgomery	13-25-15	05/09/06	52	Good	
				04/17/01	52	Good				
Densons Cr	SR 1323	Montgomery	13-25-20-(9)	04/23/96	56	Excellent				
				07/27/04	44	Good-Fair				
				Dumas Cr	SR 1310	Montgomery	13-25-20-8	04/16/01	54	Excellent
Bridgers Cr	SR 1519	Montgomery	13-25-24	04/26/06	54	Excellent				
				04/22/96	52	Good				
				04/23/96	42	Good-Fair				
Rocky Cr	NC 24/27	Montgomery	13-25-30-(0.3)	05/09/06	54	Excellent				
				SR 1549	Montgomery	13-25-30-(0.5)	05/09/06	54	Excellent	
				04/17/01	54	Excellent				
Rocky Cr	SR 1563	Montgomery	13-25-36	04/26/06	58	Excellent				
				10/26/99	56	Excellent				
				06/15/99	56	Excellent				
Cheek Cr	SR 1563	Montgomery	13-25-36	04/13/99	58	Excellent				
				09/21/98	58	Excellent				
				09/21/98	58	Excellent				

Appendix F-3 (continued).

HUC/Waterbody	Station	County	Index No.	Date	NCIBI Score	NCIBI Rating
03040104 Lake Tillery-Pee Dee River						
Cheek Cr	SR 1541	Montgomery	13-25-36	04/26/06	50	Good
				04/23/96	54	Excellent
Hamer Cr	SR 1159	Richmond	13-25-37	04/05/01	---	Not Rated
Mountain Cr	SR 1150	Richmond	13-28-(0.5)	04/25/06	56	Excellent
				04/15/96	52	Good
Big Mountain Cr	SR 1319	Richmond	13-28-1-(0.5)	09/22/98	56	Excellent
				10/27/99	46	Good-Fair
				06/15/99	52	Good
				04/12/99	54	Excellent
Big Mountain Cr	NC 73	Richmond	13-28-1-(0.5)	04/12/99	52	Good
Big Mountain Cr	SR 1005	Richmond	13-28-1-(0.5)	04/12/99	54	Excellent
03040105 Rocky River						
Rocky R	SR 1608	Cabarrus	13-17	05/12/06	50	Good
				04/14/99	32	Poor
				04/17/96	34	Poor
Clarke Cr	SR 1449	Cabarrus	13-17-4	07/18/06	30	Poor
Mallard Cr	SR 2467	Mecklenburg	13-17-5	07/18/06	44	Good-Fair
				04/19/01	56	Excellent
				06/10/96	50	Good
Mallard Cr	SR 1300	Cabarrus	13-17-5	07/16/04	46	Good-Fair
Coddle Cr	SR 1612	Cabarrus	13-17-6-(0.5)	07/23/04	32	Poor
Reedy Cr	SR 1136	Cabarrus	13-17-8	07/18/06	46	Good-Fair
				04/18/01	46	Good-Fair
Irish Buffalo Cr	SR 1132	Cabarrus	13-17-9-(2)	05/12/06	54	Excellent
				04/19/01	50	Good
				04/17/96	52	Good
Coldwater Cr	NC 73	Cabarrus	13-17-9-4-(1.5)	05/12/06	36	Fair
				04/18/01	44	Good-Fair
				04/17/96	52	Good
Dutch Buffalo Cr	SR 1006	Cabarrus	13-17-11-(1)	06/23/04	44	Good-Fair
Dutch Buffalo Cr	SR 2622	Cabarrus	13-17-11-(5)	04/18/01	52	Good
				04/17/96	44	Good-Fair
Dutch Buffalo Cr	NC 200	Cabarrus	13-17-11-(5)	07/16/04	42	Good-Fair
Clear Cr	SR 3181	Mecklenburg	13-17-17	06/23/04	54	Excellent
Crooked Cr	SR 1547	Union	13-17-20	07/19/06	48	Good
N Fk Crooked Cr	SR 1520	Union	13-17-20-1	10/03/95	50	Good
N Fk Crooked Cr	SR 1514	Union	13-17-20-1	10/03/95	46	Good-Fair
S Fk Crooked Cr	SR 1515	Union	13-17-20-2	10/03/95	42	Good-Fair
S Fk Crooked Cr	SR 1515	Union	13-17-20-2	10/03/95	38	Fair
Island Cr	SR 1118	Stanly	13-17-26	04/13/06	54	Excellent
				04/11/01	54	Excellent
Long Cr	off SR 1900	Stanly	13-17-31	06/24/04	50	Good
Big Bear Cr	NC 73	Stanly	13-17-31-5	04/18/01	48	Good
				04/18/96	52	Good
Big Bear Cr	SR 1134	Stanly	13-17-31-5	06/24/04	46	Good-Fair
Stony Run	SR 1970	Stanly	13-17-31-5-5	04/13/06	46	Good-Fair
Richardson Cr	NC 207	Union	13-17-36-(3.5)	07/19/06	30	Poor
				04/11/01	46	Good-Fair
Bearskin Cr	NC 200	Union	13-17-36-6	07/18/06	36	Fair
Salem Cr	SR 1006	Union	13-17-36-15	04/12/06	46	Good-Fair
				04/11/01	48	Good
				06/10/96	36	Fair
Cribs Cr	SR 1610	Anson	13-17-37	04/12/06	26	Poor
Lanes Cr	SR 1929	Union	13-17-40-(1)	04/12/06	36	Fair
				04/11/01	40	Fair
Lanes Cr	SR 1415	Anson	13-17-40-(12)	04/16/96	40	Fair
Beaverdam Cr	SR 1005	Union	13-17-40-11	07/19/06	30	Poor
Hardy Cr	SR 1934	Stanly	13-17-42	04/13/06	50	Good

Appendix F-3 (continued).

HUC/Waterbody	Station	County	Index No.	Date	NCIBI Score	NCIBI Rating
03040201 Pee Dee River						
Cartledge Cr	SR 1142	Richmond	13-35	04/10/06	52	Good
				04/06/01	50	Good
Hitchcock Cr	SR 1486	Richmond	13-39-(1)	04/24/06	---	Not Rated
				04/05/01	---	Not Rated
Chock Cr	SR 1475	Richmond	13-39-6	04/25/06	---	Not Rated
Rocky Fork Cr	SR 1487	Richmond	13-39-8	08/21/90	---	Not Rated
Rocky Fork Cr	SR 1424	Richmond	13-39-8	04/24/06	---	Not Rated
				04/05/01	---	Not Rated
Beaverdam Cr	SR 1486	Richmond	13-39-8-7	04/24/06	---	Not Rated
				04/15/96	---	Not Rated
Jones Cr	SR 1812	Anson	13-42	04/16/96	34	Poor
N Fk Jones Cr	SR 1121	Anson	13-42-1-0.5	04/11/06	50	Good
Bailey Cr	SR 1811	Anson	13-42-1-3	04/10/06	44	Good-Fair
				04/06/01	52	Good
				04/15/96	52	Good
S Fk Jones Cr	SR 1821	Anson	13-42-2	04/11/06	44	Good-Fair
				04/10/01	54	Excellent
Mill Cr	SR 1826	Anson	13-43	04/11/06	56	Excellent
Marks Cr	SR 1104	Richmond	13-45-(2)	04/25/06	---	Not Rated
				04/06/01	---	Not Rated
Deadfall Cr	SR 1109	Anson	13-47-2	04/11/06	30	Poor

Appendix F-4. Fish community metric values from 83 Wadeable streams in the Yadkin River basinwide monitoring program, 2006¹

HUC	Waterbody	Location	County	d. a. (mi ²)	Date	No. Species	No. Fish	No. Sp. Darters	No. Sp. SBT	No. Sp. Suckers	No. Intol. Sp.	% Tolerant	% Omni. +Herb.	% Insect.	% Pisc.	% DELT	% MA
03040101 Yadkin River Headwaters																	
	Yadkin R	NC 268	Caldwell	85.2	08/02/06	22	284	3	1	3	4	5	38	62	0.00	0.00	68
	Buffalo Cr	SR 1594	Caldwell	29.8	08/03/06	13	330	2	3	1	2	1	28	70	2.12	0.00	77
	Kings Cr	SR 1552	Caldwell	27.6	06/23/06	21	599	3	4	3	2	8	47	53	0.33	0.00	62
	Laurel Cr	SR 1508	Watauga	7.8	08/03/06	13	128	1	4	1	2	11	31	54	14.84	0.00	77
	Beaver Cr	SR 1131	Wilkes	17.4	06/22/06	18	537	2	5	3	1	14	41	59	0.19	0.00	72
	Stony Fk	SR 1170	Wilkes	25.8	06/23/06	18	484	2	4	3	4	3	44	54	1.86	0.00	72
	N Pr Lewis Fk	SR 1304	Wilkes	23.7	08/03/06	15	434	3	2	3	3	3	14	85	0.92	0.23	80
	S Pr Lewis Fk	SR 1154	Wilkes	32.3	08/04/06	22	734	3	2	4	5	4	30	70	0.14	0.00	73
	N Fk Reddies R	SR 1567	Wilkes	12.7	08/04/06	11	426	1	3	1	2	4	35	64	1.17	0.23	64
	Mulberry Cr	SR 1002	Wilkes	39.0	06/23/06	22	713	3	3	4	6	4	52	47	0.70	0.00	73
	M Pr Roaring R	SR 1002	Wilkes	57.3	08/04/06	19	340	3	3	2	6	4	30	68	1.47	0.00	47
	Big Bugaboo Cr	SR 1924	Wilkes	16.7	06/22/06	17	1189	2	4	2	2	9	45	55	0.08	0.00	65
	Elkin Cr	SR 2044	Wilkes	25.6	06/22/06	14	860	3	2	2	2	4	46	54	0.00	0.00	79
	Mitchell R	SR 1330	Surry	29.1	06/21/06	18	442	3	7	2	4	4	26	70	3.85	0.00	67
	S Fk Mitchell R	SR 1301	Surry	24.2	06/21/06	19	455	3	6	3	4	11	27	71	1.98	0.00	74
	Snow Cr	SR 1121	Surry	17.2	06/07/06	19	722	3	4	4	3	16	45	53	1.39	0.00	79
	Fisher R	SR 1331	Surry	36.9	06/21/06	23	766	3	7	3	4	5	31	68	0.65	0.00	43
	Little Fisher R	SR 1480	Surry	21.3	06/20/06	17	735	3	3	3	4	4	38	62	0.14	0.00	47
	Cody Cr	US 268	Surry	10.8	06/07/06	19	518	3	3	1	2	23	36	62	1.93	0.00	58
	Ararat R	NC 104	Surry	36.2	06/20/06	19	899	3	2	3	2	4	33	67	0.00	0.00	74
	Lovills Cr	SR 1371	Surry	35.0	06/19/06	16	2073	3	1	2	2	5	38	62	0.00	0.00	88
	Stewarts Cr	SR 1622	Surry	24.2	06/20/06	20	906	3	2	3	2	5	23	77	0.00	0.11	70
	Toms Cr	SR 2024	Surry	37.7	06/19/06	22	834	3	5	3	2	6	35	65	0.60	0.00	55
	Little Yadkin R	SR 1236	Stokes	32.3	06/19/06	17	1002	3	2	2	2	11	30	70	0.00	0.00	65
	N Deep Cr	SR 1605	Yadkin	35.8	06/07/06	16	198	1	4	1	1	42	42	54	4.04	0.00	50
	S Deep Cr	SR 1152	Yadkin	50.6	06/06/06	17	239	3	4	2	3	20	38	62	0.42	0.00	53
	Silas Cr	SR 1137	Forsyth	11.9	06/05/06	13	154	2	2	1	0	15	46	54	0.00	0.00	69
	S Fk Muddy Cr	SR 2902	Forsyth	42.9	06/05/06	19	150	3	4	1	2	54	18	81	1.33	0.00	42
	Dutchmans Cr	US 158	Davie	57.6	06/05/06	20	189	2	7	3	0	42	23	76	1.59	0.00	30
	Town Cr	off SR 2118	Rowan	16.5	05/11/06	14	332	2	6	1	0	73	7	93	0.00	0.30	64
03040102 South Yadkin River																	
	S Yadkin R	SR 1561	Iredell	69.3	06/06/06	14	332	2	3	1	3	17	61	39	0.00	0.00	57
	Snow Cr	SR 1905	Iredell	29.3	06/06/06	12	213	2	2	1	2	6	61	39	0.00	0.00	50
	Olin Cr	SR 1892	Iredell	9.4	06/05/06	10	193	1	3	0	1	16	40	59	0.52	0.00	50
	Hunting Cr	NC 115	Wilkes	29.8	06/22/06	14	355	2	3	1	3	14	30	70	0.85	0.00	71
	N Little Hunting Cr	SR 1829	Iredell	54.5	06/06/06	16	311	1	4	3	2	33	52	47	0.96	0.00	69
	Third Cr	SR 1970	Rowan	96.6	05/11/06	10	39	0	4	2	0	28	51	44	5.13	0.00	40
	N Second Cr	SR 1526	Rowan	63.3	05/11/06	12	82	2	5	0	1	22	38	61	1.22	0.00	58
03040103 Yadkin River																	
	Abbotts Cr	SR 1800	Davidson	37.1	05/10/06	14	319	2	4	1	0	37	43	56	1.25	0.31	50
	Rich Fk	NC 109	Davidson	25.6	05/10/06	16	136	1	6	1	0	42	7	92	1.47	0.00	50
	Hamby Cr	SR 2017	Davidson	20.4	05/10/06	15	248	2	6	3	0	42	31	66	2.82	0.40	47
	Lick Cr	NC 8	Davidson	28.0	05/10/06	14	368	1	5	2	0	55	30	69	0.27	0.00	57
	Cabin Cr	SR 2536	Davidson	18.7	05/11/06	16	116	1	6	2	0	20	7	91	1.72	1.72	44
	Uwharrie R	SR 1406	Randolph	41.3	05/02/06	22	477	2	6	4	1	9	27	72	1.05	0.42	59

Appendix F-4 (continued).

HUC	Waterbody	Location	County	d. a. (mi ²)	Date	No. Species	No. Fish	No. Sp. Darters	No. Sp. SBT	No. Sp. Suckers	No. Intol. Sp.	% Tolerant	% Omni. +Herb.	% Insect.	% Pisc.	% DELT	% MA
	Little Uwharrie R	SR 1405	Randolph	42.9	05/02/06	23	725	3	4	3	2	17	29	71	0.14	0.00	61
	Caraway Cr	SR 1331	Randolph	43.9	05/08/06	19	243	3	4	2	2	30	26	74	0.41	0.00	42
	Betty McGees Cr	SR 1107	Randolph	8.0	05/08/06	18	265	2	5	1	1	26	31	69	0.00	0.38	67
	Barnes Cr	SR 1303	Montgomery	22.4	05/09/06	17	423	3	3	3	3	13	30	69	1.18	0.00	41
03040104 Lake Tillery-Pee Dee River																	
	Brown Cr	SR 1230	Anson	25.2	04/12/06	18	73	3	7	0	0	16	15	84	1.37	0.00	17
	Cedar Cr	SR 1709	Anson	8.6	04/10/06	10	119	1	2	1	0	36	13	87	0.00	0.84	90
	Little R	SR 1127	Randolph	24.7	05/08/06	19	479	3	5	2	2	16	30	70	0.42	0.00	47
	W Fk Little R	SR 1311	Montgomery	19.0	05/09/06	19	1131	3	1	3	2	9	39	60	0.27	0.00	63
	Bridgers Cr	SR 1519	Montgomery	7.3	04/26/06	15	160	3	3	1	0	21	19	79	1.88	0.00	67
	Rocky Cr	SR 1549	Montgomery	24.6	05/09/06	15	268	2	4	1	1	25	25	75	0.37	0.00	60
	Cheek Cr	SR 1563	Montgomery	10.0	04/26/06	17	490	2	4	2	2	24	29	70	0.61	0.00	76
	Cheek Cr	SR 1541	Montgomery	32.3	04/26/06	21	140	2	4	3	1	44	22	76	2.14	0.00	43
	Mountain Cr	SR 1150	Richmond	65.1	04/25/06	20	537	3	5	1	1	9	12	87	0.93	0.00	60
03040105 Rocky River																	
	Rocky R	SR 1608	Cabarrus	13.4	05/12/06	16	150	2	4	0	2	17	30	70	0.00	0.00	50
	Clarke Cr	SR 1449	Cabarrus	21.9	07/18/06	9	235	1	3	0	0	63	9	91	0.00	0.00	56
	Mallard Cr	SR 2467	Mecklenburg	11.9	07/18/06	16	693	2	4	0	0	22	46	54	0.00	0.14	81
	Reedy Cr	SR 1136	Cabarrus	30.9	07/18/06	17	248	2	5	0	2	24	50	50	0.81	0.00	47
	Irish Buffalo Cr	SR 1132	Cabarrus	45.4	05/12/06	18	383	3	3	2	1	8	38	62	0.00	0.52	72
	Coldwater Cr	NC 73	Cabarrus	34.6	05/12/06	14	190	1	3	2	0	30	3	97	0.53	0.00	50
	Crooked Cr	SR 1547	Union	47.3	07/19/06	20	680	3	2	0	1	30	33	67	0.00	0.15	70
	Island Cr	SR 1118	Stanly	19.2	04/13/06	18	194	3	5	1	0	21	34	64	2.06	0.52	56
	Stony Run	SR 1970	Stanly	19.7	04/13/06	12	212	3	2	1	1	21	50	50	0.00	0.00	67
	Richardson Cr	NC 207	Union	32.6	07/19/06	12	79	0	5	0	0	61	9	89	2.53	0.00	25
	Bearskin Cr	NC 200	Union	14.3	07/18/06	9	291	2	2	0	0	40	44	56	0.00	0.00	67
	Salem Cr	SR 1006	Union	23.6	04/12/06	17	231	2	4	2	0	35	10	90	0.00	0.00	47
	Cribs Cr	SR 1610	Anson	7.1	04/12/06	5	52	1	2	0	0	29	0	100	0.00	0.00	40
	Lanes Cr	SR 1929	Union	47.8	04/12/06	10	109	2	3	1	0	66	18	82	0.00	0.92	40
	Beaverdam Cr	SR 1005	Union	14.9	07/19/06	9	117	0	4	1	0	44	3	97	0.00	0.00	56
	Hardy Cr	SR 1934	Stanly	14.7	04/13/06	14	410	3	3	2	1	69	9	90	0.73	0.00	57
03040201 Pee Dee River																	
	Cartledge Cr	SR 1142	Richmond	30.2	04/10/06	21	170	2	5	0	1	14	34	64	2.94	0.00	43
	Hitchcock Cr	SR 1486	Richmond	15.7	04/24/06	15	74	0	5	2	0	8	8	32	59.46	0.00	53
	Chock Cr	SR 1475	Richmond	13.8	04/25/06	13	54	0	6	2	0	7	11	74	14.81	1.85	54
	Rocky Fork Cr	SR 1424	Richmond	29.7	04/24/06	11	59	1	3	1	0	39	2	97	1.69	0.00	45
	Beaverdam Cr	SR 1486	Richmond	4.5	04/24/06	8	25	0	3	0	1	12	12	72	16.00	0.00	50
	N Fk Jones Cr	SR 1121	Anson	35.4	04/11/06	23	277	2	5	1	1	17	36	61	2.89	1.08	52
	Bailey Cr	SR 1811	Anson	13.0	04/10/06	14	374	1	2	1	0	14	41	56	2.41	1.07	79
	S Fk Jones Cr	SR 1821	Anson	34.6	04/11/06	15	168	2	1	1	1	5	40	57	2.38	0.00	40
	Mill Cr	SR 1826	Anson	18.6	04/11/06	26	174	3	7	1	2	13	30	63	6.32	0.00	46
	Marks Cr	SR 1104	Richmond	29.9	04/25/06	21	238	1	9	2	0	32	3	92	5.46	0.00	52
	Deadfall Cr	SR 1109	Anson	31.5	04/11/06	10	52	1	5	1	0	42	2	87	11.54	3.85	50

*Abbreviations are d. a. = drainage area, No. = number, Sp. = species, SBT = sunfish, bass, and trout, Intol. = intolerants, Omni. + Herb. = omnivores+herbivores, Insect. = insectivores, Pisc. = piscivores, DELT = disease, erosion, lesions, and tumors, and MA = species with multiple age groups.

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

Based upon Menhinick (1991), NC DWQ's data, and data from other researchers, approximately 110 species have been collected from the Yadkin River Basin (Table 5 in Appendix F-1); more species than any other river basin in the state. The high diversity stems from several basin factors – its size, the elevation and water temperature differences from its headwaters to the state line, the four Level III ecoregions and the seven Level IV ecoregions that are found in the basin, the presence of many, large multi-purpose reservoirs; and past stocking efforts of resource agencies. The known species assemblage now includes 33 species of minnows, 15 species of suckers, 11 species of catfish, 19 species of sunfish and bass, and 8 species of darters. Many new county distributional records were also recorded in 2006 from DWQ's fish community monitoring efforts (Table 1).

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

Family/Species	Common Name	County
Petromyzontidae	Lampreys	
<i>Petromyzon marinus</i>	Sea Lamprey	Anson
Clupeidae	Herrings and Shads	
<i>Dorosoma cepedianum</i>	Gizzard Shad	Caldwell
<i>D. petenense</i>	Threadfin Shad	lotic populations in Davie
Cyprinidae	Carp and Minnows	
<i>Camptostoma anomalum</i>	Stoneroller	wider distribution in Wilkes, Surry
<i>Hybognathus regius</i>	Silvery Minnow	Forsyth
<i>Hybopsis hypsinotus</i>	Highback Chub	Anson
<i>Luxilus coccogenis</i>	Warpaint Shiner	Watauga
<i>Notemigonus crysoleucas</i>	Golden Shiner	Surry
<i>Notropis scepticus</i>	Sandbar Shiner	Union
<i>Pimephales promelas</i>	Fathead Minnow	Surry, Wilkes, Iredell
Catostomidae	Suckers	
<i>Moxostoma collapsum</i>	Notchlip Redhorse	Watauga
<i>Scartomyzon rupiscartes</i>	Striped Jumprock	most tributaries in Wilkes, Surry
Ictaluridae	North American Catfishes	
<i>Ameiurus platycephalus</i>	Flat Bullhead	Caldwell
<i>Ictalurus punctatus</i>	Channel Catfish	Forsyth
Fundulidae	Topminnows	
<i>Fundulus rathbuni</i>	Speckled Killifish	Caldwell
Poeciliidae	Livebearers	
<i>Gambusia holbrooki</i>	Eastern Mosquitofish	Randolph, Yadkin
Centrarchidae	Sunfishes	
<i>Ambloplites cavifrons</i>	Roanoke Bass	Richmond
<i>Lepomis punctatus</i>	Spotted Sunfish	Anson
<i>Micropterus punctulatus</i>	Spotted bass	Davie
Percidae	Darters	
<i>Etheostoma flabellare</i>	Fantail Darter	Yadkin
<i>Percina crassa</i>	Piedmont Darter	Stanly

At least 33 of the 110 species (30 percent of the total basin fauna) are exotics and were introduced either as sportfish, forage fish, baitfish, or for reasons unknown (Table 2). In 2006, 22 of the 77 species collected were exotic species. Of the 83 streams sampled in 2006, only 11 of them (North Deep Creek, South Deep Creek, West Fork Little River, Coldwater Creek, Cartledge Creek, Rocky Fork Creek, Beaverdam Creek (Richmond County), Bailey Creek, South Fork Jones Creeks, Mill Creek, and Marks Creek) did not have any exotics present.

Table 2. Exotic species in the Yadkin River basin. Species collected in 2006 are highlighted in blue.

Family/Species	Common Name	Family/Species	Common Name
Clupeidae	Herrings and Shads	Ictaluridae	North American Catfishes
<i>Alosa aestivalis</i>	Blueback Herring	<i>A. melas</i>	Black Bullhead
<i>Dorosoma petenense</i>	Threadfin Shad	<i>Ictalurus furcatus</i>	Blue Catfish
Cyprinidae	Carps and Minnows	<i>I. punctatus</i>	Channel Catfish
<i>Camptostoma anomalum</i>	Stoneroller	<i>Pylodictis olivaris</i>	Flathead Catfish
<i>Carassius auratus</i>	Goldfish	Salmonidae	Trouts and Salmon
<i>Ctenopharyngodon idella</i>	Grass Carp	<i>Oncorhynchus mykiss</i>	Rainbow Trout
<i>Cyprinella lutrensis</i>	Red Shiner	<i>Salmo trutta</i>	Brown Trout
<i>Cyprinus carpio</i>	Common Carp	Moronidae	Temperate Basses
<i>Luxilus coccogenis</i>	Warpaint Shiner	<i>M. chrysops</i>	White Bass
<i>Lythrurus ardens</i>	Rosefin Shiner	Centrarchidae	Sunfishes
<i>Notropis amoenus</i>	Comely Shiner	<i>Ambloplites cavifrons</i>	Roanoke Bass
<i>N. procne</i>	Swallowtail Shiner	<i>A. rupestris</i>	Rock Bass
<i>Phoxinus oreas</i>	Mountain Redbelly Dace	<i>Lepomis cyanellus</i>	Green Sunfish
<i>Pimephales promelas</i>	Fathead Minnow	<i>L. microlophus</i>	Redear Sunfish
Catostomidae	Suckers	<i>Micropterus dolomieu</i>	Smallmouth Bass
<i>Hypentelium nigricans</i>	Northern Hogsucker	<i>M. punctulatus</i>	Spotted bass
<i>Ictiobus bubalus</i>	Smallmouth Buffalo	<i>Pomoxis annularis</i>	White Crappie
<i>I. cyprinellus</i>	Bigmouth Buffalo	Percidae	Darters and Perches
<i>Scartomyzon rupiscartes</i>	Striped Jumprock	<i>Perca flavescens</i>	Yellow Perch
		<i>Sander vitreus</i>	Walleye

Nine species have been given special protection status 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.* 2006; Menhinick and Braswell 1997) (Table 3). In 2006, the Sandhills Chub was collected from Beaverdam Creek (Richmond County) and the Carolina Darter was found in Brown, Bridgers, Crooked, Island, and Lanes creeks.

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

Species	Common Name	Status	State Rank
<i>Acipenser brevirostrum</i>	Shortnose Sturgeon	Endangered	S1
<i>A. oxyrinchus</i>	Atlantic Sturgeon	Special Concern	S3
<i>Cyprinella sp. cf. zanema</i> (sp. 1)	Thinlip Chub	Special Concern	S2
<i>Semotilus lumbee</i>	Sandhills Chub	Special Concern	S3
<i>Carpionodes sp. cf. cyprinus</i>	(no common name)	Significantly Rare	S2
<i>C. sp. cf. velifer</i>	(no common name)	Special Concern	S1
<i>Moxostoma robustum</i>	Robust Redhorse	Significantly Rare	S1
<i>M. sp. cf. erythrum</i> (sp. 3)	Carolina Redhorse	Significantly Rare	S1
<i>Etheostoma collis</i> (pop. 1)	Carolina Darter	Special Concern	S3

¹S1 = 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 because of rarity or because of some factor(s) making it very vulnerable to extirpation from North Carolina. S3 = rare or uncommon in North Carolina (LeGrand *et al.* 2006).

In 2006, 77 of the 110 species were collected. Species not collected included those with preferences for larger rivers or reservoirs (e.g. sturgeons and some species of suckers) and very rare species (e.g., Thinlip Chub and Robust Redhorse). The most widely distributed species were the Redbreast Sunfish, Bluehead Chub, and Tessellated Darter; these species were collected at 78, 72, and 70 of the 83 sites, respectively. Species less widely distributed and collected only at 1 or 2 sites included Threadfin Shad, Red Shiner, Whitefin Shiner, Rosefin Shiner, Comely Shiner, Coastal Shiner, Sandhills Chub, Northern Hog Sucker, V-lip Redhorse, White Catfish, Black Bullhead, Rainbow Trout, Lined Topminnow, Roanoke Bass, Bluespotted Sunfish, Spotted Sunfish, and Swamp Darter. The numerically most abundant species were the Bluehead Chub, Redlip Shiner, and Redbreast Sunfish; these three species constituted almost 60 percent of all the fish collected. By contrast, some of the rarer species (less than five specimens collected) included the Sea Lamprey, Whitefin Shiner, Comely Shiner, Fathead Minnow, Northern Hog Sucker, V-lip Redhorse, Snail Bullhead, White Catfish, Black Bullhead, Channel Catfish, Rainbow Trout, Lined Topminnow, Roanoke Bass, Spotted Sunfish, and Spotted Bass.

Appendix F-6. Habitat evaluations and stream and riparian habitats at 83 fish community monitoring sites in the Yadkin River basin, 2006.

Habitat Assessments

A method and scoring system has been developed by the BAU staff to evaluate the physical habitats of a stream (NCDENR 2001a). The narrative descriptions of eight habitat characteristics, including channel modification, amount of instream habitat, type of bottom substrate, pool variety, riffle frequency (not evaluated in Sand Hills and Coastal Plain streams), 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.

Fish community sampling was conducted in 2006 at 83 sites (Table 1); 77 of the sites were evaluated with Mountain/Piedmont criteria, 5 sites with Coastal Plain/Sand Hills criteria, and 1 site with both sets of criteria (Mill Creek). Two-thirds of the streams, mostly within the Carolina Slate Belt and Sand Hills, had overall moderate to high quality habitats (score ≥ 65); whereas one-third of the streams, mostly in the Northern Inner Piedmont and Southern Outer Piedmont, had overall low to poor quality habitats (score < 65) (Figure 1 and Tables 1 - 3). Habitat scores ranged from 37 at North Second Creek to 97 at West Fork Little River (Tables 1 - 3).

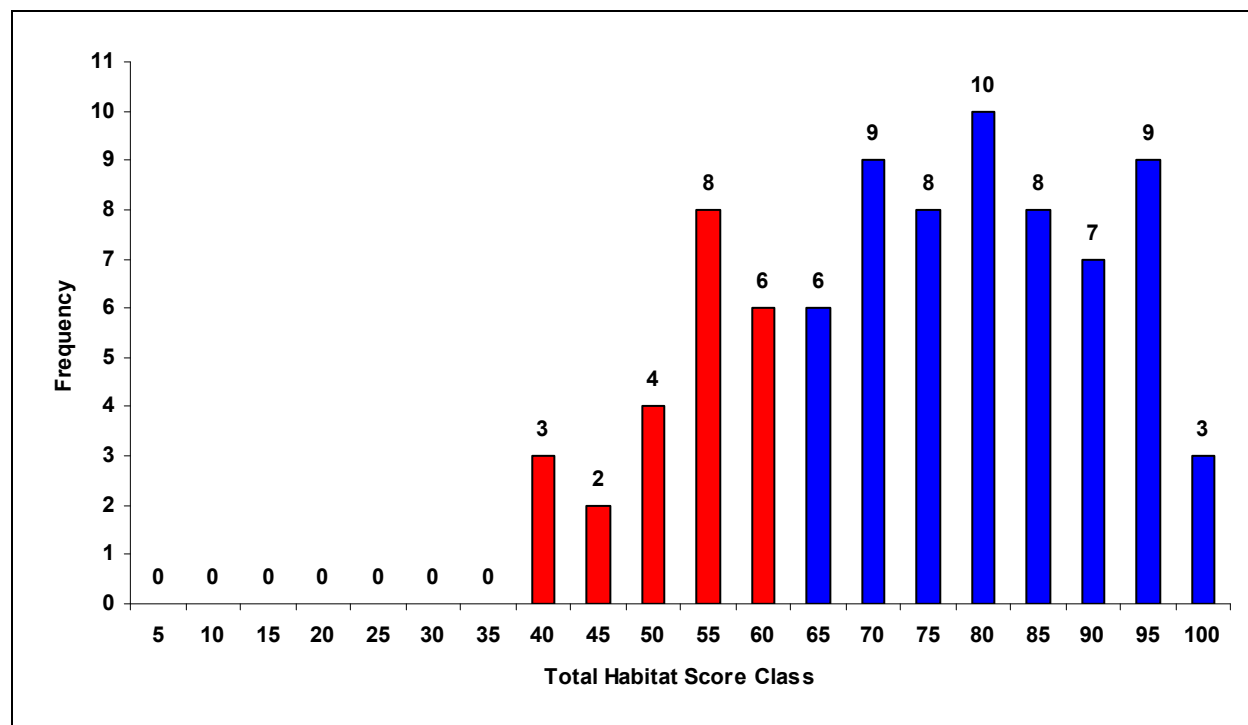


Figure 1. Distribution of the total habitat scores at 83 fish community sites in the Yadkin River basin, 2006. High to moderate quality scores are shown in blue and low to poor quality habitat sites are shown in red.

Table 1. Habitat evaluations using Mountains/Piedmont criteria at 78 basinwide fish community sites in the Yadkin River basin, 2006. Red bold denotes less than optimal habitat conditions.

HUC	Waterbody	Location	County	Width (m)	Channel	Instream Habitat	Substrate	Pools	Riffles	Bank Stability-L	Bank Stability-R	Shade	Riparian Zone-L	Riparian Zone-R	Total Score
03040101 Yadkin river Headwaters															
	Yadkin R	NC 268	Caldwell	11	5	14	11	6	7	5	5	8	3	3	67
	Buffalo Cr	SR 1594	Caldwell	13	5	18	15	9	14	7	7	7	5	4	91
	Kings Cr	SR 1552	Caldwell	8	5	16	3	4	14	4	4	7	2	5	65
	Laurel Cr	SR 1508	Watauga	10	5	18	13	9	14	7	7	10	5	4	92
	Beaver Cr	SR 1131	Wilkes	9	5	11	3	8	3	2	5	7	1	5	50
	Stony Fk	SR 1170	Wilkes	11	5	16	12	4	16	4	1	5	3	0	66
	N Pr Lewis Fk	SR 1304	Wilkes	9	5	15	7	6	10	6	6	8	3	5	71
	S Pr Lewis Fk	SR 1154	Wilkes	11	5	16	8	6	15	6	6	8	5	5	80
	N Fk Reddies R	SR 1567	Wilkes	7	5	18	10	6	16	6	6	9	3	5	84
	Mulberry Cr	SR 1002	Wilkes	12	5	18	10	8	8	3	3	7	2	2	66
	M Pr Roaring R	SR 1002	Wilkes	11	5	18	10	8	15	6	5	7	5	5	84
	Big Bugaboo Cr	SR 1924	Wilkes	10	5	18	12	10	15	6	5	7	5	2	85
	Elkin Cr	SR 2044	Wilkes	13	5	18	8	9	16	6	6	9	5	5	87
	Mitchell R	SR 1330	Surry	12	5	18	12	10	15	6	6	8	3	4	87
	S Fk Mitchell R	SR 1301	Surry	10	5	14	8	6	5	4	4	5	4	3	58
	Snow Cr	SR 1121	Surry	12	5	16	8	8	14	7	6	7	5	3	79
	Fisher R	SR 1331	Surry	14	5	18	12	8	10	6	6	10	4	4	83
	Little Fisher R	SR 1480	Surry	10	5	14	8	6	10	4	3	7	2	1	60
	Cody Cr	US 268	Surry	7	4	16	8	7	7	6	6	8	4	4	71
	Ararat R	NC 104	Surry	12	5	18	10	6	7	6	6	8	4	3	73
	Lovills Cr	SR 1371	Surry	9	3	15	6	7	15	2	2	0	1	1	52
	Stewarts Cr	SR 1622	Surry	10	5	18	11	8	15	6	7	10	4	5	89
	Toms Cr	SR 2024	Surry	14	5	18	10	9	10	6	5	8	4	5	80
	Little Yadkin R	SR 1236	Stokes	14	5	16	6	8	14	6	6	7	5	5	78
	N Deep Cr	SR 1605	Yadkin	10	5	10	3	6	3	1	1	5	2	2	38
	S Deep Cr	SR 1152	Yadkin	10	5	12	3	9	2	3	3	10	5	3	55
	Silas Cr	SR 1137	Forsyth	6	5	13	3	6	1	2	2	9	4	4	49
	S Fk Muddy Cr	SR 2902	Forsyth	9	5	11	3	6	3	3	5	7	4	5	52
	Dutchmans Cr	US 158	Davie	10	5	12	3	8	2	6	6	9	5	5	61
	Town Cr	off SR 2118	Rowan	8	4	14	8	9	5	5	5	10	5	3	68
03040102 South Yadkin River															
	S Yadkin R	SR 1561	Iredell	12	5	11	3	3	1	3	3	9	5	5	48
	Snow Cr	SR 1905	Iredell	5	5	14	4	4	5	5	5	10	5	5	62
	Olin Cr	SR 1892	Iredell	4	5	13	3	6	4	2	2	10	5	3	53
	Hunting Cr	NC 115	Wilkes	13	5	12	3	6	2	5	5	9	5	4	56
	N Little Hunting Cr	SR 1829	Iredell	9	5	10	3	8	2	2	2	4	3	5	44
	Third Cr	SR 1970	Rowan	12	4	11	3	9	1	4	4	10	5	5	56
	N Second Cr	SR 1526	Rowan	9	4	6	3	4	1	2	2	9	3	3	37

Table 1 (continued).

HUC	Waterbody	Location	County	Width (m)	Channel	Instream Habitat	Substrate	Pools	Riffles	Bank Stability-L	Bank Stability-R	Shade	Riparian Zone-L	Riparian Zone-R	Total Score
03040103 Yadkin River															
	Abbotts Cr	SR 1800	Davidson	8	5	12	3	8	3	2	2	9	5	5	54
	Rich Fk	NC 190	Davidson	6	5	12	3	9	2	2	2	7	5	5	52
	Hamby Cr	SR 2017	Davidson	10	5	16	8	9	7	6	7	9	3	5	75
	Lick Cr	NC 8	Davidson	10	5	18	10	9	4	6	7	10	4	5	78
	Cabin Cr	SR 2536	Davidson	8	5	16	10	9	4	3	3	10	5	4	69
	Uwharrie R	SR 1406	Randolph	10	5	16	8	9	3	4	4	9	5	5	68
	L Uwharrie R	SR 1405	Randolph	13	5	18	12	9	10	6	6	7	5	5	87
	Caraway Cr	SR 1331	Randolph	12	5	16	10	9	12	4	4	9	5	5	79
	Betty McGees Cr	SR 1107	Randolph	5	5	16	10	10	7	3	3	9	5	5	73
	Barnes Cr	SR 1303	Montgomery	8	5	19	15	9	16	7	7	8	5	5	96
03040104 Lake Tillery-Pee Dee Rive															
	Brown Cr	SR 1230	Anson	6	5	14	6	7	4	2	2	9	5	4	58
	Cedar Cr	SR 1709	Anson	4	5	12	6	6	14	5	5	9	5	5	72
	Little R	SR 1127	Randolph	12	5	19	14	9	16	7	7	7	5	5	94
	W Fk Little R	SR 1311	Montgomery	9	5	19	15	10	16	7	7	8	5	5	97
	Bridgers Cr	SR 1519	Montgomery	6	5	18	15	7	14	7	7	8	5	5	91
	Rocky Cr	SR 1549	Montgomery	8	5	14	8	9	7	6	6	7	5	3	70
	Cheek Cr	SR 1563	Montgomery	4	5	16	10	8	12	6	6	10	5	5	83
	Cheek Cr	SR 1541	Montgomery	7	5	14	4	7	4	3	3	9	4	5	58
	Mountain Cr	SR 1150	Richmond	12	5	18	12	10	7	6	6	7	4	5	80
03040105 Rocky River															
	Rocky R	SR 1608	Cabarrus	6	5	11	3	8	2	2	2	9	5	5	52
	Clarke Cr	SR 1449	Cabarrus	8	4	11	2	2	0	3	3	8	4	5	42
	Mallard Cr	SR 2467	Mecklenburg	10	5	16	12	9	14	4	6	7	3	4	80
	Reedy Cr	SR 1136	Cabarrus	4	5	11	3	8	2	0	0	9	3	5	46
	Irish Buffalo Cr	SR 1132	Cabarrus	10	5	16	8	6	12	6	6	8	4	4	75
	Coldwater Cr	NC 73	Cabarrus	7	5	8	3	3	1	2	2	9	3	4	40
	Crooked Cr	SR 1547	Union	12	5	18	12	8	5	5	5	7	5	5	85
	Island Cr	SR 1118	Stanly	8	5	16	14	9	12	5	5	7	5	5	83
	Stony Run	SR 1970	Stanly	8	5	17	15	10	14	7	7	7	5	5	92
	Richardson Cr	NC 207	Union	12	4	16	13	9	0	2	3	9	5	5	66
	Bearskin Cr	NC 200	Union	4	5	19	14	9	14	6	6	10	5	5	93
	Salem Cr	SR 1006	Union	11	5	18	11	9	5	5	5	8	4	5	81
	Cribs Cr	SR 1610	Anson	7	5	16	13	6	7	6	5	9	4	5	75
	Lanes Cr	SR 1929	Union	9	5	18	12	10	7	4	4	9	5	5	78
	Beaverdam Cr	SR 1005	Union	7	5	16	10	9	2	3	3	10	5	5	68
	Hardy Cr	SR 1934	Stanly	8	5	17	15	9	14	7	7	8	5	5	92
03040201 Pee Dee River															
	Cartledge Cr	SR 1142	Richmond	6	5	16	6	9	11	6	6	9	5	5	78
	N FK Jones Cr	SR 1121	Anson	9	5	16	3	7	3	5	5	9	5	5	63
	Bailey Cr	SR 1811	Anson	4	5	12	3	4	2	6	6	9	1	4	52
	S FK Jones Cr	SR 1821	Anson	8	5	16	3	9	7	3	3	9	5	5	65
	Mill Cr	SR 1826	Anson	7	5	16	6	9	7	6	6	9	5	5	74
	Deadfall Cr	SR 1109	Anson	8	4	15	12	9	0	5	5	7	5	2	64
Maximum possible scores					5	20	15	10	16	7	7	10	5	5	100

Table 2. Habitat evaluations using Coastal Plain/Sand Hills criteria at six basinwide fish community sites in the Yadkin River basin, 2006.

HUC	Stream	Location	County	Width (m)	Channel	Instream Habitat	Substrate	Pools	Bank Stability-L	Bank Stability-R	Shade	Riparian Zone-L	Riparian Zone-R	Total Score
03040201 Pee Dee River														
	Hitchcock Cr	SR 1486	Richmond	6	15	18	13	10	10	10	10	5	5	96
	Chock Cr	SR 1475	Richmond	6	15	18	6	10	10	10	10	5	5	89
	Rocky Fork Cr	SR 1424	Richmond	6	15	18	13	10	10	10	9	5	5	95
	Beaverdam Cr	SR 1486	Richmond	3	15	18	7	8	10	10	9	5	5	87
	Mill Cr	SR 1826	Anson	7	15	18	13	9	9	9	9	5	4	91
	Marks Cr	SR 1104	Richmond	7	15	18	7	10	10	10	10	5	5	90
Maximum possible score					15	20	15	10	10	10	10	5	5	100

Table 3. Rankings of 83 waterbodies in Yadkin River basin according to the total habitat scores, 2006. Mill Creek was evaluated with Mountain/Piedmont and Coastal Plain/Sand Hills criteria.

HUC	Waterbody	Location	County	Ecoregion	Score
High to Moderate Quality Habitats					
03040104	W Fk Little R	SR 1311	Montgomery	Carolina Slate Belt	97
03040201	Hitchcock Cr	SR 1486	Richmond	Sand Hills	96
03040103	Barnes Cr	SR 1303	Montgomery	Carolina Slate Belt	96
03040201	Rocky Fork Cr	SR 1424	Richmond	Sand Hills	95
03040104	Little R	SR 1127	Randolph	Carolina Slate Belt	94
03040105	Bearskin Cr	NC 200	Union	Carolina Slate Belt	93
03040105	Hardy Cr	SR 1934	Stanly	Carolina Slate Belt	92
03040101	Laurel Cr	SR 1508	Watauga	Southern Crystalline Ridges and Mountains	92
03040105	Stony Run	SR 1970	Stanly	Carolina Slate Belt	92
03040104	Bridgers Cr	SR 1519	Montgomery	Carolina Slate Belt	91
03040101	Buffalo Cr	SR 1594	Caldwell	Southern Crystalline Ridges and Mountains	91
03040201	Mill Cr	SR 1826	Anson	Sand Hills/Carolina Slate Belt	91 (74)
03040201	Marks Cr	SR 1104	Richmond	Sand Hills	90
03040101	Stewarts Cr	SR 1622	Surry	Northern Inner Piedmont	89
03040201	Chock Cr	SR 1475	Richmond	Sand Hills	89
03040101	Elkin Cr	SR 2044	Wilkes	Northern Inner Piedmont	87
03040103	L Uwharrie R	SR 1405	Randolph	Carolina Slate Belt	87
03040101	Mitchell R	SR 1330	Surry	Northern Inner Piedmont	87
03040201	Beaverdam Cr	SR 1486	Richmond	Sand Hills	87
03040101	Big Bugaboo Cr	SR 1924	Wilkes	Northern Inner Piedmont	85
03040105	Crooked Cr	SR 1547	Union	Carolina Slate Belt	85
03040101	M Pr Roaring R	SR 1002	Wilkes	Northern Inner Piedmont	84
03040101	N Fk Reddies R	SR 1567	Wilkes	Southern Crystalline Ridges and Mountains	84
03040104	Cheek Cr	SR 1563	Montgomery	Triassic Basins	83
03040101	Fisher R	SR 1331	Surry	Northern Inner Piedmont	83
03040105	Island Cr	SR 1118	Stanly	Carolina Slate Belt	83
03040105	Salem Cr	SR 1006	Union	Carolina Slate Belt	81
03040105	Mallard Cr	SR 2467	Mecklenburg	Southern Outer Piedmont	80
03040104	Mountain Cr	SR 1150	Richmond	Carolina Slate Belt	80
03040101	S Pr Lewis Fk	SR 1154	Wilkes	Northern Inner Piedmont	80
03040101	Toms Cr	SR 2024	Surry	Northern Inner Piedmont	80
03040103	Caraway Cr	SR 1331	Randolph	Carolina Slate Belt	79
03040101	Snow Cr	SR 1121	Surry	Northern Inner Piedmont	79
03040201	Cartledge Cr	SR 1142	Richmond	Carolina Slate Belt	78
03040105	Lanes Cr	SR 1929	Union	Carolina Slate Belt	78
03040103	Lick Cr	NC 8	Davidson	Carolina Slate Belt	78
03040101	Little Yadkin R	SR 1236	Stokes	Northern Inner Piedmont	78
03040105	Cribs Cr	SR 1610	Anson	Carolina Slate Belt	75
03040103	Hamby Cr	SR 2017	Davidson	Southern Outer Piedmont	75
03040105	Irish Buffalo Cr	SR 1132	Cabarrus	Southern Outer Piedmont	75
03040101	Ararat R	NC 104	Surry	Northern Inner Piedmont	73
03040103	Betty McGees Cr	SR 1107	Randolph	Carolina Slate Belt	73
03040104	Cedar Cr	SR 1709	Anson	Triassic Basins/Carolina Slate Belt	72
03040101	Cody Cr	US 268	Surry	Northern Inner Piedmont	71
03040101	N Pr Lewis Fk	SR 1304	Wilkes	Southern Crystalline Ridges and Mountains	71
03040104	Rocky Cr	SR 1549	Montgomery	Carolina Slate Belt	70
03040103	Cabin Cr	SR 2536	Davidson	Carolina Slate Belt	69
03040105	Beaverdam Cr	SR 1005	Union	Carolina Slate Belt	68
03040101	Town Cr	off SR 2118	Rowan	Southern Outer Piedmont	68
03040103	Uwharrie R	SR 1406	Randolph	Carolina Slate Belt	68
03040101	Yadkin R	NC 268	Caldwell	Eastern Blue Ridge Foothills	67
03040101	Mulberry Cr	SR 1002	Wilkes	Northern Inner Piedmont	66
03040105	Richardson Cr	NC 207	Union	Carolina Slate Belt	66
03040101	Stony Fk	SR 1170	Wilkes	Southern Crystalline Ridges and Mountains	66
03040101	Kings Cr	SR 1552	Caldwell	Northern Inner Piedmont	65
03040201	S FK Jones Cr	SR 1821	Anson	Triassic Basins/Carolina Slate Belt	65

Table 3 (continued).

HUC	Waterbody	Location	County	Ecoregion	Score
Low to Poor Quality Habitats					
03040201	Deadfall Cr	SR 1109	Anson	Carolina Slate Belt	64
03040201	N FK Jones Cr	SR 1121	Anson	Triassic Basins/Carolina Slate Belt	63
03040102	Snow Cr	SR 1905	Iredell	Northern Inner Piedmont	62
03040101	Dutchmans Cr	US 158	Davie	Southern Outer Piedmont	61
03040101	Little Fisher R	SR 1480	Surry	Northern Inner Piedmont	60
03040104	Brown Cr	SR 1230	Anson	Triassic Basins	58
03040104	Cheek Cr	SR 1541	Montgomery	Triassic Basins	58
03040101	S Fk Mitchell R	SR 1301	Surry	Northern Inner Piedmont	58
03040102	Hunting Cr	NC 115	Wilkes	Northern Inner Piedmont	56
03040102	Third Cr	SR 1970	Rowan	Southern Outer Piedmont	56
03040101	S Deep Cr	SR 1152	Yadkin	Northern Inner Piedmont	55
03040103	Abbotts Cr	SR 1800	Davidson	Southern Outer Piedmont	54
03040102	Olin Cr	SR 1892	Iredell	Northern Inner Piedmont	53
03040201	Bailey Cr	SR 1811	Anson	Triassic Basins/Carolina Slate Belt	52
03040101	Lovills Cr	SR 1371	Surry	Northern Inner Piedmont	52
03040103	Rich Fk	NC 190	Davidson	Southern Outer Piedmont	52
03040105	Rocky R	SR 1608	Cabarrus	Southern Outer Piedmont	52
03040101	S Fk Muddy Cr	SR 2902	Forsyth	Southern Outer Piedmont	52
03040101	Beaver Cr	SR 1131	Wilkes	Northern Inner Piedmont	50
03040101	Silas Cr	SR 1137	Forsyth	Southern Outer Piedmont	49
03040102	S Yadkin R	SR 1561	Iredell	Northern Inner Piedmont	48
03040105	Reedy Cr	SR 1136	Cabarrus	Southern Outer Piedmont	46
03040102	N Little Hunting Cr	SR 1829	Iredell	Northern Inner Piedmont	44
03040105	Clarke Cr	SR 1449	Cabarrus	Southern Outer Piedmont	42
03040105	Coldwater Cr	NC 73	Cabarrus	Southern Outer Piedmont	40
03040101	N Deep Cr	SR 1605	Yadkin	Northern Inner Piedmont	38
03040102	N Second Cr	SR 1526	Rowan	Southern Outer Piedmont	37

Piedmont and Mountain Streams

In the Piedmont and Mountains major differences between the high to moderate and the low to poor quality habitat types were in the instream habitats, substrates, riffles, and bank stabilities (Table 4). Differences were not as pronounced in the abundance of pools, extent of canopy cover, or width of riparian zones. Low scores were attributable to chronic erosion of the easily eroded soils and nonpoint source sedimentation within the respective watersheds.

Table 4. Mean habitat scores for 77 fish community sites in the Mountains and Piedmont Level III ecoregions of the Yadkin River basin, 2006

Habitat characteristics	Low - Poor Quality Habitat	Moderate - High Quality Habitat	Maximum score
Instream habitat	12.0	16.8	20
Substrate	4.0	10.4	15
Riffles	3.1	10.5	16
Bank stability (right and left)	6.2	10.9	14

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 offering a good tree canopy, Little River at SR 1127 (left) and West Fork Little River at SR 1311 (right), Randolph County.

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.



Figure 3. Sandy substrates with few riffles and eroding and sloughing banks, North Deep Creek at SR 1605, Yadkin County (left) and North Little Hunting Creek at SR 1829, Iredell County (right).

Sand Hills Streams

The Sand Hills Level IV ecoregion is found throughout much of Richmond County and the extreme southeast corner of Anson County. Six streams were assessed in this ecoregion and each of them had high quality instream and riparian habitats (Table 2). Characteristics of these streams are:

- a natural channel with darkly colored water, and strong, permanent flow;
- instream habitats composed of sticks, leafpacks, macrophytes and macroalgae (such as *Vallisneria*, *Fissidens*, and *Batrachospermum*) in sun-light areas near the bridges, snags and logs, and undercut banks and root mats;
- a mixed substrate of gravel, sand, detritus, and silt; and
- stable banks with at times a dense tree canopy, and a wide riparian zone with no or rare breaks in the zone (Figures 4 - 6).



Figure 4. Hitchcock Creek at SR 1486 and Chock Creek at SR 1475, Richmond County.



Figure 5. Rocky Fork Creek at SR 1424 and Beaverdam Creek at SR 1486, Richmond County.



Figure 6 Mill Creek at SR 1826, Anson County and Marks Creek at SR at SR 1104, Richmond County.

Habitat and NCIBI Relationships

Fish communities rated Excellent were found where the habitats were of moderate to high quality (Tables 1 and 5), with the exception of the South Fork Mitchell River; and two-thirds of the communities rated Good also had habitats of moderate to high quality. Communities rated Good-Fair, Fair, or Poor, where

there were moderate to high quality habitats, were generally streams affected by low flow (i.e., Carolina Slate Belt streams), low dissolved oxygen, flow augmented by a WWTP discharge, or were located in or downstream of urban areas where good buffers and instream habitats remained. Two-thirds of the sites with low to poor quality habitats were rated Good-Fair, Fair, or Poor. Many of these sandy bottom sites were affected by nonpoint source erosion, urban/suburban development, or WWTP discharges.

Table 5. NCIBI ratings and habitat quality for 77 streams in the Piedmont and Mountains region of the Yadkin River basin, 2006.¹

NCIBI Rating	Waterbodies with Low to Poor Quality Habitat (Score < 65)	Waterbodies with Moderate to High Quality Habitat (Score ≥ 65)
Excellent	S Fk Mitchell	Stony Fk, N Pr Lewis, S Pr Lewis, M Pr Roaring, Mitchell, Snow (Surry), Fisher, Cody, Ararat, Stewarts, Toms, L Yadkin, Uwharrie, Caraway, Barnes, Little R, Rocky Cr, Cheek (SR 1563), Mountain, Irish Buffalo, Island, Mill
Good	Beaver, L Fisher, Lovills, S Deep, S Fk Muddy, Hunting, Rocky R, N Fk Jones	Yadkin, Buffalo, Kings, Laurel, N Fk Reddies, Mulberry, Big Bugaboo, Elkin, Hamby, Betty McGees, W Fk Little, Bridgers, Cheek (SR 1541), Crooked, Hardy, Carledge
Good-Fair	N Deep, Silas, Dutchmans, S Yadkin, Olin, N L Hunting, Second, Brown, Bailey	Lick, Mallard, Stony Run, Salem, S Fk Jones
Fair	Snow (Iredell), Abbotts, Coldwater	Town, Cabin, Cedar, Bearskin, Lanes
Poor	Third, Rich Fk, Clarke, Deadfall	Richardson, Crips, Beaverdam

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.

Since 1996, 239 rateable fish community samples with associated habitat evaluations have been collected throughout the basin. Disregarding the confounding effects of flows (especially in Carolina Slate Belt type streams), lingering impacts from droughts, and WWTP discharges, communities rated Excellent or Good were found where high quality instream and riparian habitats existed as contrasted to communities rated Good-Fair to Poor (Figure 7). Median habitat scores for Excellent and Good sites were 80 and 73, respectively; Good-Fair, Fair, and Poor sites had median habitat scores of 54, 64, and 50, respectively.

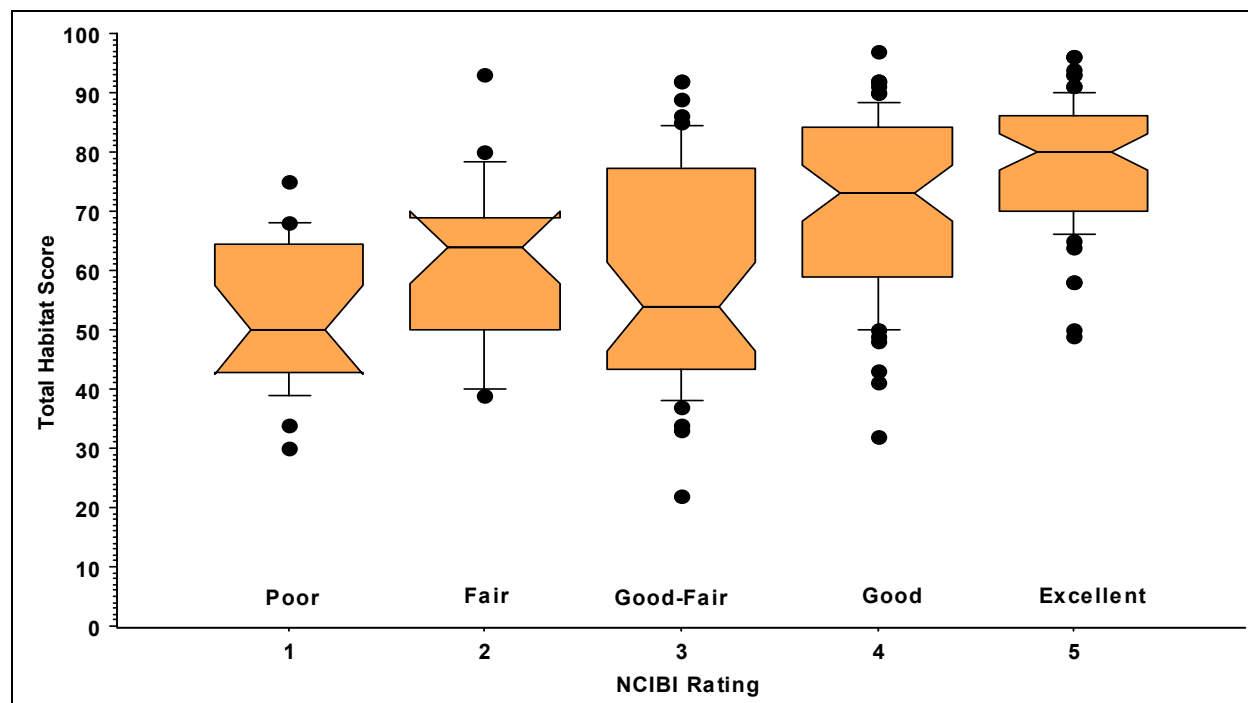


Figure 7. Habitat scores and NCIBI ratings in the Yadkin River basin, 1996 - 2006.

Appendix F-7. Water quality at 83 fish community sites in the Yadkin River basin, 2006.

In 2006 water quality data (temperature, specific conductance, dissolved oxygen, and pH) were collected at every site during fish community assessments (Table 1). Dissolved oxygen concentrations were less than the water quality standard of 5 mg/L at Clarke Creek, Richardson Creek, and Beaverdam Creek (Union County). Dissolved oxygen saturation ranged from 13 percent at Beaverdam Creek to 122 percent at the Ararat River. Supersaturation of dissolved oxygen was associated with mid-late afternoon photosynthesis by periphyton. Twenty-two percent (18 of the 83 measurements) of the pH measurements were less than 6.0 s.u.; four of these measurements were from sites in the Sand Hills (HUC 03040201).

Table 1. Water quality measurements at 83 fish community sites in the Yadkin River basin, 2006. Red bold denotes less than the water quality standard.

HUC/ Waterbody	Location	County	Date	Temperature (°C)	Specific conductance (µS/cm)	Dissolved oxygen (mg/L)	Saturation (%)	pH (s.u.)
03040101 Yadkin River Headwaters								
Yadkin R	NC 268	Caldwell	08/02/06	24.5	60	7.8	94	5.9
Buffalo Cr	SR 1594	Caldwell	08/03/06	22.6	35	7.4	86	7.0
Kings Cr	SR 1552	Caldwell	06/23/06	19.4	58	7.7	84	6.0
Laurel Cr	SR 1508	Watauga	08/03/06	22.3	30	7.1	82	5.8
Beaver Cr	SR 1131	Wilkes	06/22/06	23.0	57	7.3	85	5.8
Stony Fk	SR 1170	Wilkes	06/23/06	21.5	37	8.1	92	6.1
N Pr Lewis Fk	SR 1304	Wilkes	08/03/06	24.0	30	7.5	89	5.6
S Pr Lewis Fk	SR 1154	Wilkes	08/04/06	22.3	35	7.6	87	6.4
N Fk Reddies R	SR 1567	Wilkes	08/04/06	21.5	33	8.4	95	6.2
Mulberry Cr	SR 1002	Wilkes	06/23/06	24.2	44	8.3	99	6.0
M Pr Roaring R	SR 1002	Wilkes	08/04/06	25.1	37	7.6	92	6.0
Big Bugaboo Cr	SR 1924	Wilkes	06/22/06	20.6	42	7.8	87	6.0
Elkin Cr	SR 2044	Wilkes	06/22/06	20.6	42	7.6	85	6.0
Mitchell R	SR 1330	Surry	06/21/06	19.4	28	8.1	88	6.2
S Fk Mitchell R	SR 1301	Surry	06/21/06	21.9	37	8.4	96	6.2
Snow Cr	SR 1121	Surry	06/07/06	18.7	57	9.1	98	5.6
Fisher R	SR 1331	Surry	06/21/06	21.0	39	7.5	84	6.2
Little Fisher R	SR 1480	Surry	06/20/06	22.8	50	8.4	98	6.1
Cody Cr	US 268	Surry	06/07/06	16.9	62	9.0	93	6.3
Ararat R	NC 104	Surry	06/20/06	19.1	53	7.9	85	6.2
Lovills Cr	SR 1371	Surry	06/19/06	28.4	74	9.5	122	6.2
Stewarts Cr	SR 1622	Surry	06/20/06	26.0	42	8.1	100	5.9
Toms Cr	SR 2024	Surry	06/19/06	20.1	65	8.0	88	5.9
Little Yadkin R	SR 1236	Stokes	06/19/06	19.7	71	7.8	85	6.0
N Deep Cr	SR 1605	Yadkin	06/07/06	16.8	75	7.9	81	5.9
S Deep Cr	SR 1152	Yadkin	06/06/06	20.7	68	7.8	87	6.7
Silas Cr	SR 1137	Forsyth	06/05/06	18.3	127	7.0	74	6.2
S Fk Muddy Cr	SR 2902	Forsyth	06/05/06	17.7	95	7.9	83	6.5
Dutchmans Cr	US 158	Davie	06/05/06	19.4	140	7.0	76	6.0
Town Cr	off SR 2118	Rowan	05/11/06	17.0	262	7.7	80	6.8
03040102 South Yadkin River								
S Yadkin R	SR 1561	Iredell	06/06/06	15.6	54	8.9	89	5.6
Snow Cr	SR 1905	Iredell	06/06/06	15.9	73	6.7	68	6.6
Olin Cr	SR 1892	Iredell	06/05/06	18.6	52	7.8	83	6.2
Hunting Cr	NC 115	Wilkes	06/22/06	22.3	54	7.7	89	5.8
N Little Hunting Cr	SR 1829	Iredell	06/06/06	20.0	66	8.5	94	6.6
Third Cr	SR 1970	Rowan	05/11/06	17.5	149	7.9	83	6.2
N Second Cr	SR 1526	Rowan	05/11/06	17.7	123	8.7	91	6.4
03040103 Yadkin River								
Abbotts Cr	SR 1800	Davidson	05/10/06	15.0	138	8.9	88	6.2
Rich Fk	NC 109	Davidson	05/10/06	16.4	372	8.4	86	6.2
Hamby Cr	SR 2017	Davidson	05/10/06	15.6	305	6.4	64	6.8
Lick Cr	NC 8	Davidson	05/10/06	15.8	123	8.7	88	6.5
Cabin Cr	SR 2536	Davidson	05/11/06	16.0	102	8.0	81	6.3
Uwharrie R	SR 1406	Randolph	05/02/06	14.4	131	9.7	95	7.2

Table 1 (continued).

HUC/ Waterbody	Location	County	Date	Temperature (°C)	Specific conductance (µS/cm)	Dissolved oxygen (mg/L)	Saturation (%)	pH (s.u.)
03040103 Yadkin River								
Little Uwharrie R	SR 1405	Randolph	05/02/06	13.5	106	9.9	95	6.5
Caraway Cr	SR 1331	Randolph	05/08/06	15.4	117	8.1	81	6.3
Betty McGees Cr	SR 1107	Randolph	05/08/06	14.0	90	9.0	87	6.3
Barnes Cr	SR 1303	Montgomery	05/09/06	14.2	51	10.2	99	6.4
03040104 Lake Tillery-Pee Dee River								
Brown Cr	SR 1230	Anson	04/12/06	14.0	126	7.8	76	6.1
Cedar Cr	SR 1709	Anson	04/10/06	16.4	125	9.3	95	6.0
Little R	SR 1127	Randolph	05/08/06	14.3	71	9.0	88	6.4
W Fk Little R	SR 1311	Montgomery	05/09/06	13.7	56	9.4	91	6.3
Bridgers Cr	SR 1519	Montgomery	04/26/06	19.4	74	8.9	97	5.8
Rocky Cr	SR 1549	Montgomery	05/09/06	14.1	47	10.0	97	6.5
Cheek Cr	SR 1563	Montgomery	04/26/06	18.6	77	7.1	76	6.1
Cheek Cr	SR 1541	Montgomery	04/26/06	19.8	110	6.3	69	6.0
Mountain Cr	SR 1150	Richmond	04/25/06	26.0	62	8.4	104	6.2
03040105 Rocky River								
Rocky R	SR 1608	Cabarrus	05/12/06	13.7	362	6.6	64	6.6
Clarke Cr	SR 1449	Cabarrus	07/18/06	24.6	194	2.9	35	6.3
Mallard Cr	SR 2467	Mecklenburg	07/18/06	22.3	139	7.1	82	6.1
Reedy Cr	SR 1136	Cabarrus	07/18/06	24.7	329	6.8	82	6.2
Irish Buffalo Cr	SR 1132	Cabarrus	05/12/06	14.2	206	9.7	95	7.0
Coldwater Cr	NC 73	Cabarrus	05/12/06	15.1	202	7.7	77	6.1
Crooked Cr	SR 1547	Union	07/19/06	25.8	473	6.2	76	6.7
Island Cr	SR 1118	Stanly	04/13/06	13.4	106	8.6	82	5.8
Stony Run	SR 1970	Stanly	04/13/06	14.6	108	9.8	96	6.3
Richardson Cr	NC 207	Union	07/19/06	22.6	170	1.8	21	5.8
Bearskin Cr	NC 200	Union	07/18/06	26.9	273	7.0	88	6.0
Salem Cr	SR 1006	Union	04/12/06	17.6	195	11.2	117	6.4
Cribs Cr	SR 1610	Anson	04/12/06	11.8	144	7.8	72	6.3
Lanes Cr	SR 1929	Union	04/12/06	15.2	158	11.5	115	6.2
Beaverdam Cr	SR 1005	Union	07/19/06	23.8	161	1.1	13	5.8
Hardy Cr	SR 1934	Stanly	04/13/06	18.9	109	11.0	118	6.2
03040201 Pee Dee River								
Cartledge Cr	SR 1142	Richmond	04/10/06	11.8	67	10.3	95	6.1
Hitchcock Cr	SR 1486	Richmond	04/24/06	20.8	18	7.8	87	5.2
Chock Cr	SR 1475	Richmond	04/25/06	19.4	30	8.2	89	5.9
Rocky Fork Cr	SR 1424	Richmond	04/24/06	18.2	23	8.3	88	6.2
Beaverdam Cr	SR 1486	Richmond	04/24/06	19.2	19	8.5	92	5.6
N Fk Jones Cr	SR 1121	Anson	04/11/06	11.6	86	7.8	72	6.9
Bailey Cr	SR 1811	Anson	04/10/06	16.1	90	10.3	105	6.1
S Fk Jones Cr	SR 1821	Anson	04/11/06	12.0	65	10.0	93	6.2
Mill Cr	SR 1826	Anson	04/11/06	14.4	58	9.9	97	6.3
Marks Cr	SR 1104	Richmond	04/25/06	18.9	49	6.8	73	5.8
Deadfall Cr	SR 1109	Anson	04/11/06	16.4	135	11.6	119	6.1

Conductivity (specific conductance) ranged from 18 µS/cm at Hitchcock Creek to 473 µS/cm at Crooked Creek (Table 1 and Figure 1). Elevated readings were associated with dischargers from upstream wastewater treatment plants (e.g., at Rich Fork, Hamby Creek, and Reedy Creek) or from nonpoint sources in urban runoff (e.g. at South Fork Muddy Creek, and Bearskin Creek). Conductivity was generally lower in streams draining more forested watersheds in the upper part of the basin (HUC 03040101-Yadkin River Headwaters) and the Sand Hills ecoregion, and greater in streams draining more agricultural and developed watersheds.

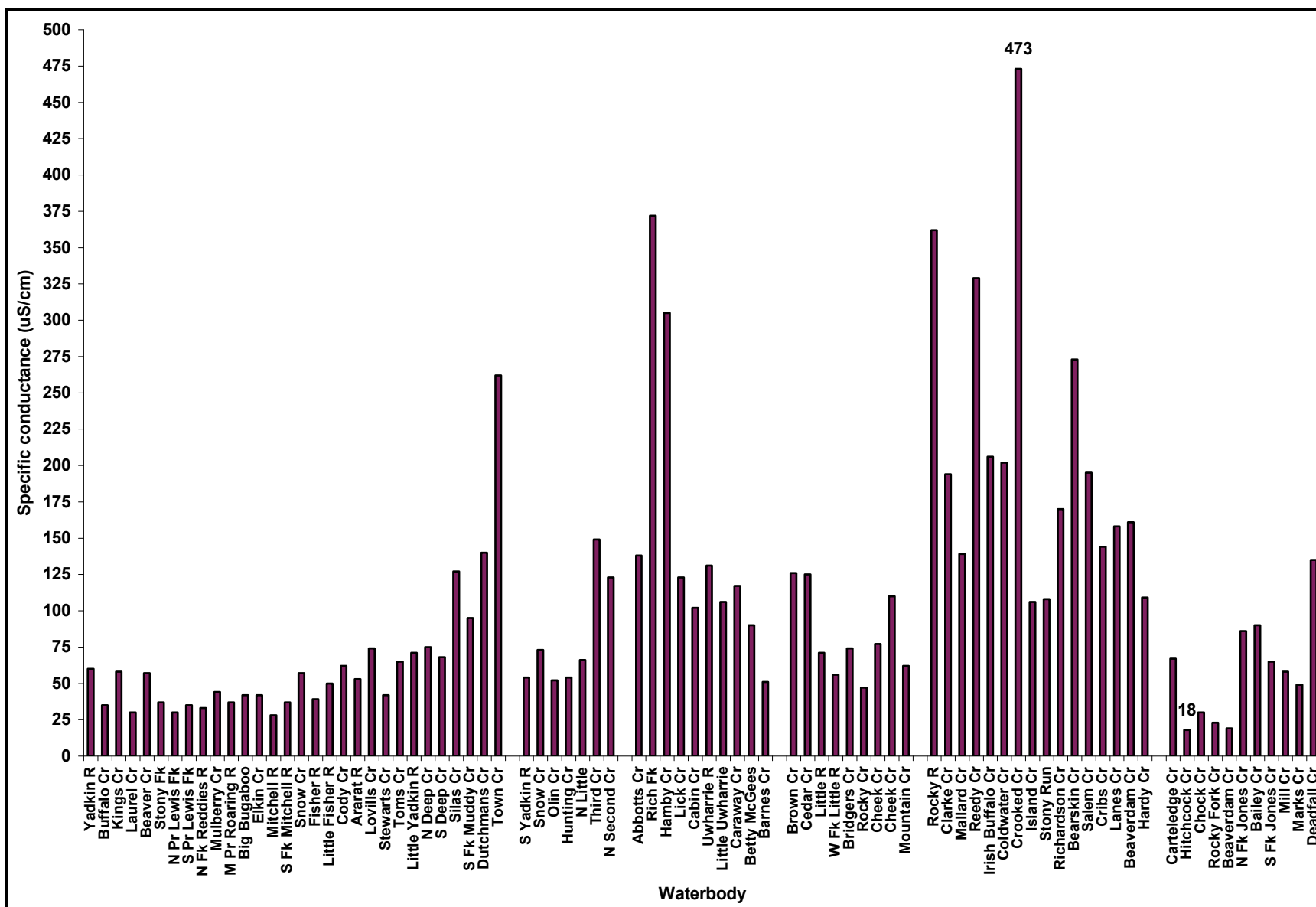


Figure 1. Specific conductance at 83 fish community sites in the Yadkin River basin, 2006.

Appendix F-8. Flow measurement and flow conditions in the Yadkin River basin.

During fish community sampling from early April to early August 2006 flows were generally less than median daily flows at nearby USGS gauge sites with occasional above median flows for short durations (Figures 1 – 6). During benthic macroinvertebrate sampling from June through August water levels were often above median flow.

However, even before the last basinwide monitoring cycle was completed in 2001, the Yadkin River basin had been experiencing a prolonged drought which started in 1998 and continued through 2002 (NCDENR 2002; Table 1; Figures 1- 6). The drought was abruptly halted by above normal precipitation in late 2002 and into 2003. Extremely high flows were then recorded in 2004. The drought was most severe during summer 2002 (Weaver 2002). The lowest daily mean discharges flows ever recorded occurred in August and September 2002 at several sites in the basin (Table 1). Figure 6 and to a lesser extent Figure 5 also show the extreme fluctuations in flows in streams that drain the Carolina Slate Belt ecoregion. Many of these streams in this ecoregion have a $7Q_{10} = 0$.

Table 1. Record-low daily mean discharges at select U. S. Geological Survey streamgaging stations. Data adopted from Weaver (2005).

Station, County	Drainage Area (mi ²)	Annual 90% exceedence flow (ft ³ /s)	Lowest Daily Mean Discharge			
			Prior to 1988		During 1998-2002	
			Water Year		Water Year	
			Min (ft ³ /s)	Date	Min (ft ³ /s)	Date
Yadkin R at Patterson, Caldwell	28.8	16	5.3	09/30/1954	3.6	09/12/2002
Elk Cr at Elkville, Wilkes	48.1	27	12	07/18/1988	7	08/13/2002
Reddies R at North Wilkesboro, Wilkes	89.2	57	23	08/17/1954	13	08/14/2002
Roaring River near Roaring River, Wilkes	128	72	32	08/27/1988	14	08/15/2002
Yadkin R at Elkin, Yadkin	869	560	246	08/31/1988	193	09/13/2002
Mitchell R near State Road, Surry	78.8	53	23	08/27/1988	15	09/12/2002
Fisher R at Copeland, Surry	128	65	13	08/28/1981	11	09/12/2002
Ararat r at Ararat, Surry	231	116	21	08/29/1981	13	08/21/2002
Little Yadkin R at Dalton, Stokes	42.8	12	1.6	08/02/1977	1.4	09/14/2002
Yadkin R at Enon, Forsyth	1,694	970	368	09/01/1981	264	09/02/2002
Yadkin R at Yadkin College, Davie	2,280	1,170	350	08/28/1988	236	08/12/2002
S Yadkin R near Mocksville, Rowan	306	112	22	07/22/1986	3	08/13/2002
Hunting Cr near Harmony, Iredell	155	67	22	08/16/1956	5.4	09/13/2002
Second Cr near Barber, Rowan	118	17	5.0	10/06/1986	1.1	09/12/2002
Dutchmans Cr near Uwharrie, Montgomery	3.4	0.3	0.01	07/15/1986	0	06/22/2002
Little R near Star, Montgomery	106	8.8	0.27	10/04/1968	0	08/12/2002
Drowning Cr near Hoffman, Richmond	183	75	20	07/09/1988	0	08/14/2002

During the drought, many of the streams draining smaller Piedmont watersheds (i.e., those in the Northern Inner Piedmont, Southern Outer Piedmont, Triassic Basins, and the Carolina Slate Belt) went completely dry or became a series of isolated pools with subsurface flows. A fish community's recovery is affected by the limited avenues available for recolonization, proximity to riverine reservoirs such as Yadkin-Pee Dee Chain of Lakes, blockage of upstream migration routes by hydroelectric and old mill dams, and by the lack of larger nearby tributaries as recolonization sources. Run-of-the-river reservoirs, even those on short reaches of rivers, can be inhospitable for many of the smaller species such as darters and shiners. Many of these species also have limited home ranges and are not migratory.

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 flows 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 - 140% 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.

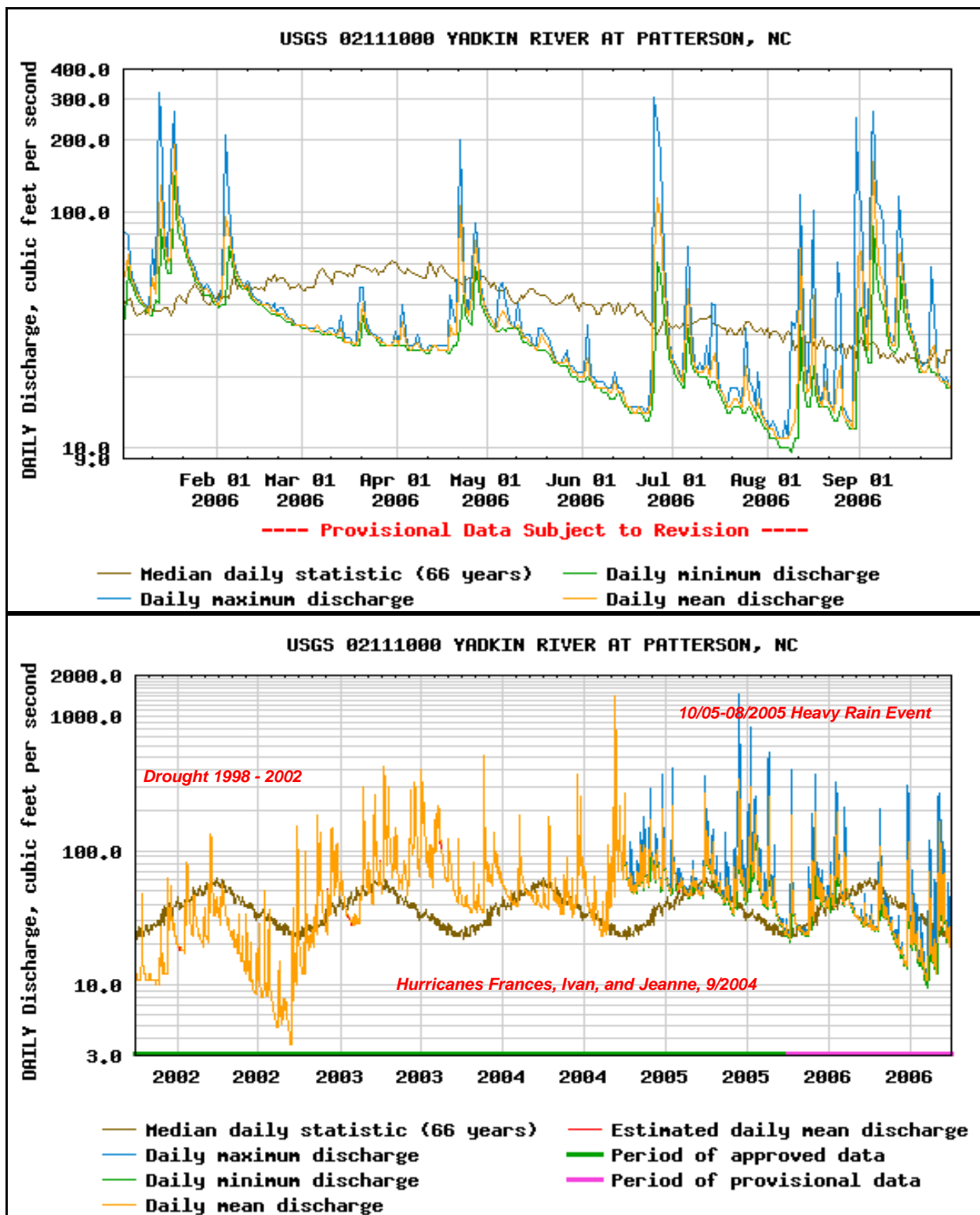


Figure 1. Flows in the Yadkin River at Patterson, January 01, 2006 – September 30, 2006 (top) and September 30, 2001 to September 30, 2006 (bottom).

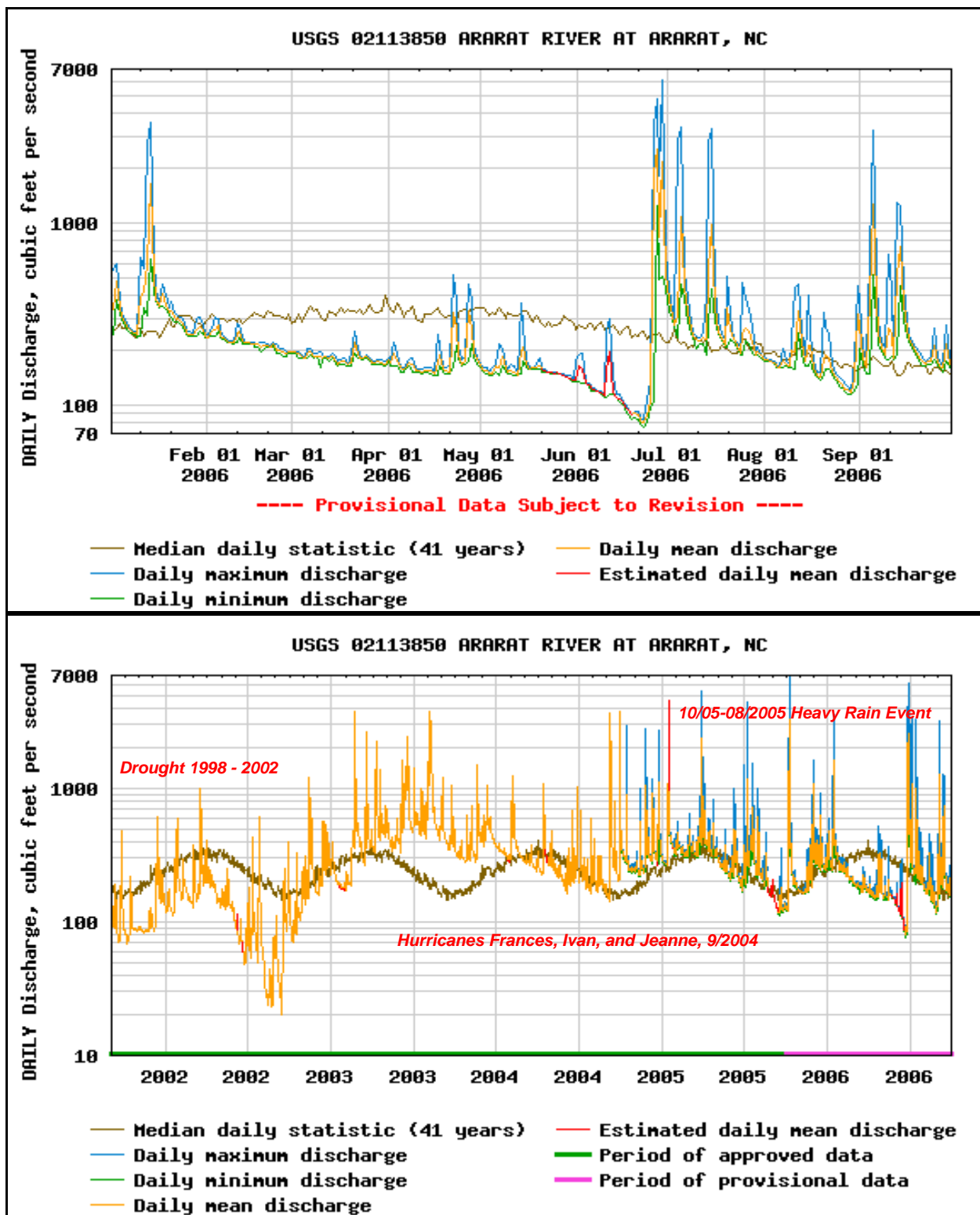


Figure 2. Flows in the Ararat River at Ararat, January 01, 2006 – September 30, 2006 (top) and September 30, 2001 to September 30, 2006 (bottom).

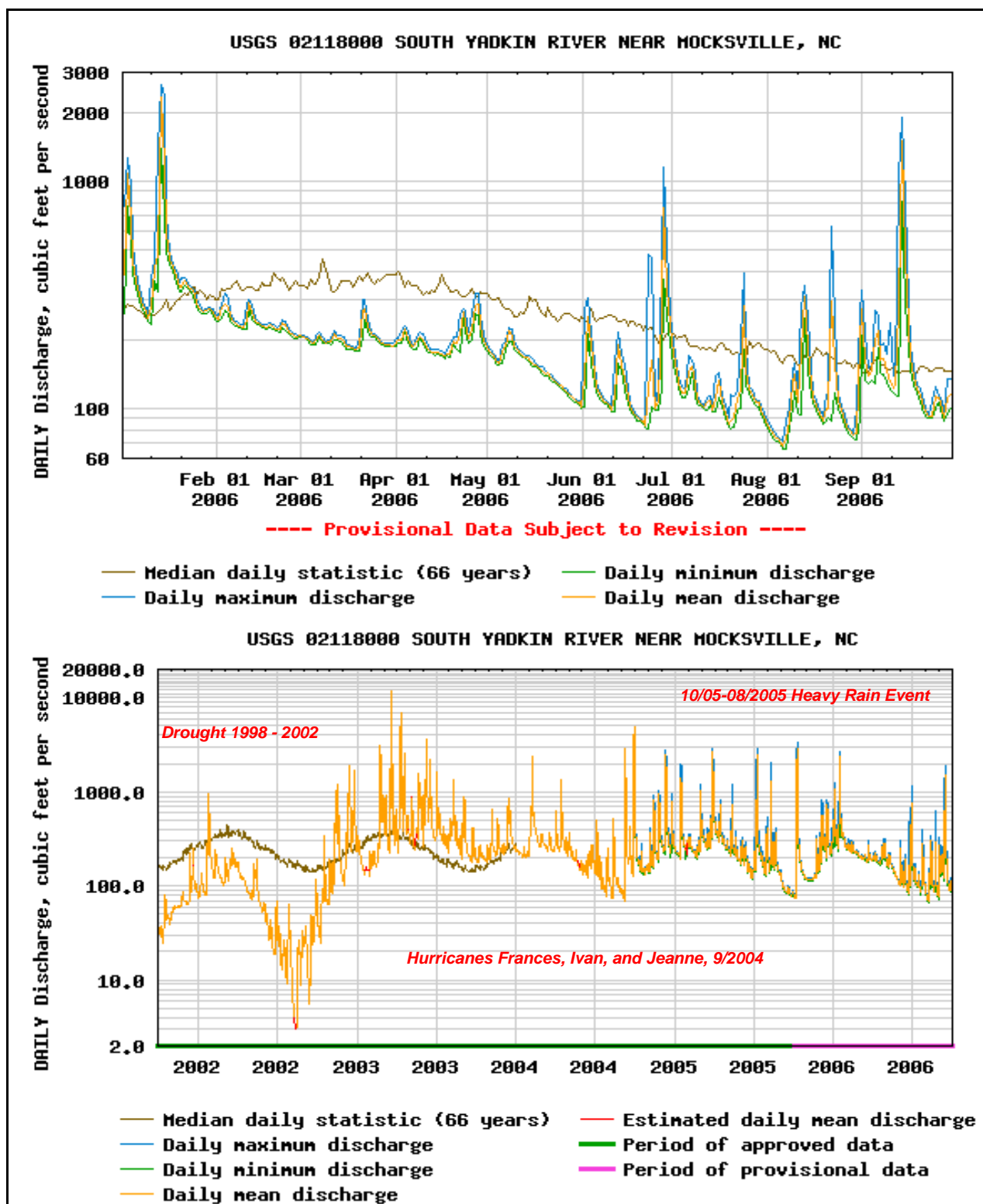


Figure 3. Flows in the South Yadkin River near Mocksville, January 01, 2006 – September 30, 2006 (top) and September 30, 2001 to September 30, 2006 (bottom).

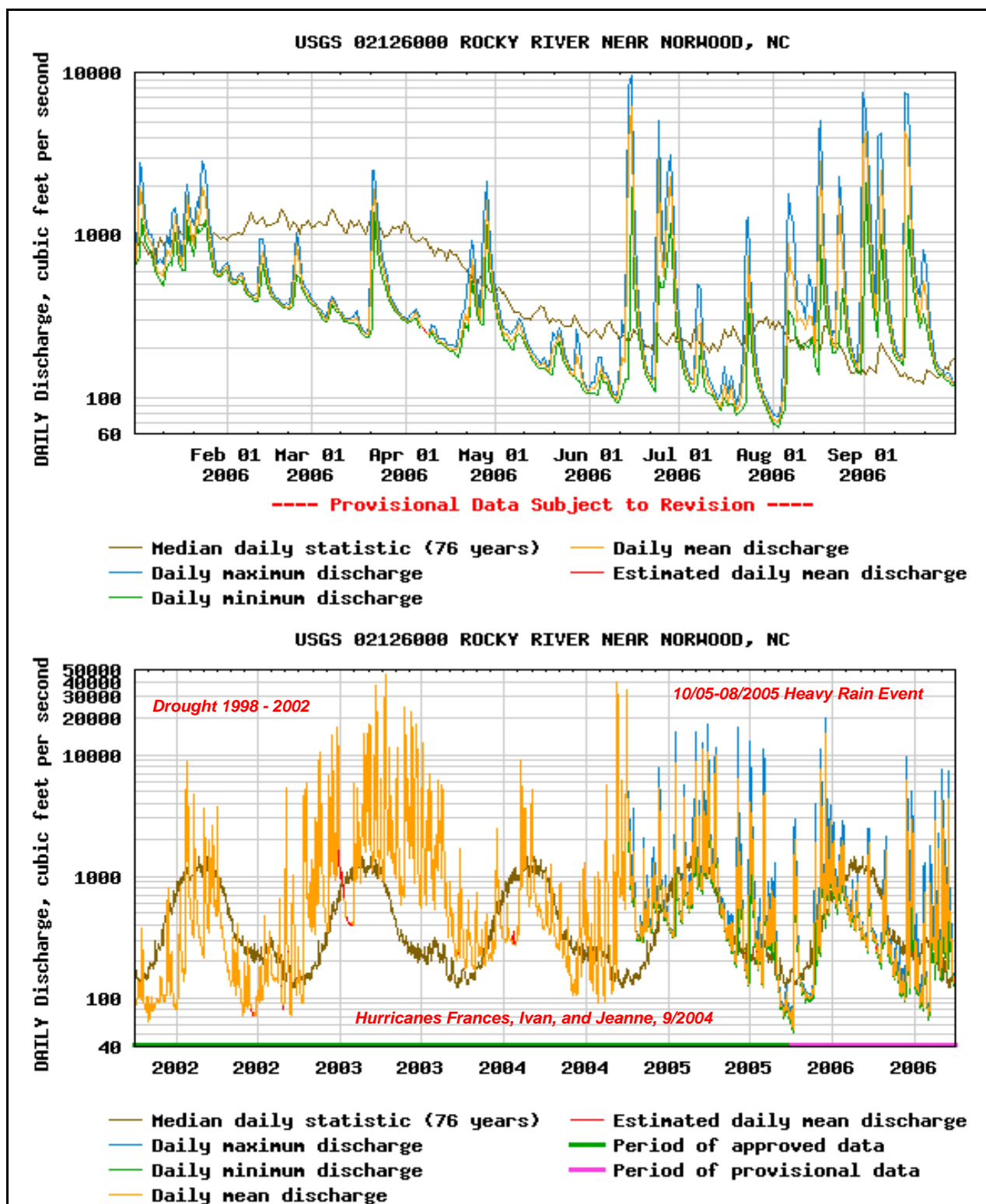


Figure 4. Flows in the Rocky River near Norwood, January 01, 2006 – September 30, 2006 (top) and September 30, 2001 to September 30, 2006 (bottom).

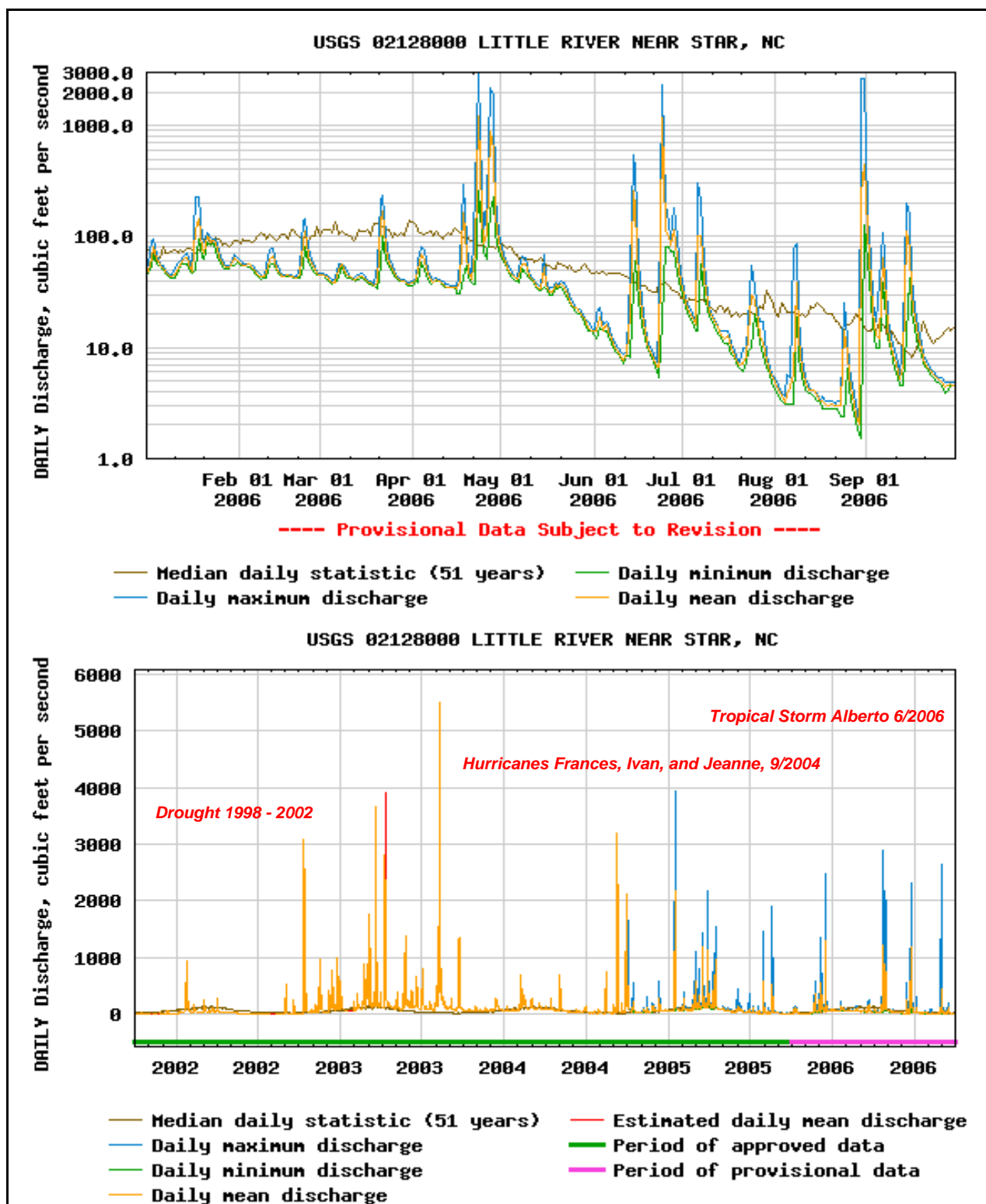


Figure 5. Flows in the Little River near Star, January 01, 2006 – September 30, 2006 (top) and September 30, 2001 to September 30, 2006 (bottom).

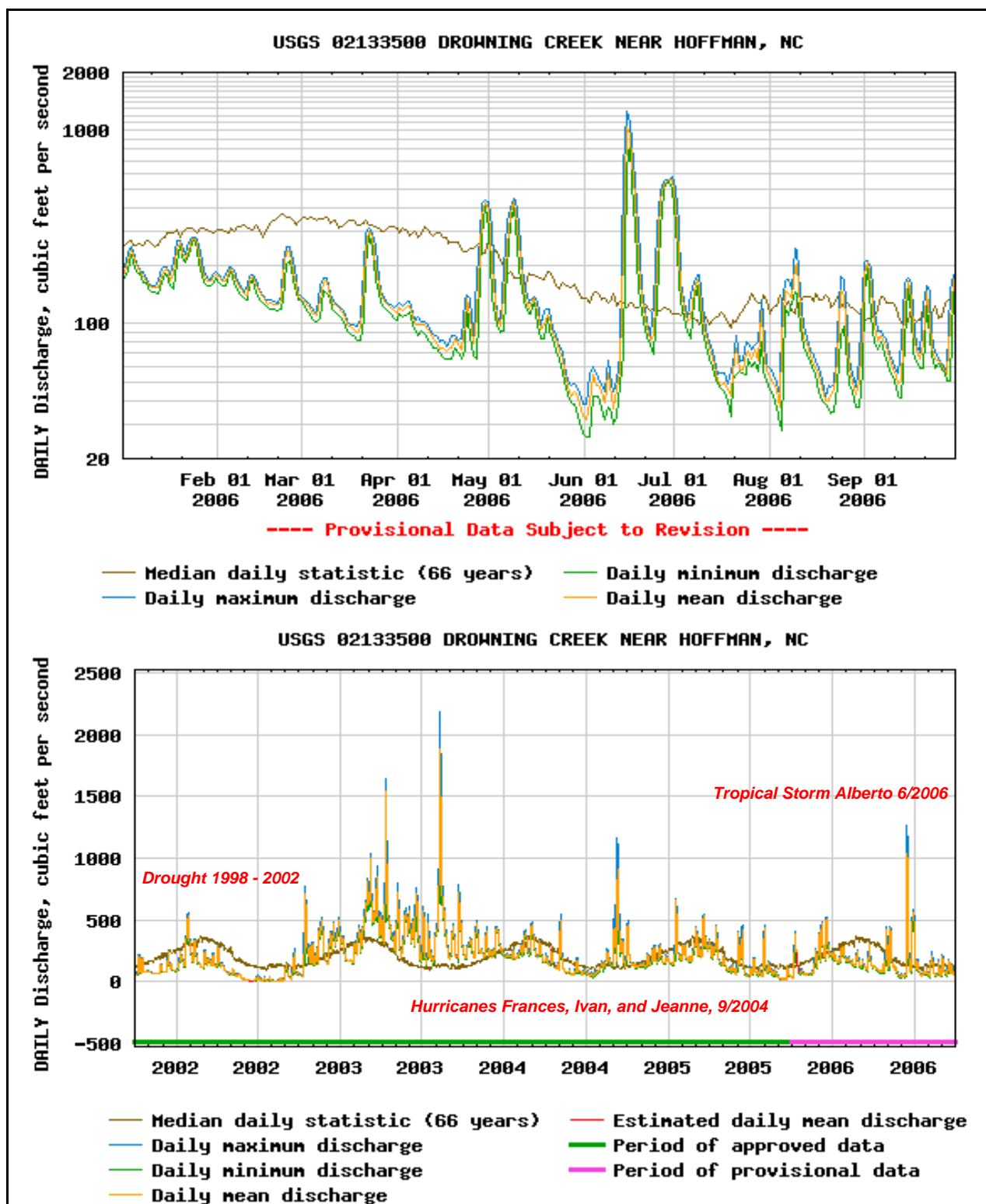


Figure 6. Flows in Drowning Creek near Hoffman, January 01, 2006 – September 30, 2006 (top) and September 30, 2001 to September 30, 2006 (bottom).

Appendix F-9. Web links.

NC Division of Water Quality, Stream Fish Community Assessment (including Habitat Assessment)
Standard Operating Procedures
<http://www.esb.enr.state.nc.us/BAU.html>

NC Division of Water Resources, Drought Monitoring
http://www.ncwater.org/Drought_Monitoring/

NC Division of Water Quality (native and exotic freshwater fish in North Carolina)
http://www.esb.enr.state.nc.us/www.esb.enr.state.nc.us/Native_and_Introduced_Freshwater_Fish_in_North_Carolina.2-1.htm

National Weather Service and North Carolina State University's Marine, Earth, and Atmospheric Sciences
Case Studies
<http://www.meas.ncsu.edu/nws/www/cases/>

US Geological Survey (real-time streamflow data for North Carolina)
<http://waterdata.usgs.gov/nc/nwis/current?type=flow>

Appendix F-10. Fish community references.

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Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	SR 1372	06/05/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CALDWELL	1	03040101	12-(1)	360514	813556

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Crystalline Ridges and Mountains	C; Tr	9.2	3	0.3

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)	17.1
Dissolved Oxygen (mg/L)	9.2
Specific Conductance (µS/cm)	44
pH (s.u.)	6.7
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	3
Right Bank Stability (7)	7
Light Penetration (10)	3
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	84

Site Photograph



Substrate	mostly cobble, boulder, gravel; some bedrock, sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/05/06	9939	-	43	-	2.67	Excellent
07/27/01	8525	-	33	-	3.50	Good

Taxonomic Analysis

The number of Trichoptera taxa doubled, from six in 2001 to 12 in 2006; four taxa not present in 2001 were common or abundant in 2006: *Lepidostoma*, *Dolophilodes*, *Polycentropus*, and *Rhyacophila fuscata*. The mayfly community differed somewhat between the two sampling events, and had a net addition of two taxa in 2006. The stonefly community was very similar in 2001 and 2006; the most notable addition was *Isoperla holochlora*, which was absent in 2001 and abundant in 2006.

Data Analysis

The site is 5.5 miles SE of Blowing Rock NC; the drainage area includes the watersheds of Ooten, Bailey Camp and Dennis Creeks. It was suggested in the prior BAU report that water quality in the catchment has been improving since 1988 when sampling occurred near the mouth of Dennis Creek and about 1 mile downstream of the present site on Yadkin River; both sites received ratings of Good-Fair in that year. The Excellent classification in 2006 provides support for the trend towards better water quality in the upper Yadkin River watershed.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	NC 268, Patterson	06/06/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CALDWELL	1	03040101	12-(1)	355930	813329

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Eastern Blue Ridge Foothills	C; Tr	28.6	10	0.5

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Omni Supply	NC0006254	0.45
Caldwell County Schools	NC0041181	0.008

Water Quality Parameters

Temperature (°C)	16.1
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	51
pH (s.u.)	6.5

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	73

Site Photograph



Substrate	mostly bedrock, boulder, sand; some cobble, gravel, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/06/06	9940	112	33	5.32	4.22	Good-Fair
08/30/01	8619	69	24	5.53	4.69	Good-Fair
07/22/96	7107	102	41	4.55	3.75	Good
07/10/90	5373	87	38	4.89	3.92	Good
08/04/87	4181	87	37	5.24	4.39	Good
08/06/85	3544	76	24	6.03	4.27	Good-Fair

Taxonomic Analysis

EPT richness was much lower in 2001 than 1996, but increased in 2006. Trichoptera richness took a particularly hard hit between 1996 and 2001, from 16 taxa down to seven; in 2006 the number was still low with eight caddisfly taxa collected. Between 1987 and 1996 there were six or seven hydropsychid taxa present at each sampling event; in two were present in 2001 and three in 2006. *Polycentropus* were either common or abundant prior to 2001, but rare in both 2001 and 2006.

Data Analysis

The site is located next to a USGS gauging station on Yadkin River near Patterson. Good-Fair ratings at the site in both 2001 and 2006 may be the result of road projects on NC 321; better erosion control in 2006 may be resulting in better values over 2001 for EPT richness and NCBI.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Yadkin R	NC 268 (Legerwood)	08/02/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Caldwell	1	03040101	360048	813030	12-(1)	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,Tr	85.2	1150	11	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	35	---	65	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Patterson School (100% domestic, 1 mile above site)	NC0043125	0.025

Water Quality Parameters

Temperature (°C)	24.5
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	60
pH (s.u.)	5.9

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	11
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	67

Site Photograph



Substrate

gravel, cobble, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/02/06	2006-106	22	48	Good
06/18/01	2001-60	20	48	Good
05/23/96	96-61	22	48	Good

Most Abundant Species

Bluehead Chub

Exotic Species

Central Stoneroller, Warpaint Shiner

Species Change Since Last Cycle

Gains -- Gizzard Shad, Rosyside Dace, Whitefin Shiner. Losses -- Striped Jumprock

Data Analysis

Watershed -- drains the extreme western headwater portion of the Yadkin River in northeast Caldwell County, including the municipalities of Patterson and Legerwood. **Habitats** -- runs, riffles, car snags (old bank stabilization), woody snags, no true pools; narrow riparian zones; low flow. **2006** -- moderate abundances, but good diversity of fish community; total of 24 species collected with Smallmouth Bass and Flat Bullhead counted (young-of-year representation only). **1996-2006** -- 26 species have been collected from this site; stable darter populations with same three species; Redbreast Sunfish is the one consistent sunfish present; declining number of sucker species in three assessments (5,4,3, respectively); same four intolerant species collected; no trout collected in 1996, 2001, or 2006; identical NCIBI scores and ratings over a ten year period.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	NC 18/268	06/08/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-(38)	360909	810845

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	500	30	0.4

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	10	80	10	0

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

Water Quality Parameters

Temperature (°C)	18.9
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	41
pH (s.u.)	6.6

Water Clarity	slightly turbid
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Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	0
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	59

Substrate	mostly cobble with some gravel and sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/08/06	9950	114	46	4.61	3.69	Excellent
07/25/01	8516	94	32	5.31	4.41	Good-Fair
07/24/96	7116	72	39	5.03	4.01	Good
06/07/93	6181	73	34	5.50	4.47	Good-Fair
08/10/89	5047	75	35	4.76	4.22	Good

Taxonomic Analysis

In 2006 the site had the highest number of EPT taxa than for any prior sampling event, with the next greatest number of 39 EPT taxa occurring in 1996. In fact, each of the three orders were higher in 2006 than for any previous year; seasonality does not account for the high numbers of those taxa seen. Four taxa were either common or abundant in 2006 and unrecorded for previous years: *Agnatina*, *Ceraclea ancylus*, *Neophylax fuscus*, and *Neophylax oligius*. The decrease in NCBI and EPT BI between 2001 and 2006 is due in large part to several taxa intolerant to the presence of stressors that were either common or abundant in 2006 and absent in 2001: *Drunella tubercalata*, *Serratella deficiens*, *Serratella molita*, *Agnatina*, *Pteronarcys*, *Ceraclea ancylus*, *Neophylax fuscus*, and *Neophylax oligius*.

Data Analysis

The site was sampled about 300 feet downstream of the NC 18/268 bridge at Wilksboro NC. The site has been sampled ten times since 1984. On seven of those occasions the site received a rating of Good-Fair, and at three other times a rating of Good. Only after the most recent sampling event in 2006 has the site received a classification of Excellent. In addition to having the highest number of EPT taxa in 2006, the site in 2006 also had the lowest NCBI and EPT BI values. The sedimentation and large amounts of filamentous algae noted in 2001 were not seen in 2006 and are likely significant for the results from the benthic data seen in 2006.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	US 21	08/07/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
YADKIN	2	03040101	12-(53)	361427	805057

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	828.2	50	1

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Louisiana Pacific Corp - ABTCO (approximately 15.5 miles upstream)	NC0005266	1
North Wilkesboro WWTP (approximately 22.5 miles upstream)	NC0020761	2
Wilkesboro WWTP (approximately 23.6 miles upstream)	NC0021717	4.9

Water Quality Parameters

Temperature (°C)	26
Dissolved Oxygen (mg/L)	6.9
Specific Conductance (µS/cm)	57
pH (s.u.)	6.2

Water Clarity

turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	0
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	2
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	52

Site Photograph



Substrate

Gravel, rubble, sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/07/06	10006	82	35	4.9	3.9	Good
08/06/01	8562	65	30	4.7	3.8	Good
07/23/96	7094	56	23	5.4	4.4	Good-Fair

Taxonomic Analysis

Total taxa collected in 2006 increased relative to 2001, mostly due to more midge species, though the sensitivity of the overall community decreased slightly. Trichopteran taxa collected in 2006 including *Brachycentrus*, *Ceraclea*, and *Micrasema* indicate that species absent in 2001 may have been the result of droughts and decreased habitat available that year. Amphipod and isopod species collected in 2006 may support the assumption that additional organic leaf litter along the edges of the river provided better habitat during this period.

Data Analysis

This relatively urban site, bounded by the towns of Elkin and Jonesville has had biological results that suggest relatively stable water quality conditions and even improvement on a ten-year scale. At the head of subbasin 2, the drainage immediately upstream of this wide site is predominately rural once it passes Wilkesboro 22 miles upstream. The site offers fairly homogenous gravel/sand habitat with little riparian canopy and few pools.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	SR 1003	08/09/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-(53)	361655	803351

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	1227.8	70	0.3

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

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

Water Quality Parameters

Temperature (°C)	26.3
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	60
pH (s.u.)	6.9
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	8
Pool Variety (10)	0
Riffle Habitat (16)	7
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	53

Substrate	Gravel, boulder, sand, bedrock
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10013	78	29	5.3	4.2	Good-Fair
08/07/01	8569	65	30	4.5	3.8	Good
07/27/96	7078	62	30	5.4	4.6	Good-Fair

Taxonomic Analysis

Total taxa at this site increased relative to the previous (2001) sampling event, mostly by a large increase in chironomid taxa. At the same time, the biotic index of the site increased from 4.54 to 5.25, helping to reduce the site's bioclassification from Good in 2001 to the current Good-Fair rating. The relative abundance of tolerant organisms like *Larsia*, *Argia*, *Plauditus dubius* and the absence/paucity of sensitive taxa previously present like *Protophila* and *Promoresia elegans* helped foment this change.

Data Analysis

This site is located between the confluences of the Fisher and Ararat rivers and receives 1228 square miles of drainage at this point. The River is wide and flowing over a short, exposed area of riffle/bedrock. Though benthos results seem relatively stable over time, hovering in the Good to Good-Fair range, the current rating shows a trend toward a more tolerant community of organisms.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	SR 1447	08/09/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	4	03040101	12-(97.5)	355140	802315

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-IV	2160.6	50	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Winston-Salem Muddy Creek WWTP	NC0050342	21.0

Water Quality Parameters

Temperature (°C)	28.2
Dissolved Oxygen (mg/L)	6.5
Specific Conductance (µS/cm)	118
pH (s.u.)	6.5
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	11
Pool Variety (10)	5
Riffle Habitat (16)	9
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	70

Substrate	cobble, gravel and sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10045	85	33	5.4	4.3	Good
09/12/01	8631	67	29	5.5	4.6	Good
07/09/90	5368	64	27	5.5	4.6	Good
08/05/86	3898	67	26	5.8	4.8	Good
09/09/85	3670	60	23	5.7	4.5	Good

Taxonomic Analysis

The number of EPT species collected has risen slightly every collection year since 1985 to the current number of 33 taxa. Additionally, the BI has decreased slightly over the same period. This site on the Yadkin River was not sampled in 1996 due to high flows. Three intolerant species were abundant in 2006, a mayfly (*Heptagenia*) and two caddisflies (*Brachycentrus numerosus* and *Protoptila*). Of note is the fact that more relatively intolerant taxa were abundant than tolerant taxa. As in 2001, three stonefly species were present though were rare.

Data Analysis

This site is approximately 10 miles downstream from the confluence with Muddy Creek and the outfall to the Muddy Creek WWTP. The large urban area of Winston-Salem drains into the Yadkin via Muddy Creek and therefore has the potential to affect water quality, particularly during low flows. Water quality, however, has remained good since 1985 indicating substantial dilution effect of water received from upstream of Muddy Creek. Another contributing factor to the high EPT count is the high amount of favorable habitat available for colonization.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Buffalo Cr	SR 1594	08/03/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Caldwell	1	03040101	360246	813149	12-19	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,Tr	29.8	1230	13	0.3	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	95	---	---	5 (camp lawns)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	22.6
Dissolved Oxygen (mg/L)	7.4
Specific Conductance (µS/cm)	35
pH (s.u.)	7.0

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	91

Site Photograph



Substrate

cobble, boulder, bedrock shelves

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/03/06	2006-108	13	52	Good
06/08/99	99-42	15	56	Excellent

Most Abundant Species

Bluehead Chub

Exotic Species

Striped Jumprock, Smallmouth Bass, Central Stoneroller, Warpaint Shiner, Brown Trout

Species Change Since Last Cycle

Losses -- White Sucker, Sandbar Shiner, Piedmont Darter Gains -- Brown Trout

Data Analysis

Watershed -- drains the extreme northeast corner of Caldwell County, and the extreme southeast corner of Watauga County; site location is at Camp Carolwood. **Habitats** -- high quality; runs, riffles, plunge pools; good riparian; low flow. **2006** -- 16 species collected including three that were only represented by young-of-year fish (White Sucker, Piedmont Darter, and Creek Chub); 77% of species with multiple age groups. **1999-2006** -- total of 17 species collected from this site; slight drop in NCIBI score and rating from 1999 special study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
BUFFALO CR	SR 1505	06/06/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CALDWELL	1	03040101	12-19	360143	813045

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Crystalline Ridges and Mountains	C; Tr	32.2	12	0.5

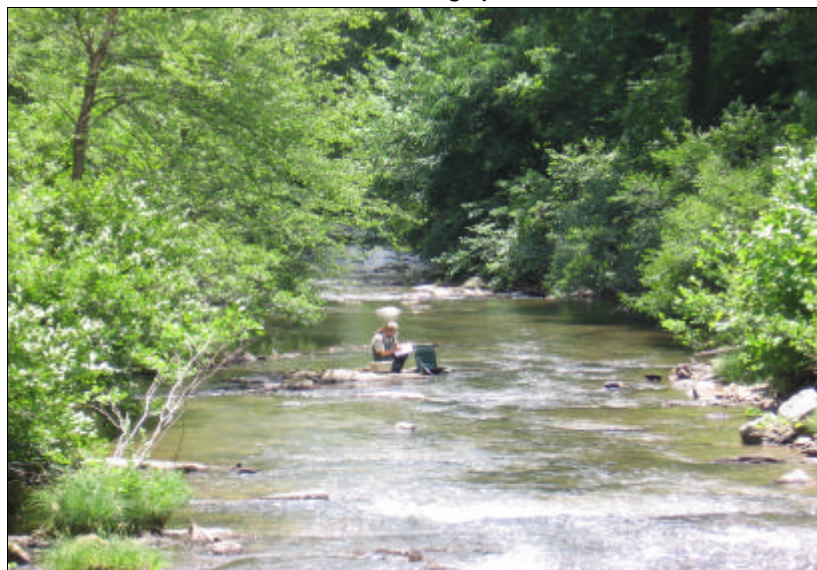
Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	0	0	0

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)	9.6
Specific Conductance (µS/cm)	29
pH (s.u.)	6.6
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
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)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	82

Substrate	bedrock and a mix of boulder, cobble, sand and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/06/06	9942	-	48	-	3.36	Excellent
08/30/01	8620	-	43	-	3.88	Excellent
07/22/96	7108	-	40	-	3.65	Excellent

Taxonomic Analysis

EPT richness increased in both 2001 and 2006. In 2006 the increase occurred in spite of the fewest number of recorded caddisfly taxa for the site; both mayfly and stonefly richness were higher in 2006 than for the two prior sampling events. Seasonality is playing a role in increased mayfly and stonefly richness; five taxa identified by the BAU as winter seasonal (*Dannella simplex*, *Drunella walkeri*, *Eurylophella verisimilis*, *Haploperla brevis*, and *Isoperla transmarina*) were present in the June sample in 2006 and absent in later season samples in 1996 and 2001. Three taxa were abundant in 2006 though unrecorded in prior samples: *Drunella cornutella*, *Maccaffertium ithaca*, and *Dolophilodes*. Though either common or abundant in 1996 and 2001, no *Micrasema* were identified from the site in 2006.

Data Analysis

The site is eight miles north of Lenoir NC, one mile south of the summit of Winding Stairs Mountain, about one mile above the confluence of Buffalo Creek and Yadkin River, and about 450 feet below a small impoundment. The highest EPT richness and the lowest EPT BI were recorded for the site in 2006. No water quality problems are indicated by the benthic community.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
KINGS CR	SR 1552	06/07/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CALDWELL	1	03040101	12-23	360234	812453

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C; Tr	25.8	12	0.4

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)	15.5
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	51
pH (s.u.)	6.7
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	4
Total Habitat Score (100)	57

Substrate	mostly sand and silt with a small amount of gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/07/06	9946	-	28	-	4.19	Good

Taxonomic Analysis

The presence of *Brachycercus* spp. and *Caenis* spp. (both common) is a benthic reflection of the silt and sand substrate. A species of *Pteronarcys* was abundant suggesting stability of water quality and habitat at the site. Other abundant taxa were: *Baetis intercalaris*, *Plauditus dubius* group, *Serratella deficiens*, *Serratella serrata*, *Maccaffertium modestum*, *Isonychia*, *Perlesta*, *Ceratopsyche bronta*, *Ceratopsyche sparna*, *Cheumatopsyche*, and *Neophylax oligius*.

Data Analysis

The site is about 11 miles NE of Lenoir NC and one stream mile above the confluence with Yadkin River. The drainage area captures much of the region between Brushy Mountains and Yadkin River in Caldwell County. This is the first year for a benthic collection on the stream. Though the site classified as Good, one taxon fewer would have resulted in a classification of Good-Fair. Habitat homogeneity resulting from a dominance of silt and sand as the bottom substrate is very likely depressing richness at the site. The EPT BI was relatively high; of the ten EPT samples collected in Yadkin River subbasin 01 in 2006, only the basinwide site at Moravian Creek was higher.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Kings Cr	SR 1552	06/23/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Caldwell	1	03040101	360235	812453	12-23	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,Tr	27.6	1075	8	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	19.4
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	58
pH (s.u.)	6.0

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	14
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	65

Site Photograph



Substrate

gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/06	2006-95	21	54	Excellent

Most Abundant Species

Bluehead Chub

Exotic Species

Striped Jumprock, Central Stoneroller,
Warpaint Shiner, Brown Trout

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- drains the northeast corner of Caldwell County. **Habitats** -- borderline between Piedmont and Mountains (Eastern Blue Ridge Foothills); snags, gravel riffles, undercuts, few side snag pools; riprap on left to stabilize banks leading to corn fields; tires in stream throughout sample reach, trash dump at upper end. **2006** -- first fish community sample at this location; good abundance (n=599) and diversity with three darter species, two sunfish, one bass, and one trout species, three sucker species, and two intolerant species; slightly skewed trophic structure towards Omnivores+Herbivores (Bluehead Chub = 41% of sample); large suckers collected with high biomass.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ELK CR	SR 1175	06/07/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-24-(10)	360623	812617

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Crystalline Ridges and Mountains	B; ORW	43.2	18	0.4

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)	21
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	36
pH (s.u.)	6.9
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	13
Pool Variety (10)	5
Riffle Habitat (16)	12
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	79

Substrate	mix of boulder, cobble, gravel, sand, and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/07/06	9948	135	62	4.26	3.53	Excellent
08/29/01	8618	100	43	4.64	3.68	Good
07/22/96	7109	85	42	4.68	3.90	Good
07/29/88	4643	96	47	4.52	3.52	Excellent
08/06/85	3545	107	44	4.73	3.73	Good

Taxonomic Analysis

The highest number of EPT taxa in Yadkin River basin in 2006 were collected at the site, far exceeding the next highest number of 53 EPT taxa collected at three other sites. Seasonality is playing only a small role in the high number of EPT taxa collected in 2006; three taxa identified as winter seasonal (*Eurylophella aestiva*, *Isoperla transmarina*, and *Apatania*) were collected in the early June sample in 2006 and not collected previously in later season samples. Several EPT taxa were identified from the site for the first time in 2006 and were either common or abundant: *Heterocloeon curiosum*, *Plauditus dubius* group, *Procloeon*, *Drunella tuberculata*, *Eurylophella aestiva*, *Serratella serrata*, *Apatania*, and *Paranyctiophylax nephophilus*.

Data Analysis

The site is 14.5 miles NNE of Lenoir NC, about 4.5 stream miles above the confluence with Yadkin River, and between Elk and County Line Ridges. High numbers of EPT taxa and specimens collected places the site into the Excellent category for 2006; the NCBI is somewhat high for the category, indicating a relatively tolerant community considering the Excellent classification. However, the highest number of EPT taxa and the lowest NCBI value were recorded for the site in 2006, possibly indicating an improvement in water quality.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LAUREL CR	SR 1508	06/07/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WATAUGA	1	03040101	12-24-8	360941	813013

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Crystalline Ridges and Mountains	C; Tr, ORW	8.3	7	0.4

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)	16.9
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	26
pH (s.u.)	6.9
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	14
Pool Variety (10)	9
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)	5
Total Habitat Score (100)	96

Site Photograph



Substrate	relatively even mix of boulder, cobble, gravel, sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/07/06	9947	-	47	-	2.82	Excellent

Taxonomic Analysis

Several taxa uncommonly collected in North Carolina were present at the site: *Habrophlebia vibrans*, *Rhithrogena exilis*, *R. uhari*, *Acroneuria carolinensis*, and *Apatania*. In addition, one stonefly rarely collected in the state was present: *Acroneuria evoluta*. Abundant taxa were: *Baetis flavistriga*, *Baetis intercalaris*, *Drunella cornutella*, *Epeorus rubidus*, *Leucrocota*, *Maccaffertium ithaca*, *Paraleptophlebia*, *Leuctra*, *Tallaperla*, *Acroneuria abnormis*, *Perlesta*, *Isoperla holochlora*, and *Neophylax oligius*.

Data Analysis

The site is about 10 miles ESE of Boone NC and about 450 feet above the confluence with Elk Creek. A portion of the drainage area coincides with a portion of the proposed 6000-acre Laurelmor Resort. Laurel Creek and all of its tributaries are classified as Outstanding Resource Waters. Good habitat diversity was reflected by the high number of EPT taxa collected. The site had been sampled once before, in December 1987, at which time it received a classification of Excellent. EPT richness was slightly higher in summer 2006 than winter 1987 (47 versus 45), contrary to the expectations of higher diversity in winter. In neither year did the benthic macroinvertebrate community show indications of impact at the site. The site supports a diverse and pollution-intolerant assemblage of macroinvertebrate species.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Laurel Cr	SR 1508	08/03/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Watauga	1	03040101	360942	813012	12-24-8	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,Tr,ORW	7.8	1430	10	0.3	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	85	---	---	15 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	22.3
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	30
pH (s.u.)	5.8

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	92

Site Photograph



Substrate

cobble, boulder, gravel, sand, silt, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/03/06	2006-109	13	48	Good
05/05/99	99-31	13	52	Good
10/01/98	98-80	14	54	Excellent
05/23/96	96-62	14	54	Excellent

Most Abundant Species

Central Stoneroller

Exotic Species

Rock Bass, Smallmouth Bass, Central Stoneroller, Warpaint Shiner, Brown Trout

Species Change Since Last Cycle

Gains -- Notchlip Redhorse, Warpaint Shiner Losses -- White Sucker, Striped Jumprock

Data Analysis

Watershed -- drains the rural area of eastern-central Watauga County; watershed is part of the Powderhorn Development; three small impoundments in the upstream watershed. **Habitats** -- runs, riffles, pools; *Rhododendron* and Hemlock-lined; water was clear, but became very silty during sampling. **2006** -- fewer fish than all previous samples (n=128 vs. 494 in 1999, 737 in 1998, and 280 in 1996); Redlip Shiner numbers very low (n=5 vs. 88 in 1999, 259 in 1998, and 125 in 1996); much higher percentage of piscivores collected (~15%) including large specimens of Smallmouth Bass, Rock Bass, and Brown Trout; fewer Stonerollers than in 1999; Warpaint Shiner is new. **1996-2006** -- consistently high habitat scores; fluctuation of trophic structure over ten year period; steady drop in NCIBI score since the 1998 assessment; stream appears to be siltier than in past assessments; the three upstream impoundments have no minimum flow requirements which may reduce flow in this watershed during periods of drought.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Beaver Cr	SR 1131	06/22/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	360428	812110	12-25	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,Tr	17.4	---	9	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	30	---	60	10 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	23.0
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	57
pH (s.u.)	5.8

Water Clarity	Slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	50

Site Photograph



Substrate	sand, bedrock
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/06	2006-94	18	52	Good
06/18/01	2001-61	19	50	Good
05/21/96	96-56	14	50	Good

Most Abundant Species	Bluehead Chub	Exotic Species	Striped Jumprock, Central Stoneroller
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Species Change Since Last Cycle	Losses -- Brown Trout, Gains -- none.
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Data Analysis

Watershed -- drains the southernmost tip of Wilkes County and a small section of northeast Caldwell County; a tributary to W. Scott Kerr Reservoir. **Habitats** -- lots of deadfalls, sandy shallow runs; severe erosion along left bank, corn field above left bank. **2006** -- good diversity with two darter species, four sunfish and one bass species, three sucker species, and one intolerant species; the trophic structure was slightly skewed towards Omnivores+Herbivores (Bluehead Chub = 33% of sample). **1996-2006** -- there are 20 species known from this site; excluding the one Brown Trout collected in 2001 and the one Common Carp collected in 1996, the list of collected species has not changed; consistently low habitat scores (49-50 total score), but stable NCIBI metrics and the same water quality rating over a ten year period.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Stony Fk	SR 1170	06/23/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	360741	812343	12-26-(7)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	25.8	1150	11	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	45	---	50	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	21.5
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	37
pH (s.u.)	6.1

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	16
Left Bank Stability (7)	4
Right Bank Stability (7)	1
Light Penetration (10)	5
Left Riparian Score (5)	3
Right Riparian Score (5)	0
Total Habitat Score (100)	66

Site Photograph



Substrate

cobble, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/06	2006-96	18	54	Excellent

Most Abundant Species

Bluehead Chub

Exotic Species

Striped Jumprock, Rock Bass, Smallmouth Bass, Central Stoneroller, Brown Trout

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- drains a portion of the western tip of Wilkes County and the extreme eastern corner of Watauga County; a tributary to W. Kerr Scott Reservoir. **Habitats** -- fast runs, good gradient riffles; severe bank erosion from cattle, especially on the right bank; 50-75 animals were in the stream (see picture) and the adjacent woods prior to sampling; specific conductance was not elevated due to wastes in and near the stream, perhaps because of good flow; the extremely rocky substrates and gradient may be offsetting the affects of instream erosion from cattle. **2006** -- first fish community sample at this site; good numbers (n = 484) and diversity of fish with two darter species, four sunfish, bass and trout species, three sucker species, and four intolerant species; White Sucker only represented by young-of-year.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
STONY FK	SR 1135	06/06/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-26-(7)	360638	812136

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	33.8	15	0.5

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	79	0	30	0

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

Water Quality Parameters

Temperature (°C)	20.2
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	32
pH (s.u.)	6.5

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	6
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	6
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	62

Site Photograph



Substrate	mostly bedrock, sand, boulder; some cobble, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/06/06	9944	-	42	-	3.74	Excellent
06/11/02	8776	-	41	-	3.38	Excellent
07/26/01	8523	-	44	-	3.66	Excellent
07/22/96	7110	-	37	-	3.62	Excellent

Taxonomic Analysis

Three taxa were collected for the first time in 2006 and were either common or abundant in the sample: *Plauditus cestus*, *Ephemerella catawba*, and *Isoperla holochlora*. Otherwise the EPT community has been quite stable over the most recent three sampling events. Other abundant taxa in 2006 were: *Baetis intercalaris*, *Baetis pluto*, *Heterocloeon curiosum*, *Plauditus dubius* group, *Caenis*, *Serratella deficiens*, *Serratella molita*, *Stenacron pallidum*, *Isonychia*, *Ephoron leukon*, *Acroneuria abnormis*, *Perlesta*, *Ceratopsyche sparna*, *Cheumatopsyche*, and *Psychomyia nomada*.

Data Analysis

The site is 7.7 miles WSW of Kerr Scott Dam and 1.6 miles from the confluence with Yadkin River. The site supports a diverse and intolerant benthic community. The biological data do not indicate the presence of stressors, and water quality appears to be stable.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
N PRONG LEWIS FORK	NR SR 1300	06/06/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-31-1-(4)	361110	811818

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	23.8	18	0.5

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

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)	8.8
Specific Conductance (µS/cm)	25
pH (s.u.)	6.5
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	69

Substrate	1/3 sand, 1/3 bedrock, even distribution among other classes
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/06/06	9943	-	38	-	3.32	Excellent
06/10/02	8772	-	42	-	3.45	Excellent
07/25/01	8518	-	35	-	3.58	Good
07/23/96	7114	-	33	-	3.25	Good

Taxonomic Analysis

Greater mayfly diversity, and to a lesser extent greater stonefly diversity, has resulted in high EPT richness in 2001 and 2006. Three mayfly species were common in 2006 though unreported from earlier collections: *Drunella cornutella*, *Ephemerella dorothea*, and *Eurylophella aestiva*. Seasonality is a factor for higher EPT richness values in 2002 and especially in 2006 (samples were collected in the first half of June in both years) than in 1996 and 2001 (collected in the last half of July). Seven of the taxa recorded at the site are identified as winter seasonal by the BAU (*Dannella simplex*, *Drunella walkeri*, *Ephemerella catawba*, *E. dorothea*, *Eurylophella aestiva*, *Eu. verisimilis*, *Epeorus dispar*); six of those taxa were only collected in the June samples (and four of those were only collected in 2006). There are also seven summer seasonal taxa recorded for the site (*Baetis flavistriga*, *Baetis intercalaris*, *Heterocloeon curiosum*, *Serratella deficiens*, *Ephoron leukon*, *Oecetis*, *Triaenodes ignitus*); overall those summer taxa do not show any relationship between June and July sampling events at the site.

Data Analysis

The site is about 9 miles W of North Wilksboro NC and about 5.5 miles NW of Kerr Scott dam. The benthic community at the site appears to be stable, with most differences between sampling events due to seasonality. No stressors are indicated by the benthic data.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Prong Lewis Fk	SR 1304	08/03/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	361100	811812	12-31-1-(4)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	23.7	1190	9	0.4	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	60	---	15	25 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	24.0
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	30
pH (s.u.)	5.6

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	7
Pool Variety (10)	6
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	71

Site Photograph



Substrate

cobble, boulder, bedrock, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/03/06	2006-110	15	56	Excellent
06/19/01	2001-64	17	56	Excellent
05/21/96	96-55	15	48	Good

Most Abundant Species

Redlip Shiner

Exotic Species

Striped Jumprock, Smallmouth Bass, Central Stoneroller, Brown Trout

Species Change Since Last Cycle

Losses -- Brassy Jumprock, Redbreast Sunfish, Bluegill. Gains -- Brown Trout

Data Analysis

Watershed -- drains part of the northwest region of Wilkes County; a tributary to W. Kerr Scott Reservoir. **Habitats** -- pools, riffles, lower half of reach is sandy. **2006** -- diverse assemblage of fish including three darter species, one bass and one trout species, three sucker species, and three intolerant species; stream continues to have very low percentage of tolerant fish (3%). **1996-2006** -- 19 species have been collected from this site; this stream continues to support a well balanced community of fish with the same NCIBI score and Excellent rating since 2001.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Prong Lewis Fk	SR 1154	08/04/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	360918	811948	12-31-2-(7)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	32.3	1150	11	0.4	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	98	---	---	2 (Kudzu slope)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	22.3
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	35
pH (s.u.)	6.4

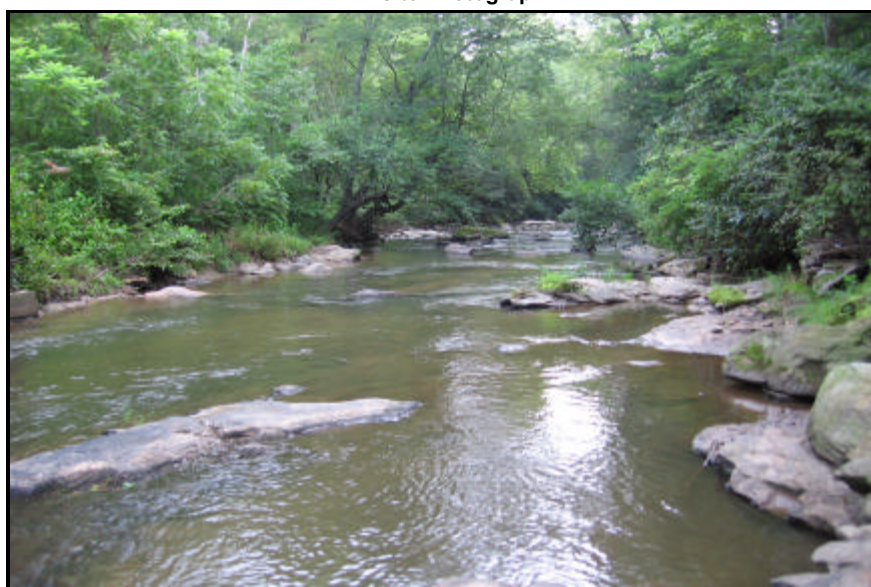
Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	80

Site Photograph



Substrate

cobble, boulder, bedrock, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/04/06	2006-111	22	54	Excellent
06/19/01	2001-63	17	48	Good
05/21/96	96-54	16	50	Good

Most Abundant Species

Redlip Shiner

Exotic Species

Striped Jumprock, Smallmouth Bass, Central Stoneroller

Species Change Since Last Cycle

Gains -- Brassy Jumprock, Smallmouth Bass, Spottail Shiner, Snail Bullhead, Flat Bullhead. **Losses** -- none.

Data Analysis

Watershed -- drains a portion of rural northwest Wilkes County; a tributary to W. Scott Kerr Reservoir. **Habitats** -- riffles, runs, chutes, sand in channel in mid reach; not as silty compared to 2001 sample when US 421 was being widened. **2006** -- low flow; fewer fish than 2001 (734 vs 1009), but a gain of five species (plus all previously collected species); a balanced and diverse community including three darter species, one sunfish and one bass species, four sucker species, and five intolerant species; Brown Trout represented by young-of-year only. **1996-2006** -- stream has always had a very low percentage of piscivores (<1%); the trophic structure has shifted to a more balanced community of fish since 2001 (Insectivores and Omnivores+Herbivores both equaled ~50% in 2001; in 2006, Insectivores = 70% and Omnivores+Herbivores = 30%). This trophic shift is the main reason for a higher NCIBI score and rating in 2006.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MORAVIAN CR	NC 18	06/05/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-39	360517	811201

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	18.3	5	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)	16.6
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	48
pH (s.u.)	6.7
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	7
Pool Variety (10)	0
Riffle Habitat (16)	12
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)	63

Substrate	mostly sand, some gravel, small amount of silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/05/06	9937	-	24	-	4.69	Good-Fair
07/26/01	8522	-	25	-	4.97	Good-Fair
07/23/96	7115	-	27	-	4.26	Good-Fair

Taxonomic Analysis

The decline in the number of EPT taxa at the site over the three sampling events is driven by the loss of Plecoptera, which is generally the most sensitive group of the three to the presence of environmental stressors; stoneflies have decreased from five taxa in 1996, to two in 2001, and to one in 2006. The remaining stonefly in 2006, *Perlesta*, is the most tolerant of those taxa found in prior sampling events. Such characteristics of the benthic fauna at the site would support an argument for a trend towards declining water quality. However, the most tolerant taxon recorded from the site, *Hydropsyche betteni*, was abundant in 1996, common in 2001, and not collected in 2006. Secondly, an intolerant caddisfly, *Neophylax oligius*, has been identified in increasing numbers from no record in 1996, common in 2001, and abundant in 2006. Lastly, an intolerant mayfly, *Serratella serrata*, was abundant in 2006 yet uncollected in either of the two prior sampling events.

Data Analysis

The site is about 4.5 miles SSW of Wilkesboro NC and 3.5 miles SSE of Kerr Scott Dam. The site had the highest EPT BI value for the ten sites collected in Yadkin River subbasin 01 in 2006 using EPT methods. The paucity of large rocky substrate for macroinvertebrate colonization is likely limiting the benthic community. Declining EPT and especially Plecoptera richness over the three sampling events may be reflecting declining water quality at the site, though EPT BI values and characteristics of the mayfly and caddisfly communities do not provide evidence for such a trend.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Fk Reddies R	SR 1567	08/04/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	361723	811631	12-40-4	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-II,Tr, HQW	12.7	1293	7	0.4	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	85	---	10	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	21.5
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	33
pH (s.u.)	6.2

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)	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)	5
Total Habitat Score (100)	84

Site Photograph



Substrate	cobble, boulder, bedrock, gravel, sand
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/04/06	2006-112	11	50	Good
06/19/01	2001-65	17	56	Excellent
05/05/99	99-33	14	58	Excellent

Most Abundant Species	Bluehead Chub	Exotic Species	Rock Bass, Smallmouth Bass, Central Stoneroller
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Species Change Since Last Cycle	Losses -- Northern Hogsucker, Highback Chub, Western Blacknose Dace, Rainbow Trout, Brown Trout, Brook Trout. Gains -- none.
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Data Analysis

Watershed -- drains part of northwest-central Wilkes County. **Habitats** -- runs, riffles, chutes, good side roots; low flow, but evidence of previous high water. **2006** -- fewer fish collected than in 2001 (426 vs. 718, respectively) including six less species; good trophic structure; lower NCIBI score and loss of one bioclassification. **1999-2006** -- 18 species have been collected from this site; consistently high quality habitat scores and stable trophic structure in all monitoring cycles; lower abundances in 2006 may be flow related.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mulberry Cr	SR 1002	06/23/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	361309	810810	12-42	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	39	---	12	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	24.2
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	44
pH (s.u.)	6.0

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	8
Riffle Habitat (16)	8
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	66

Site Photograph



Substrate

cobble, bedrock, some gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/06	2006-97	22	52	Good

Most Abundant Species

Bluehead Chub

Exotic Species

Striped Jumprock, Rock Bass, Smallmouth Bass

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- drains rural north-central Wilkes County, above North Wilkesboro. **Habitats** -- snag pools, bedrock shelves and riffles; fairly open canopy due to width of stream; cattle with access to upper part of sample reach; barbed wire across stream. **2006** -- first fish community sample at this location; lots of fish (n=713); very diverse community with three darter species, one sunfish and two bass species, four sucker species, and six intolerant species (including three cyprinids - Thicklip Chub, Fieryblack Shiner, and Highback Chub); slightly skewed trophic structure towards Omnivores+Herbivores (Bluehead Chub = 48% of sample); large specimens and biomass of all sucker species, and Smallmouth Bass.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MULBERRY CR	NC 268	06/09/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-42	361128	810649

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	45.7	20	0.4

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	10	50	40	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)	8.9
Specific Conductance (µS/cm)	50
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	10
Bottom Substrate (15)	7
Pool Variety (10)	8
Riffle Habitat (16)	8
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	57

Site Photograph



Substrate	mostly sand/silt; cobble riffle; some bedrock, trace boulder
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/09/06	9953	-	47	-	3.37	Excellent
07/25/01	8515	-	41	-	4.12	Excellent
07/24/96	7117	-	37	-	3.07	Excellent

Taxonomic Analysis

The increase in EPT richness in 2006 is driven by a large increase in the number of mayfly taxa collected; 17 and 18 Ephemeroptera taxa were collected in 1996 and 2001, while the number collected in 2006 jumped to 26. Seasonality is playing a small role in the increase in mayfly taxa in 2006; three species are identified as winter seasonal by the BAU (*Ephemerella catawba*, *Eurylophella aestiva*, and *Eu. minimella*) and were only collected in the June sample in 2006 (the other two collections were made in late July). Several taxa collected for the first time at the site in 2006 were either common (*Plautius dubius* group, *Eurylophella aestiva*, *Serratella serrata*, *Hydropsyche scalaris*) or abundant (*Ephoron leukon*, *Apatania*). The absence of wetted root mats in 2006 explains the absence of *Oecetis persimilis* and *Trienodes ignitus*, both of which were seen in the prior two collections.

Data Analysis

The site is 2.5 miles NE of downtown North Wilksboro NC and 1.9 stream miles above the confluence with Yadkin River. Macroinvertebrate habitat at the site was mostly restricted to a single riffle that was quite productive in terms of taxa richness. The highest number of EPT taxa for the three sampling events at the site occurred in 2006 despite active bridge construction above the site. No water quality problems are indicated by the benthic community.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ROARING R	SR 1990	06/08/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-46	361459	810239

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	B	128.3	25	0.5

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

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

Water Quality Parameters

Temperature (°C)	21.5
Dissolved Oxygen (mg/L)	9
Specific Conductance (µS/cm)	36
pH (s.u.)	6.9

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	75

Site Photograph



Substrate	mostly cobble/sand, lesser amounts gravel, boulder, bedrock
-----------	---

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/08/06	9951	120	50	4.12	3.23	Excellent
07/25/01	8513	89	42	4.48	3.45	Good
07/24/96	7118	98	48	4.68	3.43	Excellent
07/29/88	4644	92	43	4.77	3.54	Good
08/08/85	3549	87	36	4.81	3.29	Good
08/10/83	3134	66	35	3.94	3.35	Good

Taxonomic Analysis

Several EPT taxa either common or abundant in 2006 were not previously identified from the site: *Plauditus dubius* group, *Brachycercus*, *Eurylophella aestiva*, *Perlesta*, *Apatania*, *Hydropsyche scalaris*, and *Rhyacophila formosa*. Seasonality is not an issue with regard to the high number of EPT collected in 2006. Other abundant EPT taxa at the site were: *Baetis intercalaris*, *Caenis*, *Epeorus rubidus*, *Leucrocota*, *Maccaffertium modestum*, *Stenacron pallidum*, *Isonychia*, *Ephoron leukon*, *Acroneuria abnormis*, *Ceratopsyche sparna*, *Cheumatopsyche*, and *Neophylax fuscus*. Two uncommon oligochaetes were collected for the first time from the site in 2006: *Ripistes parasita* and *Vejdovskyella comata*.

Data Analysis

The site is eight miles NE of North Wilksboro NC and 4 stream miles from the confluence with Yadkin River. The lowest NCBI value since 1983 and the highest EPT richness ever recorded for the site occurred in 2006, pushing the bioclassification back into the Excellent category. There seems to be a trend towards improving water quality at the site since 1983, though the results from 2001 are anomalous in that regard.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
M Prong Roaring R	SR 1002	08/04/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	361736	810542	12-46-2-(6)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	57.3	1070	11	0.4	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	---	25	25 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	25.1
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	37
pH (s.u.)	6.0

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	8
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	84

Site Photograph



Substrate

cobble, boulder, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/04/06	2006-113	19	58	Excellent
06/20/01	2001-66	20	56	Excellent
05/22/96	96-60	15	50	Good

Most Abundant Species

Redlip Shiner

Exotic Species

Striped Jumprock, Rock Bass, Smallmouth Bass

Species Change Since Last Cycle

Losses -- Notchlip Redhorse, V-lip Redhorse, Brassy Jumprock, Creek Chub, Flat Bullhead **Gains** -- Rosyside Dace,

Data Analysis

Watershed -- drains the rural area of northeast Wilkes County to the northernmost tip of the county. **Habitats** -- pools, runs, good riffles, same as in 2001; side pools, snags, some eroded banks. **2006** -- good abundance (304 total) and high diversity with three darter species, two bass and one sunfish species, two sucker species, and six intolerant species; **1996-2006** -- 23 species have been collected from this site; this rural mountain stream continues to support a rich assemblage of fish and earns a high NCIBI score.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Big Bugaboo Cr	SR 1924	06/22/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	361357	805730	12-48-(0.7)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	16.7	---	10	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	75	---	20	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	20.6
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	42
pH (s.u.)	6.0

Water Clarity

Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	85

Site Photograph



Substrate

cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/06	2006-92	17	52	Good

Most Abundant Species

Bluehead Chub

Exotic Species

Striped Jumprock, Green Sunfish, Central Stoneroller

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- drains part of northeast Wilkes County, just northwest of the town of Ronda. **Habitats** -- high quality habitats; high gradient stream with boulder riffles, plunge pools, and bedrock shelves; open canopy at beginning of sample reach (powerline right of way); water very easily sited. **2006** -- first fish community sample at this site; very abundant fish (n = 1189) and biomass; moderate to high diversity with two darter species, three sunfish and one bass species, two sucker species, and two intolerant species; Bluehead Chub = 43% and Redlip Shiner = 26% of the sample. High end of Good water quality rating.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Elkin Cr	SR 2044	06/22/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	2	03040101	361651	805246	12-54-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-II,HQW	25.6	---	13	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	40	---	55	5 (lawn)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

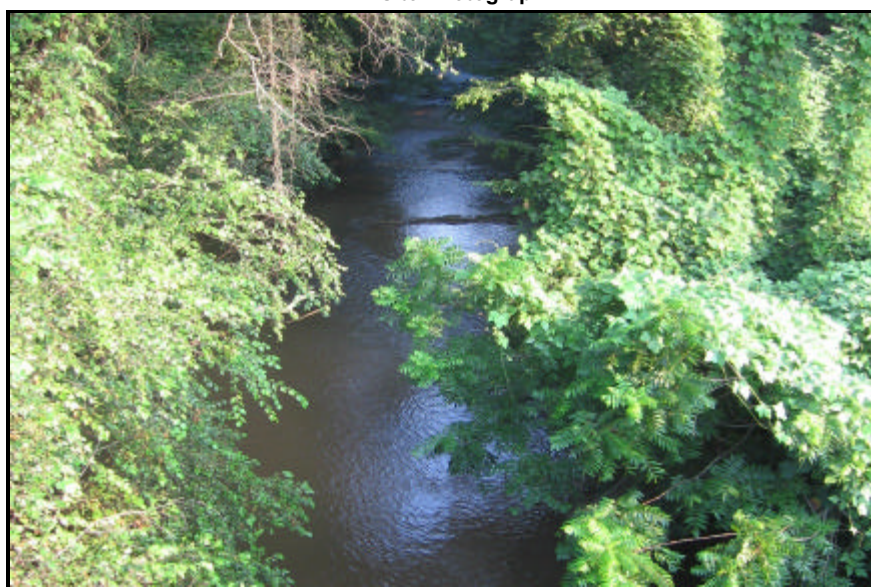
Temperature (°C)	20.6
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	42
pH (s.u.)	6.0

Water Clarity	Very slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	87

Site Photograph



Substrate	bedrock, gravel, cobble, boulder
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/06	2006-91	14	48	Good

Most Abundant Species	Bluehead Chub	Exotic Species	Fathead Minnow
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Species Change Since Last Cycle	N/A, new site in 2006
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Data Analysis

Watershed -- drains the extreme northeast corner of Wilkes County. **Habitats** -- high quality; shelves, pools, riffles; very rocky; old mill site; silts settled out on rocks; good riparian, *Rhododendron* on left. **2006** -- new fish community monitoring site; lots of fish (n= 860); moderate diversity with three darter species, two species of sunfish, suckers, and intolerants; trophic structure is slightly skewed with a relatively even percentage of Omnivores+Herbivores and Insectivores; Bluehead Chub = 44%, and Redlip Shiner = 38% of sample; no piscivores present.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ELKIN CR	NC 268	08/07/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-54-(4.5)	361512	805146

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	35.9	8	0.2

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

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

Water Quality Parameters

Temperature (°C)	24.1
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	60
pH (s.u.)	6.3
Water Clarity	turbid

Site Photograph



Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/07/06	10007	NA	24	NA	4	Good-Fair
08/06/01	8561	NA	20	NA	3.8	Good-Fair
07/22/96	7081	NA	24	NA	3.6	Good-Fair

Taxonomic Analysis

EPT taxa at the site have increased and decreased in the past ten years with the previous report (2001) being the low. The current EPT taxa total was increased by relative addition of 4 caddisfly taxa with mayfly and stonefly taxa remaining constant. The EPT biotic index increased from 3.75 in 2001 to 3.96 in 2006; a modest change toward more tolerant species.

Data Analysis

Situated on the northwest corner of Elkin, this partly urban site drains a mostly rural area. The site is located adjacent to the Elkin water treatment plant and has local hiking trails along the right bank. Silty sand and gravel substrate suggest sediment loading from upstream. The amount of litter in the stream suggests its proximity to urban and residential areas. Water quality (as indicated by macroinvertebrate sampling) has apparently remained fairly consistent for the past ten years.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MITCHELL R	SR 1330	08/08/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-62-(1)	362605	805258

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	B Tr ORW	19.8	10	0.2

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

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

Water Quality Parameters

Temperature (°C)	23.6
Dissolved Oxygen (mg/L)	8
Specific Conductance (µS/cm)	27
pH (s.u.)	6.7
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	76

Site Photograph



Substrate	Rubble, boulder, gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/06	10009	97	29	4.6	3.5	Good
08/06/01	8563	90	40	4.2	3.1	Good
07/23/96	7091	79	38	3.9	3.1	Good
02/07/91	5544	NA	41	NA	1.9	Excellent
10/25/89	5124	NA	34	NA	2.6	Good

Taxonomic Analysis

Declines in mayfly, stonefly and caddisfly taxa are accompanied by a large increase in chironomid taxa. While total taxa increased from 90 to 97 species between 2001 and 2006, the biotic index of the community now present indicates a loss of more pollution-sensitive species.

Data Analysis

This site, located in a largely agricultural and residential watershed, is downstream of Devotion and the undeveloped Reynolds property. Declines in water quality (as indicated by macroinvertebrate analysis) have been noted in the past, concurrent with the development of the Old Beau golf resort which was found responsible for sediment impacts to the stream. An apparent continued decline in the benthic community is implied by this round of sampling.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mitchell R	SR 1330	06/21/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	362607	805221	12-62-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
B,Tr,ORW	29.1	1200	13	0.4	Yes

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	19.4
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	28
pH (s.u.)	6.2

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	87

Site Photograph



Substrate

cobble, bedrock, boulder, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/21/06	2006-89	18	60	Excellent
05/26/99	99-38	15	52	Good
05/16/96	96-51	15	46	Good-Fair

Most Abundant Species

Redlip Shiner

Exotic Species

Rock Bass, Smallmouth Bass, Brown Trout

Species Change Since Last Cycle

Gains -- White Sucker, Brassy Jumprock, Largemouth Bass, Brown Trout. **Losses** -- none.

Data Analysis

Watershed -- drains western-central Surry County, including the community of Devotion. **Habitats** -- pool (lower 1/3 of site), bedrock boulders, riffles, plunge pools. **2006** -- three more species than in 1999; Redlip Shiner = 32% and Bluehead Chub = 26% of sample; unusual fish assemblage with cold, cool, and warm water species present; two large stocked Brook Trout collected; Rainbow Trout only represented by young-of-year; site is upstream of a Knapp Mill's Dam that was breached in the spring of 2006. **1996-2006** -- a total of 20 species have been collected here over a ten year period; this site shows a steady improvement of NCIBI score and bioclassification, which is likely related to ongoing conservation and restoration efforts in this watershed.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MITCHELL R	SR 1001	08/08/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-62-(12)	361841	804824

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C; ORW	76.8	10	1

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

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

Water Quality Parameters

Temperature (°C)	23.7
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	37
pH (s.u.)	6.8
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	80

Substrate	Boulder, rubble, gravel, sand
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Sample Date	Sample ID	78	EPT	BI	EPT BI	Bioclassification
08/08/06	10008	104	38	4.4	3.6	Good
08/06/01	8564	95	43	4.2	3.1	Excellent
07/27/96	7090	82	45	4.5	3.7	Good
07/01/87	4113	78	38	4.7	3.6	Good

Taxonomic Analysis

Reversing gains observed in 2001, mayfly and caddisfly taxa reduced sharply in 2006 samples. Total taxa observed increased due largely to an increase in dipteran taxa, particularly chironomid taxa. The overall biotic index for the site increased from 3.1 to almost 3.6 indicating the community shifted toward more tolerant organisms.

Data Analysis

The lower Mitchell River watershed, bounded by the US 21 and I-77 corridors west and east, respectively, drains residential and agricultural areas in a region with continued development. This site is located with the USGS gage # 02112360 (Mitchell River near State Road, NC). If, as subscribed by the 2001 report, this site enjoyed improved water quality due to drought conditions of that period, these improvements were not helpful to the site prior to the 2006 sampling event and the community reverted (in terms of tolerance) to 1996 conditions of community tolerance, though still increasing overall diversity.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Fk Mitchell R	SR 1301	06/21/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	362012	805005	12-62-13	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	24.2	---	10	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	45	---	50	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	21.9
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	37
pH (s.u.)	6.2

Water Clarity

Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	5
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	5
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	58

Site Photograph

photo not available

Substrate

sand, bedrock, cobble, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/21/06	2006-90	19	60	Excellent

Most Abundant Species

Rosyside Dace

Exotic Species

Striped Jumprock, Rock Bass, Green Sunfish,
Smallmouth Bass

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- drains the extreme west-central side of Surry County. **Habitats** -- bedrock shelf pools, sandy runs of uniform shallow depth, snags, undercuts; lower half of sample reach had better instream habitats; water easily silted. **2006** -- first fish community monitoring sample at this site; high diversity with three species of darter, six species of sunfish and bass, three sucker species, and four intolerant species; maximum NCIBI score and rating may be related to the extensive stream restoration and conservation efforts in this watershed.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
SNOW CR	SR 1121	08/07/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-62-15	361805	804604

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	17.3	6	0.2

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

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

Water Quality Parameters

Temperature (°C)	23.9
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	59
pH (s.u.)	6.1
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	6
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	65

Substrate	Sand, silt, gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/07/06	10005	NA	25	NA	4.4	Good-Fair
08/06/01	8565	NA	24	NA	4	Good-Fair
07/23/96	7080	NA	31	NA	3.6	Good
07/01/87	4114	67	27	5.1	4.3	Good-Fair

Taxonomic Analysis

Though total taxa were similar between 2001 and 2006, The mayfly *Epeorus* was not present in the 2006 sample and the more tolerant mayflies *Caenis*, *Hexagenia* and *Isonychia* were present in the latter sample. The biotic index of the site rose in 2006 compared to 2001 indicating an overall more tolerant community present. Those minor differences existed, Trichoptera and Plecoptera taxa recorded remained fairly similar between 2001 and 2006 EPT samples.

Data Analysis

A silt line was noted in riparian trees 1.5 meters above the water level indicating that this site may be subject to high-flow spate events following heavy rainfall. Note was made of a muddy-silt bottom at the site. Along with a decline in mayfly taxa (*Epeorus*) that tend to inhabit cleaner, faster moving water, these facts may indicate that the site may be experiencing greater siltation than previously encountered. A decline from a Good bioclassification to Good-Fair in the last basinwide assessment cycle may be continuing at this site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Snow Cr	SR 1121	06/07/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	361805	804605	12-62-15	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	17.2	---	12	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	85	---	15	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	18.7
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	57
pH (s.u.)	5.6

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	8
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	79

Site Photograph



Substrate

gravel, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/07/06	2006-81	19	56	Excellent

Most Abundant Species

Bluehead Chub

Exotic Species

Striped Jumprock, Smallmouth Bass

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- drains part of south-western Surry County. **Habitats** -- low flow; bedrock shelves with riffles, plunge and snag pools; old mill site. **2006** - first fish community sample at this location; lots of fish collected (722 individuals); high diversity with three darter species, four sunfish species, four sucker species, and three intolerant species collected; trophic structure was slightly skewed towards a high percentage of Omnivores+Herbivores; 79% of species represented by multiple age classes.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Fisher R	SR 1331	06/21/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	362722	804900	12-63-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-II,Tr,HQW	36.9	1185	13	0.4	Yes

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	21.0
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	39
pH (s.u.)	6.2

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	83

Site Photograph



Substrate

cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/21/06	2006-88	23	56	Excellent
06/20/01	2001-68	18	60	Excellent

Most Abundant Species

Redlip Shiner

Exotic Species

Rock Bass, Smallmouth Bass, Spotted Bass, Mountain Redbelly Dace

Species Change Since Last Cycle

Gains -- Brassy Jumprock, Rock Bass, Pumpkinseed, Spotted Bass, Spottail Shiner, Mountain Redbelly Dace, Flat Bullhead **Losses** -- Thicklip Chub, Fieryblack Shiner

Data Analysis

Watershed -- drains the extreme northwest corner of Surry County. **Habitats** -- runs, side snags, undercuts, woody debris, short and shallow riffles. **2006** -- lots of fish (n = 766, 325 more than in 2001); increase in diversity with three species of darters, seven species of bass and sunfish, three sucker species, and four intolerant species; large schools of Redlip Shiner colonizing Bluehead Chub nests. **2001-2006** -- 25 species known from this site; trout never collected here; slightly lower NCIBI score in 2006, but same Excellent rating.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
FISHER R	US 601	08/08/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-63-(7)	362451	804126

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-II HQW	105.6	7	0.4

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	20	20	60	

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

Water Quality Parameters

Temperature (°C)	25.4
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	53
pH (s.u.)	6.9
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	13
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	61

Substrate	Rubble, boulder, gravel, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/06	10011	NA	27	NA	4.7	Good-Fair
08/08/01	8572	NA	30	NA	3.2	Good
07/23/96	7092	NA	30	NA	3.6	Good

Taxonomic Analysis

Compared to 2001 samples, the loss of sensitive mayflies *Epeorus rubidus*, *Ephoron leukon*, *Serratella serratooides*, and caddisflies *Hydropsyche scalaris*, *Brachycentrus nigrosoma* and *Ceraclea ancylus* raised this site's EPT biotic index from 3.19 to 4.7. Along with a decline in EPT taxa from 30 in 2001 to 27 in 2006, the site's bioclassification downgraded from Good to Good-Fair.

Data Analysis

Infrequent riffles and silty pools characterize the substrate of this site that had little organic habitat. Due to flow conditions that existed, many root mats were out of the water. The surrounding watershed, dominated by agricultural, pastoral, and sparse rural residential uses generally retains a good wooded buffer along the riparian zone of the river. Macroinvertebrate analysis indicates a slight decline in water quality compared to previous sampling.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
FISHER R	NC 268	08/09/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-63-(9)	362022	804107

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	124.6	15	0.3

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

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

Water Quality Parameters

Temperature (°C)	24.3
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	68
pH (s.u.)	7
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	71

Substrate	Bedrock, boulder, rubble, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10012	93	28	5.4	4.5	Good-Fair
08/08/01	8571	88	39	5.1	3.9	Good
07/22/96	7079	84	36	5.1	4	Good

Taxonomic Analysis

A decline in sensitive mayfly taxa (including the complete absence of taxa abundant in 2001- *Ephoron*, *Leucrocuta*, *Stenacron*) and the absence of the previously abundant caddisfly *Symphitopsyche morosa* accompany an increase in chironomid, mollusk and dragonfly taxa in 2006 samples.

Data Analysis

Co-located with USGS Gage # 02113000 (Fisher River nr. Copeland, NC) this is the most downstream benthos site on the Fisher River, draining 125 square miles at this point. This site had heavy silt between riffles with silty periphyton covering rocks in areas of all but swiftest flow. A residential site under current construction just upstream of the site on the left bank was contributing silt runoff to the stream. Benthos results observed could imply the effects of additional embedding of silt on the habitat quality of this site.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
L FISHER R	SR 1480	08/08/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-63-10 (2)	362538	804243

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	36.2	5	0.3

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

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

Water Quality Parameters

Temperature (°C)	24.9
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	63
pH (s.u.)	6.7
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	6
Pool Variety (10)	5
Riffle Habitat (16)	12
Left Bank Stability (7)	3
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	65

Substrate

Rubble, gravel, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/06	10010	NA	25	NA	4.4	Good-Fair
08/07/01	8566	NA	22	NA	4.9	Good-Fair
07/23/96	7093	NA	29	NA	4.2	Good

Taxonomic Analysis

Slight increases in stonefly and caddisfly taxa in this 2006 EPT sample are offset by a slight decline in mayfly relative to 2001 sampling. The 2006 biotic index indicated a slightly more sensitive community present than in 2001.

Data Analysis

The Little Fisher River flows into North Carolina from Virginia and through north-central Surry County before discharging to the Fisher River. The watershed has mostly agricultural and residential uses. Steep banks along this reach are eroding in the bends of the stream. The substrate was noted as very silty. Macroinvertebrate data suggest improvement in community diversity and sensitivity since the 2001 sampling event but have not achieved values equivalent to 1996 results.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Little Fisher R	SR 1480	06/20/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	362743	804432	12-63-10-(2)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	21.3	---	10	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	22.8
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	50
pH (s.u.)	6.1

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	10
Left Bank Stability (7)	4
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	1
Total Habitat Score (100)	60

Site Photograph



Substrate	cobble, gravel, sand
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/20/06	2006-87	17	52	Good
06/20/01	2001-67	19	50	Good
05/16/96	96-50	15	46	Good-Fair

Most Abundant Species	Bluehead Chub	Exotic Species	Striped Jumprock, Smallmouth Bass, Mountain Redbelly Dace, Rainbow Trout
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Species Change Since Last Cycle	Losses -- Satfin Shiner, Thicklip Chub, Fieryblack Shiner, Flat Bullhead Dace, Rainbow Trout Gains -- Mountain Redbelly
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Data Analysis

Watershed -- drains rural north-central Surry County up to the NC-VA state line; site is below NCWRC Hatchery Supported Trout Waters. **Habitats** -- deadfalls, undercuts, snags, short riffles; the riparian zone including the right bank was recently altered via the adjacent field (soil and vegetation was pushed over the bank edge), causing sediment to enter the stream; water clear but easily silted; more sediment than 2001. **2006** -- Lots of fish (n = 735) with three darter species, three sucker species, and four intolerant species (one less than 2001); Bluehead Chub = 36% and Redlip Shiner = 33% of sample; only one individual of one sunfish species (Redbreast) collected. **1996-2006** -- slight improvement in NCIBI score; stable water quality rating.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cody Cr	US 268	06/07/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	362017	804135	12-63-14	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	10.8	---	7	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	16.9
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	62
pH (s.u.)	6.3

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	7
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	71

Site Photograph



Substrate

gravel, sand, bedrock shelves

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/07/06	2006-80	19	56	Excellent
05/16/96	96-49	18	52	Good

Most Abundant Species

Bluehead Chub

Exotic Species

Central Stoneroller, Fathead Minnow

Species Change Since Last Cycle

Gains -- Largemouth Bass, Central Stoneroller, Golden Shiner, Fathead Minnow **Losses** -- Notchlip Redhorse, Brassy Jumprock, Green Sunfish

Data Analysis

Watershed -- drains part of central Surry County, including the south side of Dobson. **Habitats** -- sandy runs with rocky ledges, overhanging bushes, a few snag pools and shallow plunge pools at the upper end of the site. **2006** -- good abundance (518 individuals); well balanced community of fish including three darter species, three sunfish species, one sucker species (two less than 1996), and two intolerant species. **1996-2006** -- an additional 211 fish were collected in 2006; the NCIBI metrics for this site have increased slightly and the bioclassification has improved to the highest rating.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ARARAT R	NC 104	07/24/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-(1)	363313	803408

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV; Tr	36.2	12	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	40	0	60	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)	59
pH (s.u.)	6.8

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	14
Pool Variety (10)	5
Riffle Habitat (16)	13
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	79

Site Photograph



Substrate	mostly gravel, cobble, sand; some boulder and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	10025	-	29	-	3.88	Good
07/23/01	8507	-	25	-	4.04	Good-Fair
07/25/96	7123	-	26	-	3.96	Good-Fair

Taxonomic Analysis

Plecoptera are primarily responsible for the increased EPT in 2006 over prior sampling events. Six stonefly taxa were collected in 2006; two and four taxa were collected 1996 and 2001 respectively. New taxa records for the site in 2006 were: *Heterocloeon anoka*, *Ephemerella subvaria*, *Maccaffertium ithaca*, *Rhithrogena uhari*, *Acroeuria arenosa*, *Paragnetina immarginata*, *Malirekus hastatus*, and *Ceratopsyche bronta*.

Data Analysis

The site is located about 4.3 miles NNE of Mount Airy NC and 1000 feet south of the Virginia border. Almost the entire drainage area is in Virginia. Sampling results from 1996, 2001, and 2006 show a relatively stable benthic community with little change in EPT BI values. The increase in the number of EPT taxa--and particularly stonefly taxa--might indicate slightly better conditions at the site in 2006 than during the prior two sampling events, though an increase in specific conductance over the three events (35, 52, and 59 µmhos/cm for 1996, 2001, and 2006 respectively) does not provide support.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Ararat R	NC 104	06/20/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	3	03040101	363313	803408	12-72-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV, Tr	36.2	---	12	0.4	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	35	---	65	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	19.1
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	53
pH (s.u.)	6.2

Water Clarity

Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	73

Site Photograph



Substrate

cobble, gravel, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/20/06	2006-85	19	54	Excellent

Most Abundant Species

Bluehead Chub

Exotic Species

Green Sunfish, Mountain Redbelly Dace

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- flows from Patrick County in southwest Virginia; downstream the river flows south and drains the east side of Mount Airy. **Habitats** -- riffles, snags, bedrock shelves. **2006** -- new fish community monitoring site; lots of fish collected (total of 899); high diversity with three darter species, two sunfish species, three sucker species, and two intolerant species, but no piscivores and no trout.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ARARAT R	SR 2026	07/25/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-(4.5)	362416	803343

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	231	30	0.5

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)
Mount Airy WWTP	NC0021121	7.0

Water Quality Parameters

Temperature (°C)	24.6
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	146
pH (s.u.)	7.8
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	6
Left Bank Stability (7)	1
Right Bank Stability (7)	5
Light Penetration (10)	4
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	65

Substrate	mostly cobble, sand, gravel; some boulder, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/25/06	10031	95	41	4.99	4.23	Good
07/23/01	8506	77	28	5.57	4.62	Good-Fair
08/28/96	7181	69	20	5.81	4.81	Fair
07/12/90	5378	59	17	6.17	5.43	Fair
07/26/88	4661	62	16	6.36	5.68	Fair
09/24/86	3919	50	11	6.56	5.46	Fair

Taxonomic Analysis

Since the sampling event in September 1986, richness in each of the orders Ephemeroptera, Plecoptera, and Trichoptera have increased. The increase in richness for each order was especially significant between the 2001 and 2006 collections (14 to 22 for mayflies, two to four for stoneflies, 12 to 15 for caddisflies). Of the six most pollution-intolerant EPT taxa recorded for the site, five were recorded for the first time in 2006: *Serratella molita*, *Brachycentrus numerosus*, *Paralephophlebia*, *Paranyctiophylax*, and *Goera*. The most tolerant taxon recorded for the site, *Hydropsyche betteni*, has declined from abundant in 1986 and 1988 to common in 1990 and has not been collected from the site during the three most recent sampling events.

Data Analysis

The site is 7 miles SSE of Mt Airy NC and about 5 miles WNW of Pilot Mountain NC. Since the sampling event in September 1986 all indications from the benthic data show consistent improvements in water quality at the site. EPT richness has increased from the low of 11 taxa in 1986 to 41 in 2006; the NCBI has decreased in value from 6.56 to 4.99 over the same period. Accordingly, the resultant bioclassification has improved from Fair in 1986 to Good in 2006. The greatest difference occurred between the sampling events in 2001 and 2006 with an increase of 13 EPT taxa collected and the addition of several particularly intolerant taxa in 2006. From 1997 to 2006 there has been a reduction in the discharge from Mount Airy WWTP, from a monthly average of 6.1 MGD in April 1997 to 2.9 MGD in July 2006 (with a spike to 6.3 MGD in March 2000). A loss of textile production in Mount Airy is responsible for the reduced discharge from the WWTP.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LOVILLS CR	SR 1700	07/24/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-8-(1)	363233	803735

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV	26.8	13	0.3

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

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

Water Quality Parameters

Temperature (°C)	24.2
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	55
pH (s.u.)	7.4

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	13
Pool Variety (10)	8
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	4
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	76

Site Photograph



Substrate	good mix of sand through bedrock classes; some silt present
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	10027	-	23	-	4.46	Good-Fair
07/24/01	8508	-	26	-	4.18	Good-Fair
07/25/96	7122	-	22	-	4.75	Good-Fair

Taxonomic Analysis

Twelve Ephemeroptera, three Plecoptera, and eight Trichoptera taxa were collected from the site in 2006. Abundant taxa were: *Acentrella*, *Baetis intercalaris*, *Heterocloeon anoka*, *Maccaffertium modestum*, *Stenacron pallidum*, *Isonychia*, *Leuctra*, *Cheumatopsyche*, and *Hydropsyche venularis*.

Data Analysis

The site is three miles NNW of downtown Mount Airy NC and one mile south of the Virginia border. Most of the drainage area for the site is in Virginia. EPT richness fell and the EPT BI value increased between 2001 and 2006, though both values are still slightly better than those attained in 1996. No specific stressors are indicated by the benthic community.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LOVILLS CR	SR 1371	07/24/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-8-(3)	362919	803701

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	35	8	0.4

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

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

Water Quality Parameters

Temperature (°C)	27.4
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	68
pH (s.u.)	9
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	13
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	9
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	0
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	55

Substrate	nearly even mix of sand, gravel, cobble; some bedrock
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	10026	73	19	5.63	4.88	Fair
07/24/01	8509	67	14	6.38	4.72	Fair
07/25/96	7121	63	16	6.42	5.06	Fair

Taxonomic Analysis

Twelve Ephemeroptera and seven Trichoptera taxa were collected in 2006; Plecoptera have never been collected from the site. Abundant EPT in 2006 were: *Heterocloeon anoka*, *Maccaffertium modestum*, *Isonychia*, *Cheumatopsyche*, *Hydropsyche venularis*, *Macronychus glabratus*, *Promoresia elegans*, *Simulium*, *Cricotopus bicinctus*, *Cricotopus vierriensis* group, Lumbriculidae, and Acari. Baetidae, a ubiquitous family of mayflies, were not identified from the site in 2001; seven baetid taxa were present in 2006.

Data Analysis

The site is located near US 52 southwest of downtown Mount Airy NC. An increase in the number of EPT taxa collected and a decrease in the NCBI value in 2006 may be indicating slightly better water quality over 1996 and 2001. The benthic fauna do not indicate a particular stressor as a problem.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Lovills Cr	SR 1371	06/19/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	3	03040101	362919	803700	12-72-8-(3)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	9.7	---	9	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	28.4
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	74
pH (s.u.)	6.2

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	15
Bottom Substrate (15)	6
Pool Variety (10)	7
Riffle Habitat (16)	15
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	0
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	52

Site Photograph



Substrate

cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/19/06	2006-84	16	48	Good

Most Abundant Species

Redlip Shiner

Exotic Species

Central Stoneroller

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- drains the west side of Mount Airy in northern Surry County; stream runs through town. **Habitats** -- riffles (with *Podostemum*), runs, pools; excessive periphyton; banks stabilized with pavers near bridge crossing; open canopy, grasses, no trees. **2006** -- first fish community sample at this location; extreme number of fish (2073) and biomass; three darter species, one sunfish species, two sucker species, and two intolerant species collected; Redlip Shiner = 40% of total, and Bluehead Chub = 31%.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Stewarts Cr	SR 1622	06/20/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	3	03040101	363138	804239	12-72-9-1	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV;Tr	24.2	---	10	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	30	---	60	10 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	26.0
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	42
pH (s.u.)	5.9

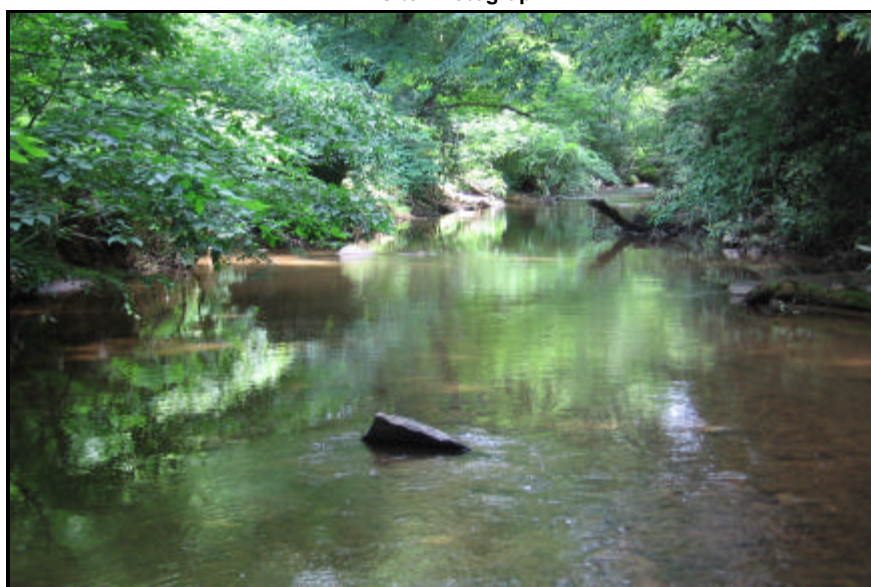
Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	11
Pool Variety (10)	8
Riffle Habitat (16)	15
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)	89

Site Photograph



Substrate

gravel, cobble, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/20/06	2006-86	20	54	Excellent
06/21/01	2001-69	17	54	Excellent
05/17/96	96-52	19	54	Excellent

Most Abundant Species

Redlip Shiner

Exotic Species

Central Stoneroller, Warpaint Shiner

Species Change Since Last Cycle

Gains -- Bluegill, Spottail Shiner, Sandbar Shiner, Mountain Redbelly Dace. **Losses** -- Smallmouth Bass, Fieryblack Shiner

Data Analysis

Watershed -- drains the extreme upper north-central region of Surry County and a small portion of south Carroll County, Virginia. **Habitats** -- runs, riffles, side woody debris; *Fissidens moss*. **2006** -- abundant fish (906 total) including three darter species, two sunfish species, three sucker species, and two intolerant species; three more species collected than in 2001, yet two less intolerants. **1996-2006** -- total of 22 species collected from this site; very consistent metrics among three samples, and identical NCIBI scores and ratings.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
STEWARTS CR	SR 2258	07/25/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-9-(1)	362744	803731

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV; Tr	78.6	15	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	20	80	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)	8.1
Specific Conductance (µS/cm)	72
pH (s.u.)	6.8

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	14
Pool Variety (10)	10
Riffle Habitat (16)	6
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	6
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	73

Site Photograph



Substrate	gravel, sand, cobble; some silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/25/06	10028	110	37	5.35	4.56	Good
07/24/01	8511	78	34	5.31	4.48	Good
07/25/96	7120	81	27	5.61	4.78	Good-Fair

Taxonomic Analysis

The greatest number of EPT taxa for a sampling event occurred in 2006. The increase in EPT richness in 2006 over 2001 was due to Plecoptera; one stonefly taxon was collected in 2001 and four in 2006. Abundant EPT taxa in 2006 included: *Baetis intercalaris*, *Serratella deficiens*, *Maccaffertium ithaca*, *Isonychia*, *Ceratopsyche bronta*, *C. sparna*, *Cheumatopsyche*, and *Hydropsyche venularis*.

Data Analysis

The site is about 3 miles SSW of downtown Mount Airy and 2.3 stream miles from the confluence with Ararat River. NCBI and EPT BI values suggest similar water quality conditions between 2001 and 2006; more significant differences are seen between 1996 and 2001 (as reflected in the improved classification of Good in 2001 from Good-Fair in 1996).

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
FLAT SHOAL	SR 2017	07/25/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-13	362420	803338

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	9	5	0.3

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)	21.7
Dissolved Oxygen (mg/L)	8
Specific Conductance (µS/cm)	52
pH (s.u.)	6.1

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	10
Riffle Habitat (16)	5
Left Bank Stability (7)	3
Right Bank Stability (7)	1
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	61

Site Photograph



Substrate	mostly sand, gravel; some silt, cobble
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/25/06	10030	-	25	-	3.30	Good-Fair

Taxonomic Analysis

Thirteen Ephemeroptera, three Plecoptera, and nine Trichoptera taxa were collected from the site. Abundant taxa were: *Baetis pluto*, *Serratella deficiens*, *Maccaffertium modestum*, *Leuctra*, *Chimarra*, and *Neophylax oligius*.

Data Analysis

The site is 7 miles SSE of Mt Airy NC, about 5 miles WNW of the city of Pilot Mountain NC, and about 250 from the confluence with Ararat River. The site was sampled for benthic invertebrates for the first time in 2006. The former basinwide site was upstream at SR 1827 and had a small drainage area; presently the BAU does not have criteria to rate such streams. Though the site at SR 2017 has the advantage of a possessing a large enough drainage area so that a rating can be assessed, the hydrology of the stream at the site is influenced by high flow events in nearby Ararat River and therefore is not representative of the stream as a whole. During the next cycle consideration for a basinwide site should be given to the next upstream road crossing or to the original site if small-stream criteria have been developed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Toms Cr	SR 2024	06/19/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	3	03040101	362308	803150	12-72-14-(4)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	37.7	---	14	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	---	5	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

Temperature (°C)	20.1
Dissolved Oxygen (mg/L)	8.0
Specific Conductance (µS/cm)	65
pH (s.u.)	5.9

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	80

Site Photograph



Substrate

gravel, cobble, bedrock, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/19/06	2006-83	22	58	Excellent
06/21/01	2001-70	23	56	Excellent

Most Abundant Species

Redlip Shiner

Exotic Species

Northern Hogsucker, Green Sunfish, Spotted Bass, Central Stoneroller

Species Change Since Last Cycle

Losses -- Notchlip Redhorse, Warmouth, Thicklip Chub, Snail Bullhead Chub, Flat Bullhead
Gains -- Spotted Bass, Creek

Data Analysis

Watershed -- drains part of the eastern edge of Surry County including the town of Pilot Mountain and a small section of Stokes County. **Habitats** -- pools, riffles, cobble, flat rocks; mountain-like; good riparian including Rhododendron and Mountain Laurel. **2006** -- lots of fish (834 total); very diverse, well balanced community of fish including three darter species, five sunfish species, three sucker species, and two intolerant species; approaching a maximum NCIBI score. **2001-2006** -- This watershed continues to support a diverse community of fish (26 species collected here) and has earned two consecutive Excellent bioclassifications.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Little Yadkin R	SR 1236	06/19/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stokes	2	03040101	361847	802402	12-77	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	32.3	---	14	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	85	---	10	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
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Water Quality Parameters

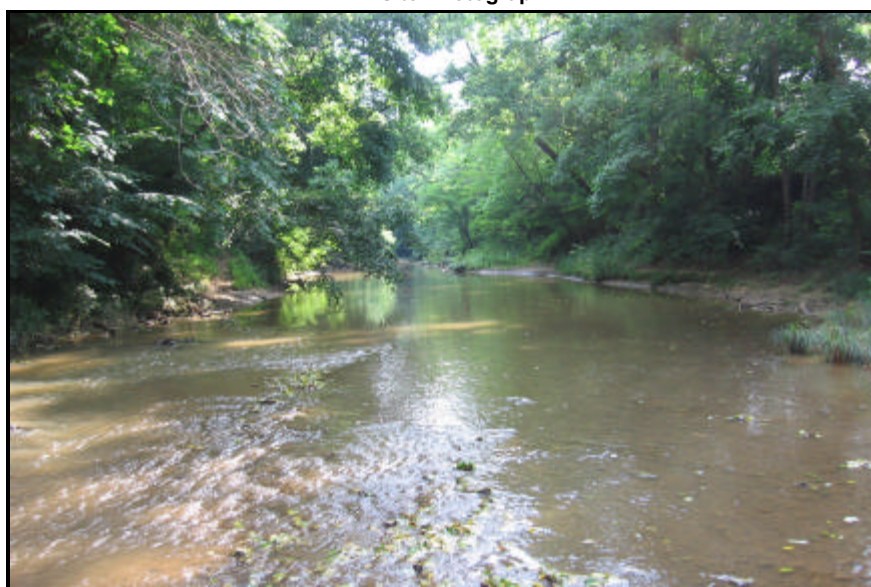
Temperature (°C)	19.7
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	71
pH (s.u.)	6.0

Water Clarity	Slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	8
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)	5
Total Habitat Score (100)	78

Site Photograph



Substrate	gravel, cobble, bedrock
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/19/06	2006-82	17	54	Excellent
06/21/01	2001-71	22	54	Excellent
05/17/96	96-53	21	54	Excellent

Most Abundant Species	Redlip Shiner	Exotic Species	Mountain Redbelly Dace
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Species Change Since Last Cycle	Losses -- Notchlip Redhorse, Green Sunfish, Largemouth Bass, Goldfish, Thicklip Chub, Fieryblack Shiner, Flat Bullhead Gains -- Bluegill, Mountain Redbelly Dace
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Data Analysis

Watershed -- drains the rural southwest corner of Stokes County. **Habitats** -- gravel and cobble riffles, woody debris, tires; open canopy at upper end of reach. **2006** -- lots of fish (1002); well balanced community, but five fewer species collected since 2001 including two intolerants (Thicklip Chub and Fieryblack Shiner). **1996-2006** -- 25 fish species have been collected at this site; slight increase in specific conductance over three cycles from 43 to 71 µS/cm; third cycle with identical NCIBI score and Excellent bioclassification.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
L YADKIN R	SR 1102	08/09/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
STOKES	2	03040101	12-77	361704	802549

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV	48.9	10	0.2

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

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

Water Quality Parameters

Temperature (°C)	26
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	73
pH (s.u.)	6.7
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	53

Substrate	Sand with little gravel and silt.
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10014	102	33	5.4	4.5	Good-Fair

Taxonomic Analysis

A fairly diverse, though relatively tolerant community of macroinvertebrates was identified at this site. Edge habitat (snags, undercut banks, root mats) provided diverse taxa despite a predominately sand substrate across the stream channel. Leptocerid caddisflies and coleopterans were well represented among taxa taking advantage of the organic habitat.

Data Analysis

This site was moved to this location for the first time in this sampling trip of 2006. At this point, the Little Yadkin River drains approximately 49 square miles, much of it in the US 52 corridor with agricultural, commercial, and residential land uses. Previous sampling, labeled as Little Yadkin River at SR 1236 had actually been collected from Danbury Creek at SR 1236, upstream of the confluence of Danbury Creek and West Prong where the Little Yadkin River is formed. The current site at SR 1102 is approximately 6 river miles downstream of this location.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
FORBUSH CR	SR 1570	08/10/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
YADKIN	2	03040101	12-83-(1.5)	360725	803034

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-IV	26.9	6	0.3

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

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

Water Quality Parameters

Temperature (°C)	24.9
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	72
pH (s.u.)	7

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	55

Site Photograph



Substrate	Rubble, sand, boulder, gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10017	NA	22	NA	4.8	Good-Fair
08/08/01	8573	NA	22	NA	4.2	Good-Fair
07/24/96	7099	NA	23	NA	4	Good-Fair

Taxonomic Analysis

Taxa richness was identical at this site in 2006 and 2001 samples though a few more tolerant species in 2006 raised the EPT biotic index slightly. The lack of the caddisfly genera *Oecetis*, *Trietodes* and *Brachycentrus* in 2006 samples may be an indication that woody habitat available at higher flow may have been absent during this sampling event due to low flows.

Data Analysis

Forbush Creek, just north of North Deep Creek and US 421 drains an agricultural area though increasing development from the south along the highway corridor probably influences the area. The site has steep and highly eroded banks with a rubble/sand substrate. A large corn field abuts the stream on the right bank. The benthic community appears fairly consistent over time though a slight trend toward more tolerant species was observed during the 2006 sampling event.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LOGAN CR	SR 1571	08/11/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
YADKIN	2	03040101	12-83-2-(0.7)	360726	803015

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-IV	26.3	5	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	70		30	

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

Water Quality Parameters

Temperature (°C)	23.9
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	89
pH (s.u.)	6.6
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	5
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	51

Substrate

Sand, gravel, silt, rubble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/11/06	10018	NA	21	NA	5.1	Good-Fair
08/09/01	8576	NA	31	NA	4.8	Good
07/24/96	7098	NA	27	NA	4.7	Good-Fair

Taxonomic Analysis

EPT taxa declined sharply in 2006 sampling compared to 2001. Trichoptera and Plecoptera taxa dropped by half while the EPT biotic index declined only slightly. This fact may suggest that declines may have been habitat, rather than water quality related.

Data Analysis

The Logan Creek site is surrounded by open agricultural fields. The immediate watershed has a fairly broad floodplain, making the land ideal for this use. At the time of sampling, the stream was heavily laden with woody debris piles, suggesting recent high flows that may have scoured benthos populations and created the drop in taxa richness observed. Some riparian logging activities were also obvious at the site. Previous sampling had indicated a relatively stable community.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Deep Cr	SR 1605	06/07/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Yadkin	2	03040101	360811	803744	12-84-1-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	35.8	---	10	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	40	---	30	30 (overhead powerline)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	16.8
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	75
pH (s.u.)	5.9

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	10
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	1
Right Bank Stability (7)	1
Light Penetration (10)	5
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	38

Site Photograph



Substrate

sand, clay

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/07/06	2006-79	16	42	Good-Fair
06/21/01	2001-72	13	44	Good-Fair
05/15/96	96-46	13	44	Good-Fair

Most Abundant Species

Bluehead Chub

Exotic Species

None

Species Change Since Last Cycle

Gains -- Highback Chub, Golden Shiner, Margined Madtom, Fantail Darter **Losses** -- Fieryblack Shiner

Data Analysis

Watershed -- drains eastern and northern Yadkinville and southern Booneville, in central Yadkin County. **Habitats** -- sandy runs, side snag pools, few root wads and undercuts; areas with severe vertical bank erosion; power line right of way and ATV access; no canopy in upper 1/3 of site. **2006** -- good diversity, with 16 species collected; first collection of Fantail Darter at this site. **1996-2006** -- 17 fish species are known from this site; little change in the fish community, with an almost identical NCIBI score, and the same rating; consistently very low habitat scores over three assessments.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
N DEEP CR	SR 1510	08/11/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
YADKIN	2	03040101	12-84-1-(0.5)	360733	803532

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	42	10	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Yadkinville WWTP	NC0020338	1.0

Water Quality Parameters

Temperature (°C)	23.5
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	91
pH (s.u.)	6.9

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	92

Site Photograph



Substrate	Boulder, rubble, gravel, sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/11/06	10015	75	26	5.3	4.8	Good-Fair
08/09/01	8575	76	26	5.4	4.6	Good-Fair
07/25/96	7100	57	24	5.3	4.9	Good-Fair
04/12/93	6155	53	25	4.9	4.4	Good-Fair

Taxonomic Analysis

Taxonomic results for 2006 are very similar to 2001 data. EPT abundance has increased from 137 to 146, spurred by an increase in several baetid mayfly taxa. The stream maintains a fairly diverse, if somewhat tolerant community of macroinvertebrates. A jump in taxa between 1996 and 2001 appears to have been maintained fairly consistently since then. Blackfly larvae and the relatively sensitive mayfly *Serratella deficiens* are taxa that have reappeared in abundance.

Data Analysis

Located several miles downstream of the Yadkinville WWTP, this site is located in a forested drainage and is situated in Shore-Styers Mill Site park. A waterfall just upstream of the site provides good physical aeration when flowing. The substrate has a good mix of rock sizes provided common riffles and the riparian vegetation provides both good canopy and runoff buffer.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Deep Cr	SR 1152	06/06/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Yadkin	2	03040101	360550	804035	12-84-2-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	50.6	---	10	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	20.7
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	68
pH (s.u.)	6.7

Water Clarity

Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	2
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	55

Site Photograph



Substrate

sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/06/06	2006-78	17	52	Good
06/22/01	2001-73	19	52	Good
05/15/96	96-47	17	48	Good

Most Abundant Species

Bluehead Chub

Exotic Species

None

Species Change Since Last Cycle

Gains -- Warmouth, Fieryblack Shiner, Fantail Darter, Eastern Mosquitofish **Losses** -- White Sucker, Green Sunfish, Whitefin Shiner, Spottail Shiner, Snail Bullhead, Flat Bullhead

Data Analysis

Watershed -- drains the southwest side of Yadkin County, west of Yadkinville. **Habitats** -- good pools (favored by sucker species), coarse woody debris, large bedrock outcrop on left side. **2006** -- good species diversity including four darter species, three sucker species, and three intolerant species (Fieryblack Shiner, Highback Chub, Piedmont Darter). **1996-2006** -- 25 species have been collected here; this site has sustained a stable and diverse fish community, and a rating of Good since 1996.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
S DEEP CR	SR 1710	08/09/01	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
YADKIN	2	03040101	12-84-2-(5.5)	360624	803518

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV	63.5	10	0.3

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

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

Water Quality Parameters

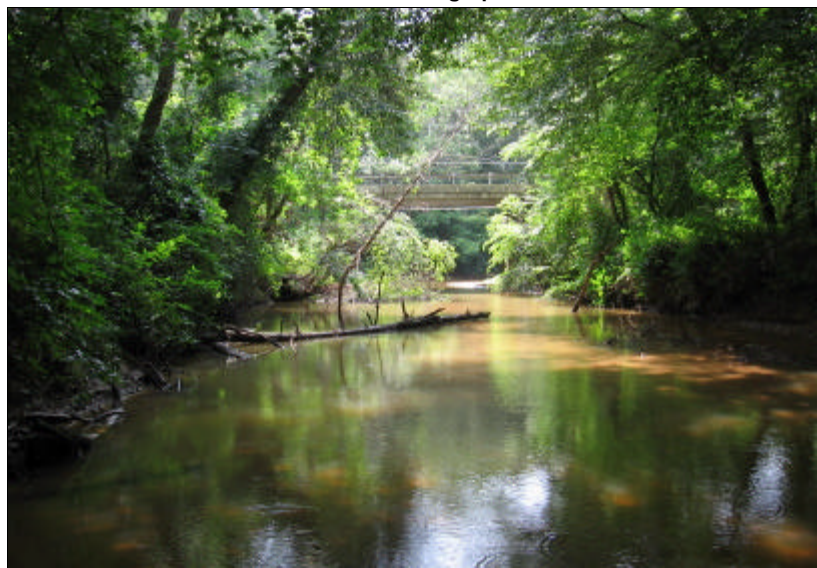
Temperature (°C)	23
Dissolved Oxygen (mg/L)	6.4
Specific Conductance (µS/cm)	68
pH (s.u.)	7.4

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	52

Site Photograph



Substrate	Sand, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10016	75	24	4.9	3.9	Good-Fair
08/09/01	8574	65	19	5.3	4.4	Good-Fair
07/26/96	7101	56	26	4.8	4.4	Good-Fair

Taxonomic Analysis

The 2006 sampling event at this site realized a gain in mayfly, stonefly and caddisfly taxa, all contributing to a decrease in the biotic index (overall and EPT); an indication that a less tolerant benthic community currently inhabits the site. Overall, 10 taxa were gained in this most current survey.

Data Analysis

South Deep Creek drains the southwest corner of Yadkin County before joining North Deep Creek 3 miles downstream of this site. The sandy/silty substrate here is likely contributed in some part by the steep, badly eroded banks. Evidence of flash flows of 5 feet stage were present, though flow was low at the time of sampling with many root mats out of the water. Stream-edge woody debris and remaining root mats provided much of the habitat for the benthic community observed, qualifying the site for a Good-Fair bioclassification.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MUDDY CR	SR 1898	08/07/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
FORSYTH	4	03040101	12-94-(0.5)	361331	802022

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	7.3	3	0.2

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

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

Water Quality Parameters

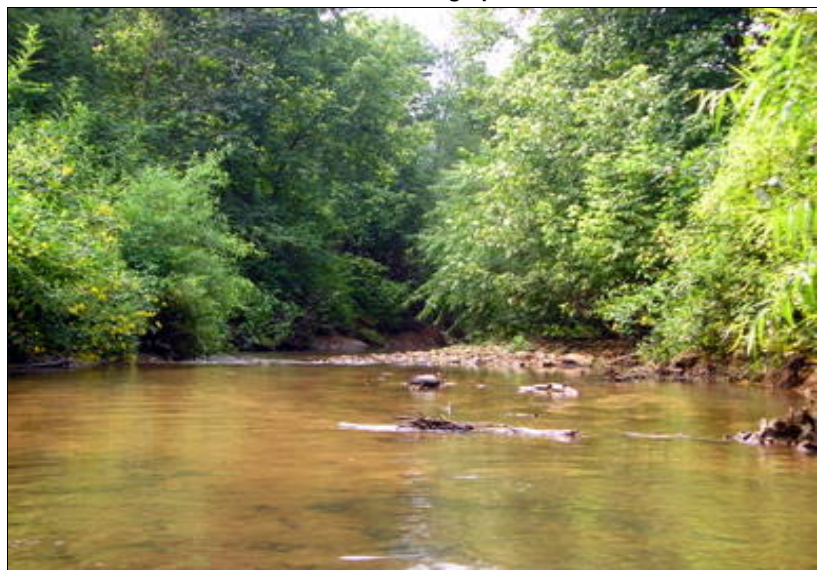
Temperature (°C)	24
Dissolved Oxygen (mg/L)	6.9
Specific Conductance (µS/cm)	65
pH (s.u.)	6.5

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	7
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	63

Site Photograph



Substrate	mostly sand with some gravel and cobble
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/07/06	10038	---	14	---	5.9	Fair
08/06/01	8500	---	19	---	5.1	Good-Fair
08/05/96	7103	---	18	---	5.0	Good-Fair

Taxonomic Analysis

Benthic sampling in 2006 resulted in the lowest number of EPT ever collected at this site. Taxa collected in 2001 that were absent in 2006 included two intolerant caddisflies, *Neophylax oligius* and *Pycnopsyche* as well as three mayflies, *Baetisca carolina*, *Hexagenia*, and *Stenacron interpunctatum*. Taxa never before collected included the mayfly *Plauditus*, and the caddisfly *Polycentropus*. The increase in the EPT BI indicates an overall more tolerant EPT community.

Data Analysis

Upstream of Winston-Salem, this segment of Muddy Creek primarily drains agricultural land, though the immediate landuse at the site was forest and residential. The reduction of the rating from Good-Fair in 2001 to Fair in 2006 appears to be associated with poorer habitat (73 in 2001). Sediment loading from agriculture and erosion has possibly impacted the macroinvertebrate community as higher sediment homogeneity was observed in 2006 than in previous years.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MUDDY CR	SR 2995	09/28/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
FORSYTH	4	03040101	12-94-(0.5)	360001	802025

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	224.2	17	0.5

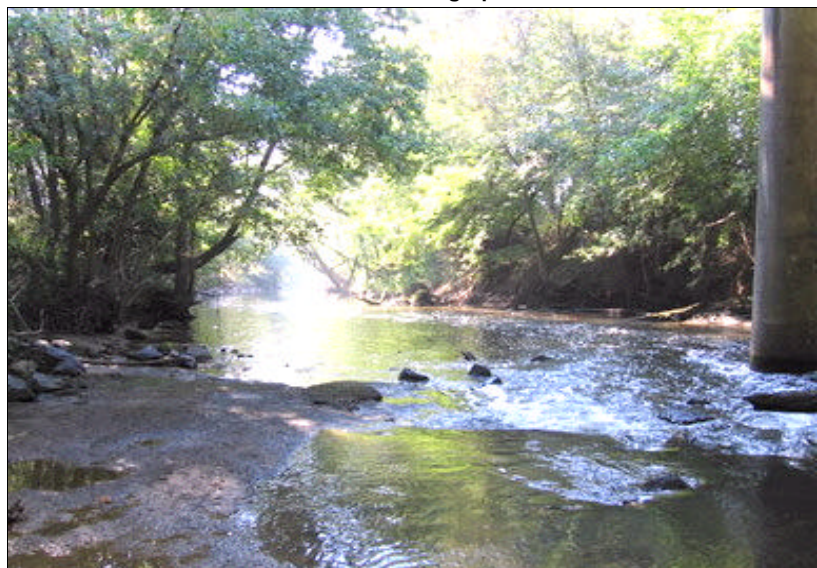
Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	0	100	0	0

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)	8.6
Specific Conductance (µS/cm)	420
pH (s.u.)	7.5
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	52

Substrate	mostly sand with some bedrock, boulder and cobble
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/28/06	10071	58	12	6.3	5.4	Fair
08/07/01	8462	50	14	6.5	5.8	Good-Fair
08/06/96	7125	51	18	6.4	5.6	Good-Fair
07/31/85	3572	53	17	6.6	5.2	Fair

Taxonomic Analysis

The loss of two EPT taxa and a reduced EPT abundance (from 80 in 2001 to 70 in 2006) at this site reduced the bioclassification to Fair for 2006. Previously abundant taxa not collected in 2006 included only the mayfly *Stenacron interpunctatum*. Of note, two intolerant stoneflies, *Acroneuria abnormis* and *Paragnetina fumosa* have been present since 1985. The midge (Chironomidae) community was more diverse than in past years with a higher number of tolerant species, five of which were abundant (*Conchapelopia* gr. and *Polypedilum illinoense* gr., *P. flavum*, *Rheocrocopus robacki* and *Rheotanytarsus*)

Data Analysis

This site is below the confluence of Muddy and Salem Creeks. The high specific conductance measured (420) is a result of urban runoff from southwestern Winston-Salem and the W-S Archie-Elledge WWTP that discharges into Salem Creek. Although the biotic index is lower than the 2001 BI, the stream still rated Fair due a low EPT richness and EPT abundance. However, this site only missed a Good-Fair rating by one abundance value (EPT N =70) indicating that stream conditions have not changed much since 2001.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Silas Cr	SR 1137	06/05/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Forsyth	4	03040101	360244	802115	12-94-10	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	11.9	---	6	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	18.3
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	127
pH (s.u.)	6.2

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	49

Site Photograph



Substrate

sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/05/06	2006-72	13	44	Good-Fair
04/24/02	2002-31	12	44	Good-Fair
04/30/01	2001-28	12	40	Fair

Most Abundant Species

Bluehead Chub

Exotic Species

Rosefin Shiner

Species Change Since Last Cycle

Gains -- Warmouth, Speckled Killifish, Tessellated Darter **Losses** -- Bluegill, Highback Chub

Data Analysis

Watershed -- drains a section of central Winston-Salem in southwest Forsyth County. **Habitats** -- shallow sandy runs, side snags, undercuts, coarse woody debris. **2006** -- good species diversity, yet lowest number of fish collected at this site (total = 154); first time Tessellated Darter collected here; Highback Chub (intolerant) is missing (collected in the 2002 303(d) sample). **2001-2006** -- among three assessments, there have been 18 fish species collected from this urban site; the Bluehead Chub has always been the most abundant fish; after an improvement in 2002, the fish community rating has remained stable.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
SALEM CR	SR 2902	08/08/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
FORSYTH	4	03040101	12-94-12-(4)	360318	801708

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	59.4	7	0.3

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)	25.6
Dissolved Oxygen (mg/L)	7
Specific Conductance (µS/cm)	178
pH (s.u.)	6.4
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	60

Substrate	Mostly sand, some gravel and cobble
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/06	10042	58	16	6.6	6.0	Fair
08/06/01	8501	45	9	6.9	6.3	Fair
08/05/96	7104	53	11	7.2	6.0	Fair
09/27/82	2870	31	4	7.9	7.1	Poor

Taxonomic Analysis

A total of 16 EPT taxa were collected in 2006, seven of which have never before been collected at this site. Of these new taxa, only two were abundant, the very tolerant mayflies *Paracloeodes fleeki* and *P. minutus*. The remaining five new taxa were rare to common and included two relatively intolerant caddisflies (*Diplectrona modesta* and *Polycentropus*), one moderately tolerant caddisfly (*Tricorythodes*), one moderately tolerant mayfly (*Tricorythodes*) and one tolerant caddisfly (*Hydroptila*). Macroinvertebrate taxa tolerant of organic loading were abundant particularly the midges *Dicortendipes neomodestus* and *Polypedilum illinoense* gr. In addition to the increase in EPT, the biotic index has consistently decreased every sampling year.

Data Analysis

This portion of Salem Creek drains much of Winston-Salem and though many small dischargers exist upstream none are within a mile of the sampling site. This stream has maintained a Fair bioclassification every year except 1982 when it was rated Poor. The habitat improved in 2006 (score 60) since 2001 (score 39), most likely contributing to the increase in EPT taxa. Also, excessive periphyton growth was observed in both 2001 and 2006, further evidence of high nutrient loadings in this stream. Salem Creek at SR 2902 appears to be improving though more monitoring is needed to verify this trend.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
SALEM CR	SR 2991	08/09/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
FORSYTH	4	03040101	12-94-12-(4)	360030	802009

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	69.3	15	0.4

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Winston-Salem Archie Elledge WWTP	NC0037843	30

Water Quality Parameters

Temperature (°C)	29.1
Dissolved Oxygen (mg/L)	6
Specific Conductance (µS/cm)	500
pH (s.u.)	7.1
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	4
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	45

Substrate	Sand with some bedrock
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10044	51	11	6.6	6.3	Fair
08/06/01	8544	42	10	7.1	6.4	Fair
08/05/96	7105	43	8	7.2	5.9	Fair
09/27/82	2871	22	0	8.4	---	Poor

Taxonomic Analysis

EPT richness has remained stable since 1996 although EPT N has increased steadily since 1982 (0 in 1982, 30 in 1996, 50 in 2001 and 58 in 2006). In addition, the biotic index has decreased every year. Absent from previous years, the heptageniid mayflies *Maccaffertium modestum* and *Stenacron interpunctatum* were collected but were rare. Tolerant taxa were found in abundance and included mayflies (*Baetis intercalaris* and *Pseudocloeon propinquum*) and hydropsychid caddisflies (*Cheumatopsyche*, *Hydropsyche betteni* and *H. venularis*). Organic waste indicator chironomid taxa, *Polypedium illinoense* gr. and *P. flavum*, were also abundant.

Data Analysis

This site is downstream of Winston-Salem Archie Elledge WWTP but upstream of the confluence with Muddy Creek. Salem Creek has rated Fair since 1996. The high specific conductance is typical of a stream below a WWTP and reflects the high volume of treated waste that is discharged. The low EPT and the current BI of 6.65 reflect substantially degraded water quality attributable in large part to the high degree of urbanization and poor habitat. It appears discharge from the WWTP may further degrade water quality as evidenced by the higher EPT richness (16) and abundance (85) seen at the Salem Creek site (SR 2902) above the WWTP.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
S FK MUDDY CR	SR 2902	08/08/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
FORSYTH	4	03040101	12-94-13	360023	801810

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont		42.3	10	0.3

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

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

Water Quality Parameters

Temperature (°C)	24.9
Dissolved Oxygen (mg/L)	5.5
Specific Conductance (µS/cm)	111
pH (s.u.)	6.5
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

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

Substrate	Mostly sand with some gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/06	10043	61	17	6.0	5.3	Good-Fair
08/06/01	8545	---	17	---	5.5	Good-Fair
08/05/96	7124	---	14	---	4.8	Good-Fair

Taxonomic Analysis

The number of EPT taxa remained constant at 17, however, the site was sampled with a more exhaustive method than in previous years. The majority of abundant taxa at the site were tolerant species (the mayflies *Baetis intercalaris*, *Pseudocloeon propinquum*, *Maccaffertium modestum* and the caddisfly *Cheumatopsyche*) though two fairly intolerant caddisfly taxa (*Nectopsyche exquisita* and *Triaenodes ignitus*) were also abundant. The number of stonefly species decreased from 3 in 2001 to 1 in 2006 (*Paragnetina fumosa*).

Data Analysis

A major tributary to Muddy Creek, the South Fork Muddy Creek drains the southeastern portion of Winston-Salem. The stream has consistently rated Good-Fair since it was first monitored in 1996. This stream has more agricultural and less urban inputs than Salem Creek nearby and as a consequence has a higher bioclassification. The Biotic index indicates fairly degraded water quality which is primarily due to urban and agricultural runoff as no permitted dischargers exist on this stream. Though no direct comparisons can be made to previous data, it is clear that water quality at this site has not worsened since 2001.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Fk Muddy Cr	SR 2902	06/05/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Forsyth	4	03040101	360022	801807	12-94-13	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	42.9	---	9	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	95	---	---	5 (old sand dipping operation)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	17.7
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	95
pH (s.u.)	6.5

Water Clarity

Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	52

Site Photograph



Substrate

sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/05/06	2006-71	19	52	Good
04/30/01	2001-31	13	42	Good-Fair

Most Abundant Species

Satinfin Shiner

Exotic Species

Rosefin Shiner, Channel Catfish

Species Change Since Last Cycle

Gains -- White Sucker, Pumpkinseed, Bluegill, Largemouth Bass, Gizzard Shad, Eastern Silvery Minnow, Rosefin Shiner, Bluehead Chub, Channel Catfish, Piedmont Darter, Eastern Mosquitofish. **Losses** -- Green Sunfish, Redlip Shiner, Flat Bullhead, Margined Madtom.

Data Analysis

Watershed -- drains the southeastern side of Winston-Salem and a portion of northern Davidson County. **Habitats** -- entrenched; shallow sandy runs, woody debris, side snags; site is just above an old sand dipping operation. **2006** -- high percentage of Insectivores collected (81%). Conductivity reading of 95 µS/cm continues to reflect the urban and agricultural nature of this watershed. **2001-2006** -- 65 fewer fish were collected in 2006; the change in community structure between these monitoring cycles includes a total of 15 fish species (gain of 11, and loss of four); 23 species are known from this site; substantial improvement in the NCIBI score, and an increase in one bioclassification.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
DUTCHMANS CR	US 158	08/10/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIE	5	03040101	12-102-(2)	355648	803209

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	57.6	3	0.2

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

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

Water Quality Parameters

Temperature (°C)	24.6
Dissolved Oxygen (mg/L)	6
Specific Conductance (µS/cm)	141
pH (s.u.)	6.9

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	49

Site Photograph



Substrate	Sand, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10019	77	19	6	5.5	Good-Fair
08/07/01	8568	72	20	6.4	5.5	Good-Fair
07/24/96	7096	69	24	5.6	4.8	Good

Taxonomic Analysis

Total taxa encountered at this site in 2006 increased due to higher chironomid richness. EPT taxa remained nearly constant with a slight increase in odonates. The overall biotic index showed a slight improvement toward less tolerant organisms.

Data Analysis

Dutchmans Creek bisects Davie County. This site lies south of the I-40 corridor and is the most upstream benthos sampling location on the stream. The site has a low gradient with sandy, silty substrate. Low flow conditions existing during the sampling event had root mats exposed and only a central channel of flow remaining. These conditions seem to maintain a fairly consistent, if relatively tolerant macroinvertebrate community at the site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Dutchmans Cr	US 158	06/05/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davie	5	03040101	355649	803208	12-102-(2)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	57.6	---	10	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	---	---	10 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	19.4
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	140
pH (s.u.)	6.0

Water Clarity	Turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	2
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	61

Site Photograph



Substrate	sand, gravel, boulders
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/05/06	2006-73	20	46	Good-Fair
05/04/01	2001-42	17	44	Good-Fair
05/13/96	96-40	12	38	Fair

Most Abundant Species	Redbreast Sunfish	Exotic Species	Green Sunfish, Redear Sunfish, Spotted Bass, Threadfin Shad, Channel Catfish
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Species Change Since Last Cycle

Gains -- White Sucker, Green Sunfish, Redear Sunfish, Spotted Bass, Threadfin Shad, Eastern Silvery Minnow, Flat Bullhead. **Losses** -- Creek Chubsucker, Red Shiner, Highback Chub, Redlip Shiner.

Data Analysis

Watershed -- drains the northwest quadrant of Davie County and a small area along the southern edge of Yadkin County. **Habitats** -- boulder and snag pools, sand bars, side snags. **2006** -- high number of species collected (n=20) including two darter species, five sunfish species, two bass species, and three sucker species. **1996-2006** -- a steady increase in species diversity and NCIBI Score since 1996; 26 species are known from this site; the trophic structure has shifted from a majority of Omnivores+Herbivores (Bluehead chubs = 40% of the sample in 2001) to a majority of Insectivores (76%) in 2006 (collectively, Redbreast Sunfish and Bluegill make up ~51% of sample); the percentage of piscivores has also increased slightly over these monitoring cycles. Stable NCIBI score and rating since 2001.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
DUTCHMANS CR	NC 801	08/10/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIE	5	03040101	12-102-(2)	355107	802834

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	124.5	10	0.4

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

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

Water Quality Parameters

Temperature (°C)	24.5
Dissolved Oxygen (mg/L)	5.6
Specific Conductance (µS/cm)	171
pH (s.u.)	6.8

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	0
Riffle Habitat (16)	0
Left Bank Stability (7)	5
Right Bank Stability (7)	3
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	41

Site Photograph



Substrate	Sand, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10020	90	23	6.3	5.5	Good-Fair
08/07/01	8567	77	17	6.5	5.2	Fair
07/24/96	7095	84	30	6.2	4.7	Good

Taxonomic Analysis

Both total and EPT taxa at this site appear to have recovered somewhat since the drought conditions experienced in 2001 though the population now appears somewhat more tolerant with the biotic index climbing to 5.48. EPT abundance however lags below levels observed during 1996 sampling with only 3 mayfly and 1 caddisfly taxa abundant (>9 individuals). Chironomid taxa increased from 24 in 1001 to 31 in 2006.

Data Analysis

This site on Dutchmans Creek is located in the southeastern corner of Davie County near the bottom of the Dutchmans Creek watershed and well downstream of Mocksville and the Mocksville WWTP. A sandy low-gradient stream, it provides relatively poor habitat (habitat score of 41 out of 100) for macroinvertebrates and many of the taxa found are located in stream-edge woody habitat (snags, roots mats). The paucity of this habitat encountered in 2001 is slightly improved, though not ideal in 2006 with many root mats still out of the water due to low flows. Stream banks here are steep, sandy and eroded.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cedar Cr	off SR 1410	07/26/04	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davie	5	03040101	355756	803130	12-102-13-(2)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	12.1	--	5	0.2	No

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)	22.4
Dissolved Oxygen (mg/L)	5.3
Specific Conductance (µS/cm)	260
pH (s.u.)	6.6

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	1
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	50

Site Photograph



Substrate Gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/26/04	2004-134	8	40	Fair
05/04/01	2001-43	11	50	Good
05/13/96	96-41	11	46	Good-Fair

Most Abundant Species

Redbreast Sunfish

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- Red Shiner, Highback Chub, Creek Chub, and Creek Chubsucker. **Gains** -- Flat Bullhead.

Data Analysis

Watershed -- drains north-central Davie County; no municipalities in watershed; site is ~3.7 miles below Cedar Creek S&W Dam # 8 (there is no minimum flow requirement below the dam) and ~1.8 miles below site sampled in 1996 and 2001 (difference in drainage areas between the two sites is 1.2 square miles); on Vulcan quarry property, upstream from any quarry runoff, access to stream at the Pinebrook Science Center. **Habitat** -- gravelly runs; no riffles; side roots and snags; very shallow and narrow. **2004** -- low flow; specific conductance was elevated; number of fish decreased from 437 in 2001 to 153 in 2004; lower than expected total species diversity; suckers and intolerant species absent. **1996 - 2004** -- specific conductance has steadily increased from 197 to 222 to 260 µS/cm; 15 species are known from the site, including the nonindigenous Red Shiner; the percentage of tolerant fish (primarily Redbreast Sunfish) very high (66 - 86%); Redbreast Sunfish consistently the dominant species; sampled as part of a NCSU Urban Fish Study. A low flow- and reservoir-affected stream.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
S YADKIN R	SR 1561	07/25/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
IREDELL	6	03040102	12-108-(5.5)	355311	805924

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV	69.3	12	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)	24.5
Dissolved Oxygen (mg/L)	6.2
Specific Conductance (µS/cm)	57
pH (s.u.)	6.4

Water Clarity

slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	10
Bottom Substrate (15)	3
Pool Variety (10)	3
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	6
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	47

Substrate

Sand, Gravel, Silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/25/06	9988	96	28	5.5	4.5	Good
09/11/01	8621	68	21	5.7	4.9	Good-Fair
07/24/01	8488	77	25	5.8	5.1	Good
08/05/96	7148	70	30	5.0	4.3	Excellent

Taxonomic Analysis

The 2006 sample produced a stonefly community that was comparable to the 1996 community. The intolerant stonefly Leuctra (TV=2.5) was collected for the first time in 2006.

Data Analysis

This site is located in the upper portion of the watershed before the stream receives any influence from major tributaries. In 1996, this site was rated Excellent. Since then, it has rated Good or Good-Fair and a definite decline in the diversity and tolerance of the macroinvertebrate community has occurred. This was most evident in the loss of the stonefly community between sampling periods. The overall EPT taxa richness decreased from 30 to 25 in July 2001. It further decreased to 21 two months later when another field crew sampled the site as a Quality Assurance Sample. The 2006 sample produced a slightly higher EPT taxa richness suggesting a slight increase in water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Yadkin R	SR 1561	06/06/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	355311	805924	12-108-(5.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	69.3	--	13	0.3	No

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)	15.6
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	54
pH (s.u.)	5.6

Water Clarity

Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	3
Riffle Habitat (16)	1
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	48

Site Photograph



Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/06/06	2006-75	14	42	Good-Fair
05/03/01	2001-39	16	46	Good-Fair
05/14/96	96-45	11	40	Fair

Most Abundant Species

Bluehead Chub

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- Notchlip Redhorse, Striped Jumprock, Brassy Jumprock, Flat Bullhead, and Largemouth Bass.
Gains -- Satinfish Shiner, Green Sunfish, and Bluegill.

Data Analysis

Watershed -- drains the northeast quadrant of Alexander County, including the Town of Taylorsville. **Habitat** -- shallow sandy runs, side snags, some buried woody debris; "holes" missing. **2006** -- high percentage of omnivores+herbivores (61% of all fish were Bluehead Chub); low total species diversity; only one species of sucker collected; first time Green Sunfish collected at the site. **1996 - 2006** -- consistently low total habitat scores; specific conductance ~ 50 µS/cm; total species at site = 20, but the Tessellated Darter has never been collected from the site; increase in the percentage of Bluehead Chub from 31 to 45 to 61%, decrease in the percentage of insectivores from 66 to 55 to 39%; slight decrease in the NCIBI score, but not the rating.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
S YADKIN R	SR 1159	09/11/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIE	6	03040102	12-108-(14.5)	355040	803934

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-IV	306.5	19	0.7

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)	21.4
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	77
pH (s.u.)	6.5
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	5
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	4
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	64

Substrate	Boulder, Rubble, Silt, Sand, Gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/11/06	9995	77	32	5.2	4.6	Excellent
07/24/01	8489	80	32	4.7	3.9	Excellent
08/06/96	7150	60	29	4.5	3.8	Good
07/13/89	4980	73	32	4.7	3.9	Excellent
08/05/86	3899	79	26	5.1	4.1	Good

Taxonomic Analysis

The addition of two tolerant taxa, the mayfly *Caenis* (TV=7.4) and the oligochaete *Branchiura sowerbyi* (TV=8.3), which had not previously been collected at this location, may have contributed to the slightly higher Biotic Index. Abundant EPT taxa included *Baetis intercalaris*, *Caenis*, *Hexagenia*, *Isonychia*, *Stenonema modestum*, *Acroneuria abnormis*, *Hydropsyche venularis*, and *Nectopsyche exquisita*.

Data Analysis

This site is located at the Davie/Rowan County line and has consistently rated Good or Excellent since 1986. It continues to support a diverse and intolerant benthic macroinvertebrate community. However, the Biotic Index did increase slightly from previous collections.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Snow Cr	SR 1905	06/06/06	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	355346	805522	12-108-9-(0.6)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	29.3	--	5	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	15.9
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	73
pH (s.u.)	6.6

Water Clarity

Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	62

Site Photograph



Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/06/06	2006-76	12	38	Fair

Most Abundant Species

Bluehead Chub

Exotic Species

Stripped Jumprock

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains rural northwest Iredell and extreme northeast Alexander counties; no municipalities in watershed; site is ~ 1 mi. above mouth.
Habitat -- sand and gravel substrate; bar development; channel filled with sediment from upstream sediment sources. **2006** -- low diversity; one of a few sites in 2006 without any Tessellated Darter; high percentage of omnivores+herbivores; ~ 60% of all fish were Bluehead Chub.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ROCKY CR	SR 1884	07/26/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
IREDELL	6	03040102	12-108-11	355755	805010

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	56.5	12	0.4

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

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

Water Quality Parameters

Temperature (°C)	23.3
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	44
pH (s.u.)	6.4
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	65

Substrate	Sand, Rubble, Gravel, Boulder, Silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/26/06	9990	--	44	--	4.2	Excellent
07/23/01	8485	--	38	--	3.8	Excellent
08/05/96	7146	--	26	--	3.9	Good

Taxonomic Analysis

Although the EPT biotic index increased slightly, only one pollution tolerant mayfly, *Caenis*, went from rare or not collected in 1996 or 2001, respectively, to abundant in 2006. Several intolerant EPT taxa were collected for the first time at this location and included the mayflies *Brachycercus*, *Epeorus*, *Ephemera*, *Ephoron Leukon*, *Heterocloeon curiosum*, *Paraleptophlebia*, *Plauditus dubius* group, *Procloeon*, and *Pseudocloeon dardanum*, the stonefly *Leuctra*, and the caddisflies *Glossosoma*, *Paranyctiophylax celta*, *Psychomyia flavida*, and *Setodes*.

Data Analysis

This site is located approximately two miles upstream of its confluence with Patterson Creek. In 1996, this site missed an Excellent bioclassification by two taxa (26 EPT taxa found). This site received an Excellent bioclassification in 2001 (39 EPT) and in 2006 (44 EPT).

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Rocky Cr	SR 1890	07/26/04	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	355545	804850	12-108-11	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	62.4	--	8	0.4	No

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)	23.0
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	46
pH (s.u.)	5.8

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	64

Site Photograph



Substrate Sand, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/26/04	2004-135	19	54	Excellent

Most Abundant Species

Bluehead Chub

Exotic Species

Green Sunfish and Smallmouth Bass

Species Change Since Last Cycle

N/A; new site in 2004.

Data Analysis

Watershed -- headwaters arise in the Brushy Mountains in southern Wilkes County, flows through northeastern Alexander and northwestern Iredell County; rural, no municipalities in the watershed; tributary to Patterson Creek. **Habitat** -- sandy runs, gravel/boulder/bedrock/shelf riffles, two good plunge pools; bank instability; very similar (habitats, substrate, clarity, and species) to Hunting and North Little Hunting creeks. **2004** -- pH reading was correct and verified; relatively low specific conductance; percentage of tolerant fish was moderate (33 percent) and included the Satfin Shiner, White Sucker, Flat Bullhead, Redbreast Sunfish, and Green Sunfish; but five intolerant species were also present and included the Thicklip Chub, Fieryblack Shiner, Highback Chub, Smallmouth Bass, and Piedmont Darter; sampled as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
PATTERSON CR	SR 1890	07/26/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
IREDELL	6	03040102	12-108-11-3	355527	804927

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	35.3	10	0.2

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

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

Water Quality Parameters

Temperature (°C)	25.5
Dissolved Oxygen (mg/L)	6
Specific Conductance (µS/cm)	61
pH (s.u.)	6.5

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	15
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)	97

Site Photograph



Substrate	Boulder, Rubble, Silt, Bedrock, Gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/26/06	9991	--	32	--	3.9	Excellent
07/23/01	8486	--	25	--	4.1	Good

Taxonomic Analysis

EPT taxa collected for the first time (at this site) in 2006 included the mayflies *Caenis*, *Epeorus rubidus*, *Hexagenia*, *Leucrocota*, and *Pseudocloeon propinquum*, the stonefly *Leuctra*, and the caddisflies *Brachycentrus nigrosoma*, *Hydropsyche rossi*, *Neophylax oligius*, *Oecetis persimilis*, and *Rhyacophila fuscula*.

Data Analysis

Patterson Creek is a small tributary to Rocky Creek. It has been sampled on three prior occasions during winter and spring as part of Watershed Assessment Team (WAT) training. This site was added to the basinwide schedule in 2001 and has only been sampled twice as a basinwide site. In 2006, it rated Excellent, up from the Good rating it received in 2001. EPT taxa richness increased from 25 in 2001 to 32 in 2006. Since 2001 was a drought year, this may explain the increase in the number of EPT taxa collected.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Patterson Cr	SR 1890	07/09/04	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	355525	804924	12-108-11-3	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	35.4	--	7	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	75	0	20	5 (rural residential)

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

Water Quality Parameters

Temperature (°C)	20.7
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	68
pH (s.u.)	5.8

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	0
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	57

Site Photograph



Substrate Sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/09/04	2004-116	12	52	Good

Most Abundant Species

Notchlip Redhorse

Exotic Species

None

Species Change Since Last Cycle

N/A; new site in 2004.

Data Analysis

Watershed -- drains rural north-central Iredell County; no municipalities in watershed; a tributary to Rocky Creek, site is ~ 0.5 mile above mouth. **Habitat** -- channel filled with sediment; no riffles; long pools and sandy runs; open canopy. **2004** -- total species diversity and diversity of darters lower than expected; only one species of darter collected (Tessellated Darter); lots of biomass with large suckers (White Sucker, Notchlip Redhorse, and Brassy Jumprock); Rosyside Dace and Creek Chub represented only by young-of-year; sampled as part of a NCSU Urban Fish Study.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Olin Cr	SR 1892	06/05/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	355639	805204	12-108-11-3-3	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	9.4	--	4	0.3	No

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)
None	---	---

Water Quality Parameters

Temperature (°C)	18.6
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	52
pH (s.u.)	6.2

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	4
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	53

Site Photograph



Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/05/06	2006-74	10	44	Good-Fair
05/14/96	96-44	9	36	Fair

Most Abundant Species

Bluehead Chub

Exotic Species

Fathead Minnow

Species Change Since Last Cycle

Losses -- Margined Madtom. Gains -- Highback Chub and Fathead Minnow.

Data Analysis

Watershed -- drains rural north-north central Iredell County; rural, no municipalities in watershed; small tributary to Patterson Creek. Habitat -- shallow sandy runs, stick and gravel riffles, snag pools; very turbid when walking in channel. **2006** -- low total species diversity; no suckers; moderately high percentage of omnivores+herbivores. **1996 and 2006** -- slight improvement observed; increase in the total number of fish collected; less dominance by the Bluehead Chub; consistently low total habitat scores and total species diversity; number of species known from site = 11; NCIBI score increased and rating improved to Good-Fair.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
HUNTING CR	NC 115	07/25/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	6	03040102	12-108-16-(0.5)	360444	805839

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-III	29.8	16	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)
None		

Water Quality Parameters

Temperature (°C)	22
Dissolved Oxygen (mg/L)	6.5
Specific Conductance (µS/cm)	50
pH (s.u.)	6.3
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	10
Pool Variety (10)	5
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	6
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	72

Substrate	Gravel, Sand, Boulder, Rubble, Silt, Bedrock
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/25/06	9987	100	43	4.2	3.4	Excellent
07/30/01	8483	--	37	--	3.7	Excellent
06/16/92	5856	84	43	4.0	3.5	Excellent

Taxonomic Analysis

Abundant taxa included *Baetis intercalaris*, *Epeorus rubidus*, *Isonychia*, *Stenonema modestum*, *Serratella deficiens*, *Acroneuria abnormis*, *Leuctra*, *Paragnetina immarginata*, *Perlesta*, *Brachycentrus nigrosoma*, *Cheumatopsyche*, *Chimarra*, *Dolophilodes*, *Neophylax oligius*, *Symphitopsyche sparna*, and *Trienodes ignitus*.

Data Analysis

This site is located in southeastern Wilkes County near the Iredell County line. It has been sampled three times since 1992 and has always rated Excellent. A tributary with a heavy silt load is located just upstream of the bridge. During sampling in 2006, a plume of silt from this tributary was observed (see photo) even though there was no prior rain. Consequently, this heavy silt load has the potential to impact benthic habitats by filling in crevices where macroinvertebrates live and covering food supplies (i.e., algae on rocks).

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Hunting Cr	NC 115	06/22/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	6	03040102	360444	805839	12-108-16-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	29.8	--	13	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	22.3
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	54
pH (s.u.)	5.8

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	2
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	56

Site Photograph



Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/06	2006-93	14	52	Good
05/03/01	2001-40	17	58	Excellent
05/15/96	96-48	16	56	Excellent
06/16/92	92-19	12	52	Good

Most Abundant Species

Rosyside Dace

Exotic Species

Smallmouth Bass

Species Change Since Last Cycle

Losses -- White Sucker, Notchlip Redhorse, V-lip Redhorse, Flat Bullhead, and Piedmont Darter. **Gains** -- Spottail Shiner (new record for creek) and Bluegill.

Data Analysis

Watershed -- drains the rural southeast corner of Wilkes County; stream flows parallel to NC 115 upstream of the sampling site; rural, no municipalities in watershed. **Habitat** -- eroding banks, shallow channel, seemed to have more silt in the creek than in 2001. **2006** -- number of fish and species, especially suckers and darters, lower than in 2001. **1992 - 2006** -- total habitat scores have varied from 49 to 68; specific conductance has gradually increased from 38 to 48 to 54 µS/cm since 1996; trophically no change; very stable metrics; total number of species known from site = 21; Bluehead Chub consistently the dominant species; NCIBI ratings fluctuate between high Good and high Excellent.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
HUNTING CR	SR 2115	09/11/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
IREDELL	6	03040102	12-108-16-(12)	360000	804444

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV	156.0	20	0.5

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)
None		

Water Quality Parameters

Temperature (°C)	19.8
Dissolved Oxygen (mg/L)	9
Specific Conductance (µS/cm)	58
pH (s.u.)	6.2
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	10
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	57

Substrate	Sand, Silt, Rubble, Boulder
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/11/06	9994	85	34	5.8	4.4	Good
07/23/01	8481	74	31	5.1	4.2	Excellent
07/07/96	7153	66	30	4.7	3.3	Excellent
07/27/88	4665	72	27	5.4	4.1	Good
07/30/85	3609	79	33	4.9	3.7	Excellent

Taxonomic Analysis

Abundant taxa included *Pseudocloeon propinquum*, *Caenis*, *Hexagenia*, *Isonychia*, *Stenonema modestum*, *Brachycentrus nigrasoma*, *Nextopsyche exquisita*, *Ancyronyx variegatus*, *Argia*, *Boyeria vinosa*, *Macromia*, *Corydalus cornutus*, *Ablabesmyia mallochi*, *Polypedium flavum*, and *P. illino*.

Data Analysis

This site is located about midway between the headwaters of Hunting Creek and its confluence with the South Yadkin River. The site has rated Excellent or Good since 1985. Although the bioclassification was down in 2006, the EPT taxa richness and total taxa richness was the highest ever recorded at this location. With the exception of 1996, the EPT Biotic Index has gradually increased since 1985 suggesting a slight decline in water quality. However, no major changes in the biological community were observed.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
N L HUNTING CR	SR 1829	07/26/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
IREDELL	6	03040102	12-108-16-6	360113	804601

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-III	54.5	10	0.3

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

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

Water Quality Parameters

Temperature (°C)	22
Dissolved Oxygen (mg/L)	6.1
Specific Conductance (µS/cm)	55
pH (s.u.)	6.4
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	2
Riffle Habitat (16)	5
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	6
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	52

Substrate	Sand, Boulder, Rubble, Gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/26/06	9989	87	30	5.2	4.6	Good
07/23/01	8480	--	31	--	4.1	Excellent
08/05/96	7145	--	28	--	3.7	Excellent

Taxonomic Analysis

EPT taxa that were not collected in 2006 but were common or abundant in 2001 include *Heptagenia marginalis*, *Serratella serratoides*, *Stenacron pallidum*, *Polycentropus*, and *Pycnopsyche*. Only one new taxon, *Baetis flavistriga*, a tolerant mayfly (TV=7.0), was collected in 2006.

Data Analysis

North Little Hunting Creek at SR 1829 is the most downstream bridge crossing before its confluence with Hunting Creek. The stream rated Excellent in 1996 and 2001. In 2006, EPT taxa richness decreased and the EPT Biotic Index increased resulting in a Good bioclassification rating.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Little Hunting Cr	SR 1829	06/06/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	360113	804601	12-108-16-6	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	54.5	--	9	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	10	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)	8.5
Specific Conductance (µS/cm)	66
pH (s.u.)	6.6

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	10
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	2
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	4
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	44

Site Photograph



Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/06/06	2006-77	16	44	Good-Fair
05/03/01	2001-41	21	50	Good
05/14/96	96-43	17	44	Good-Fair

Most Abundant Species

Bluehead Chub

Exotic Species

Smallmouth Bass; no exotics in 1996 or 2001.

Species Change Since Last Cycle

Losses -- Rosyside Dace, Whitefin Shiner, Highback Chub, Snail Bullhead, Tessellated Darter, and Piedmont Darter. **Gains** -- Smallmouth Bass (first record for creek; 235 and 236 mm total length).

Data Analysis

Watershed -- includes the southeast corner of Wilkes and southwest corner of Yadkin counties south of US 421; bisected by I-77; part of the catchment is in the Brushy Mountains of Wilkes County; lowermost crossing before confluence with Hunting Creek; rural, no municipalities in watershed. **Habitat** -- shifting sandy runs, side snags, large deadfalls on the sides, bedrock outcrops on left; extreme fluctuations in flows. **2006** -- decline in number of fish and species, especially darters; high percentage of omnivores+herbivores and tolerant fish; large specimens of Notchlip Redhorse, Smallmouth Bass, and Redbreast Sunfish. **1996 - 2006** -- consistently low total habitat scores (~40); specific conductance has gradually increased from 37 to 56 to 66 µS/cm since 1996; total number of species known from the site = 22; trophically no change, very stable metrics; Bluehead Chub consistently the dominant species (~50%); NCIBI ratings fluctuate between medium Good-Fair and medium Good.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Bear Cr	SR 1116	07/09/04	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davie	6	03040102	354932	803507	12-108-18-(1)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	29.1	--	6	0.5	No

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

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)	6.3
Specific Conductance (µS/cm)	150
pH (s.u.)	6.7

Water Clarity	Slightly turbid
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Habitat Assessment Scores (max)

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

Site Photograph



Substrate	Sand, silt
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/09/04	2004-117	15	40	Fair

Most Abundant Species	Redbreast Sunfish	Exotic Species	Green Sunfish
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Species Change Since Last Cycle	N/A; new site in 2004.
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Data Analysis

Watershed -- drains west-central Davie County, including the western area of the Town of Mocksville; site is ~ 1 mile above confluence with the South Yadkin River. **Habitat** -- sandy runs, snag and tree pools; bank instability. **2004** -- total species diversity and diversity of darters lower than expected; only one species of darter was collected (Tessellated Darter); intolerant species were absent; percentage of tolerant fish was greater than expected (56 percent) and included the Satinfish Shiner, White Sucker, Brown Bullhead, Redbreast Sunfish, and Green Sunfish; lots of biomass with large suckers (White Sucker, Creek Chubsucker; Notchlip Redhorse, and Brassy Jumprock); sampled as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
FOURTH CR	SR 1003	07/26/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	6	03040102	12-108-20	354716	803848

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	74.3	22	0.4

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)
Fourth Creek WWTP	NC0031836	6.0

Water Quality Parameters

Temperature (°C)	25
Dissolved Oxygen (mg/L)	6.2
Specific Conductance (µS/cm)	163
pH (s.u.)	7.1
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	8
Pool Variety (10)	5
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	5
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	70

Substrate	Boulder, Silt, Rubble
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/26/06	9992	--	28	--	4.8	Excellent
09/11/01	8614	--	21	--	5.3	Good
07/24/01	8484	--	20	--	5.3	Good-Fair
08/06/96	7151	--	23	--	5.2	Good

Taxonomic Analysis

Abundant taxa included *Acentrella*, *Baetis flavistriga*, *Baetis intercalaris*, *Stenonema modestum*, *Cheumatopsyche*, *Hydropsyche betteini*, *Leucotrichia pictipes*, *Nectopsyche exquisita*, *Psychomyia flava*, *Symphitopsyche sparna*, and *Triaenodes ignitus*. New taxa that had not been previously collected at this site include the mayflies *Baetis pluto* and *Procladius*, the stoneflies *Neoperla* and *Paragnetina immarginata*, and the caddisflies *Hydropsyche venularis*, *Hydroptila*, *Oecetis persimilis*, and *Psychomyia flava*.

Data Analysis

This site is located approximately 10 miles downstream of the Fourth Creek WWTP. EPT taxa richness and EPT Biotic Index were similar for the 1996 sample and the two 2001 samples suggesting stable water quality. Although the July 2001 sample rated Good-Fair, it was one taxa away from receiving a Good rating and the Biotic Index was identical to the September 2001 sample. In 2006, a significant increase in the number of EPT taxa and a decrease in the EPT Biotic Index occurred suggesting an improvement in water quality. According to the Mooresville Regional Office, Statesville lost some of their industrial wastewater contributors, which may have played a part in the improvement of the creek's overall water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Fourth Cr	SR 1985	07/29/03	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Rowan	6	03040102	354751	803610	12-108-20	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	80	--	14	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Statesville's Fourth Creek WWTP	NC0031836	4

Water Quality Parameters

Temperature (°C)	23.3
Dissolved Oxygen (mg/L)	7.4
Specific Conductance (µS/cm)	136
pH (s.u.)	7.3

Water Clarity	Turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	2
Riffle Habitat (16)	0
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	43

Site Photograph



Substrate	Sand
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/29/03	2003-42	11	34	Poor
06/03/03	2003-19	8	26	Poor
05/02/01	2001-38	12	28	Poor
04/26/96	96-39	9	32	Poor

Most Abundant Species	Bluehead Chub	Exotic Species	Red Shiner, Fathead Minnow, Channel Catfish, and Spotted Bass
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Species Change Since Last Cycle	Gains -- Fathead Minnow, White Perch, and Spotted Bass. Losses -- Eastern Silvery Minnow, Creek Chubsucker, Brown Bullhead, and Largemouth Bass.
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Data Analysis

Watershed -- drains central Iredell and northwestern Rowan counties; City of Statesville is in the upper portion of the watershed; 12% of watershed is developed; 41% is cultivated; and 46% is forested. **Habitat** -- no riffles; side snags; good riparian zones and canopy, but eroding and "blown-out" banks; entrenched. **2003** -- few fish and species present, intolerant species absent; poor evidence of recruitment; Eastern Silvery Minnow and Common Carp represented only by young-of-year. **1996 - 2003** -- for a watershed of its size, the fauna is depauperate in the number of species and of individuals; intolerant species absent; only 19 species are known from the site; of which 10 are tolerant species and 5 are nonindigenous; data were summarized in Biological Assessment Unit Memorandum F-20031006.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
THIRD CR	SR 1970	07/27/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	6	03040102	12-108-20-4	354603	803733

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	96.6	15	0.3

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)
Third Creek WWTP	NC0020591	4.0

Water Quality Parameters

Temperature (°C)	23
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	154
pH (s.u.)	6.7

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	51

Site Photograph



Substrate	Sand, Detritus
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/27/06	9993	70	24	5.5	4.4	Good
07/24/01	8490	52	22	5.2	4.4	Good
08/06/96	7149	56	23	4.9	4.4	Good
07/09/90	5369	62	23	5.6	4.2	Good

Taxonomic Analysis

EPT taxa richness has been nearly identical at this location since sampling commenced in 1990. Although total EPT taxa richness has not changed, there were a few intolerant EPT taxa collected at this location for the first time and included the mayflies *Acentrella parvula*, *Cercobrachys*, and *Pseudocloeon dardanum*.

Data Analysis

This site is located in the lower reach of the watershed approximately ten miles below Third Creek WWTP and five miles above the creek's confluence with Fourth Creek. EPT taxa richness and EPT Biotic Index have been nearly identical since 1990. Overall, these data suggest stable conditions in the Third Creek watershed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Third Cr	SR 1970	05/11/06	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Rowan	6	03040102	354603	803733	12-108-20-4	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	96.6	--	12	0.5	No

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)
City of Statesville's Third Creek WWTP	NC0020591	4

Water Quality Parameters

Temperature (°C)	17.5
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	149
pH (s.u.)	6.2

Water Clarity

Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	1
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	56

Site Photograph



Substrate Sand, coarse woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/11/06	2006-44	10	32	Poor
05/02/01	2001-37	11	34	Poor
04/25/96	96-38	13	40	Fair

Most Abundant Species

Bluehead Chub

Exotic Species

Channel catfish, Green Sunfish, Yellow Perch

Species Change Since Last Cycle

Losses -- Common Carp, Satinfish, Whitefin Shiner; Whitefin Shiner; Fieryblack Shiner; Gizzard Shad; Largemouth Bass, and Tessellated Darter. **Gains** -- White Sucker, Notchlip Redhorse, Eastern Mosquitofish, Green Sunfish, Pumpkinseed, Bluegill, and Yellow Perch.

Data Analysis

Watershed -- drains southeast Alexander, central Iredell, including the southern edge of the City of Statesville, and northwest Rowan counties. WWTP with rare violations for dissolved oxygen, cadmium, and total suspended solids from June 2001 to June 2006 (BIMS query 12/14/2006). Habitat -- no riffles, logs in the current, side snags, fast flow; water still turbid three days after rains. **2006** -- fewest fish of any Piedmont/Mountain site; low diversity; no intolerant species; 1 of 3 Piedmont/Mountain sites with no darters; Redlip Shiner has never been collected at the site. **1996 - 2006** -- consistently low total habitat scores (~50); specific conductance variable (144 - 262 µS/cm); consistently very few fish and species, < 130 specimens have been collected in 3 attempts; consistently poor reproduction; total number of species known from site = 21, but none consistently collected except for Bluehead Chub, Channel Catfish, and Redbreast Sunfish.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
N SECOND CR	SR 1526	07/24/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	6	03040102	12-108-21	354149	803642

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	63.3	7	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)	24
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	117
pH (s.u.)	6.6

Water Clarity	turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	2
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	10
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	58

Site Photograph



Substrate	Sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	9984	--	18	--	5.0	Good-Fair
07/02/02	8856	61	17	6.7	5.4	Fair
07/24/01	8487	--	10	--	6.0	Fair
08/06/96	7152	--	16	--	4.8	Good-Fair

Taxonomic Analysis

The biological community collected in 2006 was almost identical to what was collected in 1996. Three new EPT taxa were collected in 2006: the mayfly, *Pseudocloeon frondale* and the caddisflies, *Lype diversa* and *Oecetis persimilis*.

Data Analysis

This is the most upstream site on North Second Creek. A sand mining operation was located downstream of the bridge. In 1996, this site rated Good-Fair, it fell to Fair in 2001 and 2002, and increased back to Good-Fair in 2006. The lowest EPT taxa richness and highest EPT Biotic Index scores for this site were recorded in 2001 during the drought. In 2002, EPT richness increased from 10 to 17 and the EPT Biotic Index decreased from 6.0 to 5.4 indicating some improvement in water quality. In 2006, the site rated Good-Fair and had EPT richness and Biotic Index scores similar to that recorded in 1996 suggesting that the stream had recovered from the drought.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Second Cr	SR 1526	05/11/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Rowan	6	03040102	354149	803642	12-108-21	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	63.3	--	9	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	0	45	5 -- powerline corridor

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)	8.7
Specific Conductance (µS/cm)	123
pH (s.u.)	6.4

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	6
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	37

Site Photograph



Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/11/06	2006-43	12	46	Good-Fair
05/02/01	2001-36	9	42	Good-Fair
04/25/96	96-37	13	40	Fair

Most Abundant Species

Bluehead Chub

Exotic Species

Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

Losses -- Striped Jumprock. Gains -- Eastern Mosquitofish, Green Sunfish, Bluegill, Largemouth Bass.

Data Analysis

Watershed -- drains rural eastern Iredell and western Rowan counties; includes northeast part of the Town of Mooresville. Habitat -- lowest habitat score of any fish site in 2006; one long sandy run with poor instream habitats; good canopy, but deeply entrenched; sand dipping operation below the bridge. **2006** -- two-thirds fewer fish than in 2001 but slight increases in the diversity of sunfish and percentage of insectivores; no species of suckers. **1996 - 2006** -- consistently low total habitat scores (22 - 50); specific conductance ~ 100 µS/cm; consistently very few species, total number of species known from site = 16; Redlip Shiner has never been collected at the site; Bluehead Chub has been the dominant species in 2001 and 2006; NCIBI ratings have ranged from high Fair to high Good-Fair.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
N SECOND CR	US 70	07/24/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	6	03040102	12-108-21	354305	803544

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	117.4	11	0.5

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)

NPDES Number	Volume (MGD)
Second Creek WWTP	0.03
Arteva Specialties	2.3

Water Quality Parameters

Temperature (°C)	23.3
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	129
pH (s.u.)	6.6

Water Clarity

slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	12
Bottom Substrate (15)	2
Pool Variety (10)	4
Riffle Habitat (16)	5
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)	52

Site Photograph



Substrate

Sand, Silt, Rubble, Boulder

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	9983	75	18	6.3	5.6	Good-Fair
07/02/02	8855	65	14	6.8	6.0	Fair
07/24/01	8492	66	16	6.8	6.1	Fair
08/07/96	7154	54	17	6.2	5.8	Good-Fair

Taxonomic Analysis

No major changes in the benthic community were observed. Abundant taxa included *Pseudocloeon propinquum*, *Stenonema modestum*, *Tricorythodes*, *Cheumatopsyche*, *Hydropsyche betteni*, *Hydroptila*, *Nextopsyche exquisita*, *Trienodes ignitus*, *Ancyronyx variegatus*, *Macronychus glabratus*, *Boyeria vinosa*, *Gomphus*, *Ophiogomphus*, *Conchapelopia* group, *Polypedilum illinoense*, *P. scalaenum*, *Anopholes*, *Antocha*, and *Corbicula fluminea*.

Data Analysis

This is the most downstream site on North Second Creek approximately one half mile downstream of the confluence with Withrow Creek. It is also an ambient chemistry monitoring site. The outfall from Second Creek WWTP is located approximately 150 meters upstream of the bridge. This site rated Good-Fair in 1996, fell to Fair in 2001 and 2002, and increased back to Good-Fair in 2006. The lowest EPT taxa richness and highest Biotic Index scores for this site were recorded in 2001 and 2002 during the drought. Since the WWTP has not incurred any limit violations in the past five years, these low ratings appear to be more drought related than from WWTP effluent impacts. The Good-Fair rating in 2006 indicates some recovery since the drought.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
WITHROW CR	SR 1547	07/24/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	6	03040102	12-108-21-3	354109	804152

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	29.0	7	0.1

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

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

Water Quality Parameters

Temperature (°C)	25
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	92
pH (s.u.)	6.5

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	2
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	10
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	55

Site Photograph



Substrate	Sand, Gravel, Silt, Detritus
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	9985	--	19	--	4.7	Good-Fair
07/25/01	8491	--	18	--	4.8	Good-Fair
08/07/96	7155	--	14	--	4.8	Good-Fair

Taxonomic Analysis

Abundant taxa included *Baetis intercalaris*, *Isonychia*, *Stenonema modestum*, *Serratella deficiens*, *Tricorythodes*, *Cheumatopsyche*, and *Triaenodes ignitus*.

Data Analysis

Withrow Creek, a tributary to North Second Creek, was sampled at this location to assess the overall water quality of this portion of the North Second Creek watershed. This site has rate Good-Fair since 1996. Thus, no changes in water quality were observed. EPT taxa richness and EPT Biotic Index have been nearly identical since 1996.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Grants Cr	SR 1910	07/08/04	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Rowan	4	03040103	354134	802813	12-110	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	56.9	--	9	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	23.3
Dissolved Oxygen (mg/L)	6.4
Specific Conductance (µS/cm)	133
pH (s.u.)	6.6

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	4
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	60

Site Photograph



Substrate Sand, cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/08/04	2004-114	19	48	Good
05/02/01	2001-35	12	42	Good-Fair

Most Abundant Species

Bluegill and Bluehead Chub

Exotic Species

Common Carp, Red Shiner, Green Sunfish, and Spotted Bass

Species Change Since Last Cycle

Gains -- Common Carp, Red Shiner, Eastern Silvery Minnow, Golden Shiner, Creek Chubsucker, Spotted Sucker, Flat Bullhead, White Catfish, Pumpkinseed, Bluegill, sunfish hybrid, Black Crappie, Spotted Bass, and Largemouth Bass. **Losses** -- Redlip Shiner, Rosyside Dace, Creek Chub, Brown Bullhead, Eastern Mosquitofish, and Warmouth.

Data Analysis

Watershed -- drains central and northeastern Rowan County, including the towns of Spencer, Salisbury, China Grove, and Landis; site is ~3.5 miles upstream from the backwaters of the Yadkin River and High Rock Lake and 1.3 miles downstream of 2001 site at SR 2200, difference in drainage area is 1.8 square miles. **Habitat** -- sandy runs, snag pools, one riffle; golf course along southern shoreline. **2004** -- diverse, but the proximity to reservoir and river influenced the fish community; intolerant species were absent; slightly greater than expected percentage of omnivores+herbivores; 8 of 19 species represented by only 1 or 2 fish per species; loss of the Redlip Shiner - second most abundant species in 2001. **2001 and 2004** -- 25 species are known from the site, but only 6 collected in both years (Bluehead Chub, Redbreast Sunfish, Green Sunfish, Tessellated Darter, and Fantail Darter); dominant species both years was the Bluehead Chub; sampled in 2004 as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
GRANTS CR	SR 1910	08/09/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	4	03040103	12-110	354151	802649

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	61.8	8	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None: The Salisbury WWTP was erroneously reported to be upstream in 2003 report	---	---

Water Quality Parameters

Temperature (°C)	24.9
Dissolved Oxygen (mg/L)	5.9
Specific Conductance (µS/cm)	159
pH (s.u.)	6.9
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	5
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	0
Total Habitat Score (100)	54

Substrate	mostly sand with some cobble (rip-rap)
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10047	87	18	6.4	6.0	Good-Fair
08/07/01	8463	72	13	6.6	6.3	Fair
08/06/96	7126	74	20	6.4	5.5	Good-Fair
07/13/89	4981	67	20	6.2	5.5	Good-Fair

Taxonomic Analysis

EPT taxa in 2006 increased modestly to 18 from the 13 collected in 2001. This increase was comprised of one mayfly and 4 caddisfly taxa. Two caddisflies not previously collected at this site, the intolerant *Neophylax oligius* and *Chimarra*, occurred though were rare in abundance. The abundant mayfly, *Procladius*, was also collected for the first time in 2006. The decrease of the Biotic index to 6.4 indicates a return to the marginally better water quality seen prior to 2001.

Data Analysis

Located approximately 2.5 miles from the confluence with the Yadkin River, this site predominately receives urban runoff from Salisbury and Spencer. Grants Creek also suffers from poor habitat with a mostly homogeneous substrate (sand), poor riffles and lack of pools. Additionally, the riparian areas are minimal with moderate erosion. Results from the 2006 benthic survey indicate a return to the Good-Fair conditions seen prior to 2001. Grants Creek was rated a Fair in 2001, a low flow year, suggesting that a higher than normal concentration of pollutants was affecting the benthic community for that year.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Swearing Cr	SR 1104	07/08/04	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	7	03040103	354612	801803	12-113	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	31.8	--	12	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	40	0	35	25 (suburban residential)

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

Water Quality Parameters

Temperature (°C)	25.4
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	110
pH (s.u.)	6.7

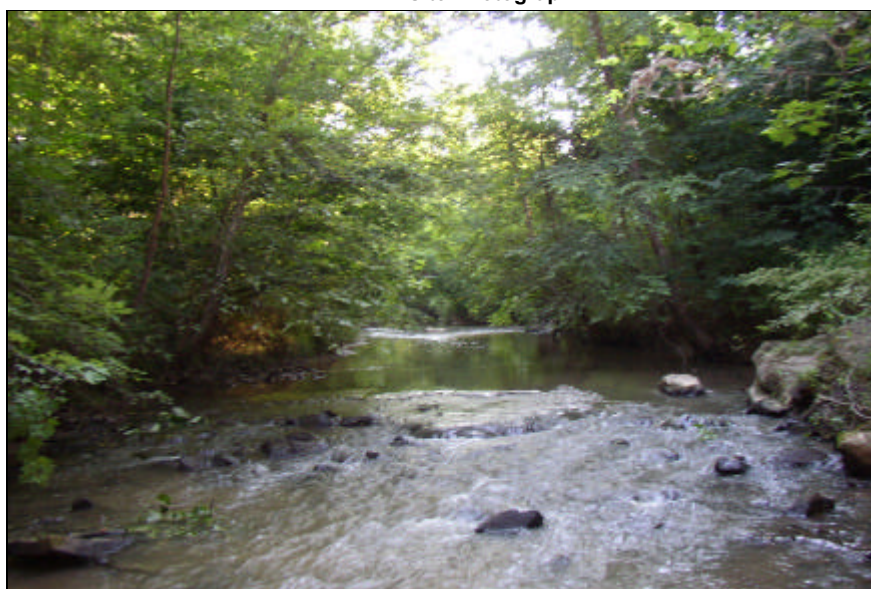
Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	5
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	66

Site Photograph



Substrate Sand, cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/08/04	2004-113	12	40	Fair

Most Abundant Species

Fantail Darter, Redbreast Sunfish, Eastern Silvery Minnow

Exotic Species

Red Shiner and Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2004.

Data Analysis

Watershed -- drains the western portion of the City of Lexington; tributary to High Rock Lake. **Habitat** -- sandy runs, snag pools, and bedrock riffles; bank instability. **2004** -- total number of fish, total species diversity, and diversity of darters lower than expected; intolerant species and species of suckers were absent; percentage of tolerant fish (Satinfin Shiner, Red Shiner, Golden Shiner, Flat Bullhead, Redbreast Sunfish, and Green Sunfish) moderately high; sampled as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
SWEARING CR	NC 47	09/11/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	7	03040103	12-113	354520	801820

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	34.8	6	0.2

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)
None		

Water Quality Parameters

Temperature (°C)	21.4
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	131
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)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	51

Site Photograph



Substrate	Sand, Detritus, Silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/11/06	9996	57	17	6.4	5.5	Good-Fair
07/03/02	8858	63	12	6.6	5.7	Fair
07/25/01	8493	--	13	--	5.8	Fair
08/07/96	7156	--	16	--	5.2	Good-Fair

Taxonomic Analysis

Abundant taxa included *Baetis intercalaris*, *Stenonema modestum*, *Cheumatopsyche*, *Ancyronyx variegatus*, *Macronychus glabratus*, *Argia*, *Boyeria vinosa*, *Calopteryx*, *Macromia*, *Progomphus obscurus*, and *Corbicula fluminea*. Taxa collected in 2006 that had not been previously collected at this site included *Baetis pluto*, *Baetisca*, *Pteronarycs*, *Chimarra*, *Nectopsyche exquisita*, and *Oecetis persimilis*.

Data Analysis

This tributary to the Yadkin River has been sampled four times since 1996. It received a Good-Fair rating in 1996, decreased to Fair in 2001 and 2002, and was back to Good-Fair in 2006. The 2001 and 2002 samples were borderline Fair/Good-Fair with each needing one more taxon to receive a Good-Fair rating. Based on the benthic data no major changes in water quality have been observed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Town Cr	off SR 2118	05/11/06	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Rowan	4	03040103	354110	802424	12-115-3	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	16.5	---	8	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	---	---	50 (Salisbury Spencer WWTP)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	17.0
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	262
pH (s.u.)	6.8

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	68

Site Photograph



Substrate

cobble, gravel, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/11/06	2006-42	14	38	Fair

Most Abundant Species

Green Sunfish

Exotic Species

Green Sunfish, Redear Sunfish, Red Shiner

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- drains East Spencer and south Salisbury in central Rowan County; a tributary to High Rock Lake. **Habitats** -- side snags, boulders, runs, short riffles; good riparian on left; WWTP on right, but it no longer discharges to Town Creek. **2006** -- new fish community monitoring site; the trophic structure of this fish community was skewed towards a high percentage of Insectivores (93%), many of which were tolerant species (73% of total, Green Sunfish = 36% of sample); six sunfish species collected, all having large individuals; no intolerant species collected; high conductivity due to urban runoff.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ABBOTTS CR	SR 1755	09/13/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	7	03040103	12-119-(1)	355730	800643

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-III	22.3	8	0.2

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)	18.5
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	133
pH (s.u.)	7.5

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	6
Pool Variety (10)	4
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	69

Site Photograph



Substrate	Gravel, Sand, Silt, Rubble, Boulder
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/13/06	10000	65	17	5.8	5.1	Good-Fair
09/28/01	8640	--	15	--	5.4	Good-Fair
08/08/96	7158	--	16	--	5.2	Good-Fair

Taxonomic Analysis

Abundant taxa included *Acentrella*, *Hexagenia*, *Stenonema modestum*, *Tricorythodes*, *Cheumatopsyche*, *Leucotrichia pictipes*, and *Nectopsyche exquisita*.

Data Analysis

This site is located north of NC 109 and is the most upstream benthic sampling site on Abbotts Creek. It has been sampled three times since 1996 and has always rated Good-Fair. EPT taxa richness and EPT Biotic Index scores were nearly identical for all three samples which suggests no major changes in water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Abbotts Cr	SR 1800	05/10/06	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	7	03040103	355619	800853	12-119-(4.5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III; CA	37.1	--	8	0.3	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)	15.0
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	138
pH (s.u.)	6.2

Water Clarity

Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	54

Site Photograph



Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/10/06	2006-37	14	40	Fair
05/01/01	2001-32	15	46	Good-Fair
04/24/96	96-34	15	44	Good-Fair

Most Abundant Species

Bluehead Chub (2006)

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- Gizzard Shad, Rosyside Dace, White Sucker, Notchlip Redhorse, and Pumpkinseed. **Gains** -- Creek Chub, Flat Bullhead, and Green Sunfish (first time collected at the site).

Data Analysis

Watershed -- drains the extreme southeastern corner of Forsyth and the northeastern corner of Davidson counties, including the southern portion of the City of Kernersville; semi-rural/suburban; upstream of Lake Tom-a-Lex. **Habitat** -- coarse woody debris; large deadfalls; snags; eroded vertical banks. **2006** -- decline in the number of species of suckers and increase in the percentage of tolerant fish (primarily Satfin Shiner and Redbreast Sunfish). **1996 - 2006** -- total habitat scores have averaged ~ 50; specific conductance has gradually increased from 104 to 121 to 138 µS/cm since 1996; an abundant, but not diverse community; total number of species known from site = 19; no intolerant species are known from the site; the percentage of tolerant fish has increased from 10 to 17 to 37% since 1996; trophically no change, very stable metrics; Bluehead Chub has consistently been the dominant species (~40%); NCIBI ratings range between 40 and 46, NCIBI ratings from high Fair to high Good-Fair. 2006 data were summarized in BAU Memorandum 20061120.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ABBOTTS CR	SR 1243	09/12/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	7	03040103	12-119-(6)	354824	801407

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	175.0	12	0.3

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	70	0	30	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)	5.3
Specific Conductance (µS/cm)	153
pH (s.u.)	6.6
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	13
Bottom Substrate (15)	8
Pool Variety (10)	6
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)	5
Total Habitat Score (100)	74

Substrate	Rubble, Gravel, Boulder, Sand, Silt, Bedrock
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/12/06	9997	63	11	6.7	6.2	Fair
07/25/01	8494	61	15	6.8	6.2	Fair
08/09/96	7161	62	17	6.5	6.2	Fair
11/13/85	1612	49	12	7.4	6.2	Fair

Taxonomic Analysis

Several taxa typically found in urban streams (i.e., *Cheumatopsyche*, *Hydropsyche betteni*, *Argia*, *Ablabesmyia mallochi*, *Conchapelopia* group, *Polypedilum illinoense* group, and *Rheocricotopus robacki*) were found in abundance.

Data Analysis

This site is located within Lexington city limits and is the most downstream sampling location for benthos on Abbotts Creek. It has consistently received a Fair rating since 1985. Abbotts Creek receives urban runoff from the city of Lexington. In addition, the city of Lexington WWTP is permitted to discharge 5.5 MGD to Abbotts Creek Arm of High Rock Lake, which is located approximately 2.5 miles downstream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Rich Fk	NC 109	05/10/06	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	7	03040103	355615	800652	12-119-7	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	25.6	--	6	0.3	No

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)
City of High Point's Westside WWTP; Instream Waste Concentration = 93%	NC0024228	6.2

Water Quality Parameters

Temperature (°C)	16.4
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	372
pH (s.u.)	6.2

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	2
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	52

Site Photograph



Substrate	Soft, sinking sand
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/10/06	2006-38	16	34	Poor
05/01/01	2001-33	13	40	Fair
04/25/96	96-35	10	34	Poor

Most Abundant Species	Redbreast Sunfish and Bluegill	Exotic Species	Swallowtail Shiner, Green Sunfish, and Redear Sunfish
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Species Change Since Last Cycle	Losses -- Gizzard Shad, Rosyside Dace, and Spottail Shiner. Gains -- Creek Chub, White Catfish, Eastern Mosquitofish, Warmouth, and Tessellated Darter (first time ever at site).
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Data Analysis

Watershed -- drains the west-southwest areas of the City of High Point and northeast corner of Davidson County. Habitat -- runs, snags, coarse, woody debris; sand dipping operation downstream and WWTP upstream. WWTP with frequent violations in 2003 and 2004 for biochemical oxygen demand and fecal coliform bacteria, proceeded to enforcement; occasional other violations for pH, total phosphorus, and total ammonia; no reported violations in 2006 (BIMS query 12/14/2006). **2006** -- decline in the number of fish, increase in total diversity; no intolerant species; high percentage of tolerant fish; 92% of all fish were insectivores. **1996 - 2006** -- specific conductance consistently greater than 325 µS/cm; total habitat scores range from 39 to 66; total species at site = 21; has steadily increased to 16; no intolerant species known from site; percentage of tolerant fish consistently high; Redbreast Sunfish typically one of the dominant species; percentage of species with multiple ages increased from 30 to 46 to 50% since 1996. 2006 data were summarized in BAU Memorandum 20061120.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
BRUSHY FK	SR 1810	09/12/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	7	03040103	12-119-5-(1)	355528	801049

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-III	20.8	7	0.3

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

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

Water Quality Parameters

Temperature (°C)	19.5
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	116
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)	3
Pool Variety (10)	9
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	55

Site Photograph



Substrate	Sand, Silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/12/06	9999	61	15	5.9	5.0	Good-Fair
07/30/01	8498	53	20	5.4	4.4	Good
08/08/96	7159	--	13	--	4.7	Fair

Taxonomic Analysis

Abundant taxa included *Hexagenia*, *Isonychia*, *Stenonema modestum*, *Tricorythodes*, *Paragnetina fumosa*, *Cheumatopsyche*, *Triaenodes ignitus*, *Macronychus glabratus*, *Macromia*, *Calopteryx*, *Conchapelopia* group, *Polypedilum convictum*, and *Corbicula fluminea*.

Data Analysis

Brushy Fork, located north of Lexington, is a tributary to Tom-a-Lex Lake (the water supply for the cities of Lexington and Thomasville). In 1996, the site received a Fair rating and in 2001, it increased to Good. The rating dropped to Good-Fair in 2003 and 2006. According to Historic Palmer Drought Indices (<http://www.ncdc.noaa.gov/oa/climate/research/drought/palmer-maps/>), 1996 was a normal year for rainfall whereas, in 2001, the area was in a moderate drought. The increased rating in 2001 may be due to the low flow limiting impacts from nonpoint sources. In addition, a slight increase in available habitat and an increase in abundance of intolerant taxa were also noted in 2001. Although the 1996 sample was an EPT sample, when a correction factor is applied to compare with a Full Scale sample, the 1996 sample is comparable to the 2006 sample in terms of EPT taxa richness, indicating no real change in water quality even though the bioclass changed. Both samples were borderline Fair/Good-Fair.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
HAMBY CR	SR 2017	09/12/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	7	03040103	12-119-7-4	354953	800948

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	21.0	10	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)
Thomasville WWTP	NC0024112	4.0

Water Quality Parameters

Temperature (°C)	20
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	379
pH (s.u.)	6.8

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	3
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	77

Site Photograph



Substrate	Rubble, Sand, Boulder, Gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/12/06	9998	51	11	6.9	6.4	Fair
05/12/03	9128	60	9	7.2	6.3	Fair
07/30/01	8499	58	12	6.5	6.1	Fair

Taxonomic Analysis

Although dissolved oxygen was not low at the time of sampling, *Argia* and *Calopteryx* were very abundant. Species indicative of nutrient enrichment, toxicity, and urbanization were also abundant (i.e., *Cheumatopsyche*, *Hydropsyche betteni*, *Conchapelopia* group, *Polypedilum scalaenum*, and *Natarsia*).

Data Analysis

This site is located approximately four and one half miles downstream of Thomasville WWTP and has been sampled three times since 2001. All three samples received Fair bioclassifications and the benthic community has remained relatively unchanged: EPT taxa richness has been 12, 9, and 11 and the EPT Biotic Index ranged from 6.1 to 6.4.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Hamby Cr	SR 2017	05/10/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	7	03040103	354954	800947	12-119-7-4	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	20.4	--	10	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Thomasville's Hamby Creek WWTP; Instream Waste Concentration = 94%	NC0024112	6

Water Quality Parameters

Temperature (°C)	15.6
Dissolved Oxygen (mg/L)	6.4
Specific Conductance (µS/cm)	305
pH (s.u.)	6.8

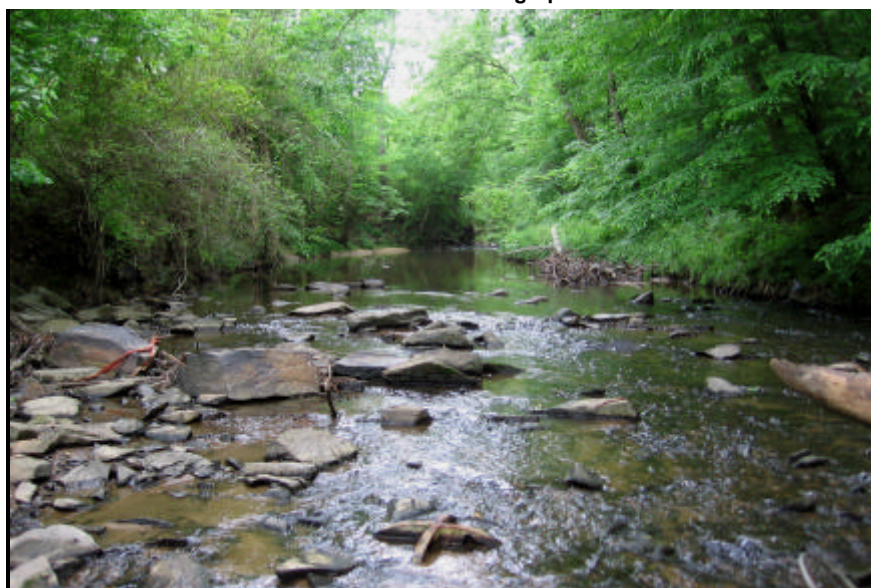
Water Clarity

Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	75

Site Photograph



Substrate Cobble, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/10/06	2006-39	15	48	Good

Most Abundant Species

Redbreast Sunfish and Bluehead Chub

Exotic Species

Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains northeast Davidson County, including the I-85 corridor and the City of Thomasville; headwaters in Thomasville; borders the Carolina Slate Belt. **WWTP** -- many violations during the period June 2001 to June 2006 for biochemical oxygen demand, fecal coliform bacteria, total residual chlorine, metals (nickel, cadmium, and chromium), cyanide, pH, nutrients, and total suspended solids; proceeded to enforcement for many of the repeated violations (BIMS query 12/14/2006). **Habitat** --a Carolina Slate Belt type stream; bedrock, sand, and silts in the pools; shallow riffles; good riparian on right. **2006** -- large biomass of White Sucker, Creek Chubsucker, Brassy Jumprock, Flat Bullhead, Bluegill, Redbreast Sunfish, and Largemouth Bass; no Redlip Shiner or intolerant species; discharge from WWTP augments stream flow and nutrients stimulate fish production; data were summarized in BAU Memorandum 20061120.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LICK CR	NC 8	08/11/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	8	03040103	12-126-(3)	353647	801026

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV	28.7	8	0.2

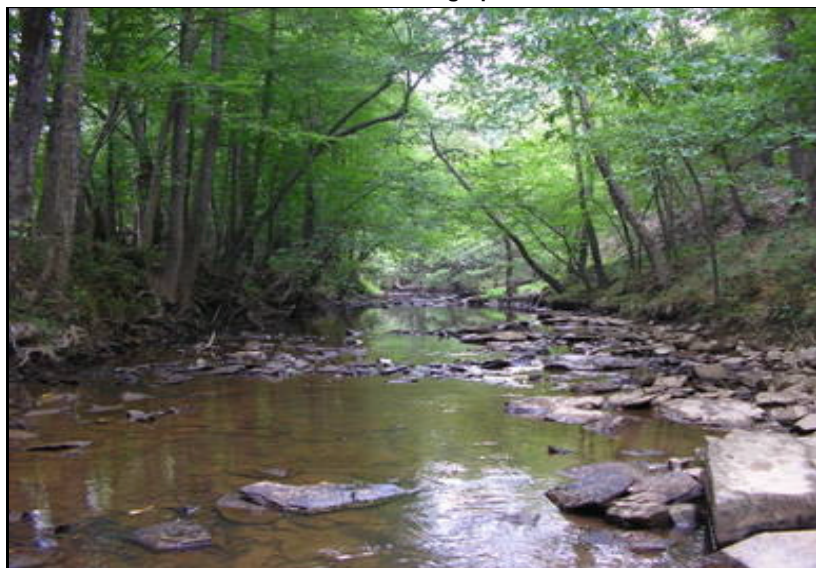
Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	30	0	0	70 (50 fallow, 20 disturbed)

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

Water Quality Parameters

Temperature (°C)	24.9
Dissolved Oxygen (mg/L)	4.2
Specific Conductance (µS/cm)	179
pH (s.u.)	6.5
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	10
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	8
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	70

Substrate	Boulder, cobble and gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/11/06	10053	81	13	6.7	6.6	Fair
09/03/03	9287	79	17	6.5	5.7	Good-Fair
08/07/01	8504	---	11	---	6.5	Fair
08/06/96	7128	---	12	---	5.6	Fair

Taxonomic Analysis

A loss of four EPT and an increase in the biotic index occurred since a special study was conducted on Lick Creek in 2003. No intolerant species were abundant while the cosmopolitan tolerant mayflies *Maccaffertium modestum* and *Stenacron interpunctatum* as well as the hydropsychid caddisflies *Cheumatopsyche* and *Hydropsyche betteni* were abundant. The silt loving mayfly, *Caenis*, was abundant as well. An indicator of slate belt streams and their low flow conditions, *Stenonema femoratum* was collected though it was only common. Chironomids indicative of organic enrichment (*Dicrotendipes neomodestus*) and of low dissolved oxygen (*P. illinoense* gr) were abundant while the low DO indicator *Physa* (a snail) made its first appearance in this stream.

Data Analysis

Lick creek drains a portion of southeastern Davidson county including the municipality of Denton. Aside from the urban impacts of Denton, the most probable reason for the Fair bioclass is the influence of the Denton WWTP and low flow. The plant, a minor discharger, is located about 2.5 miles upstream of NC 8 and is the most likely source of organic enrichment in the stream. The specific conductance in 2006 was higher than in 2003 (100) though much lower than in the drought year of 2001 (382). High amounts of silt and flocculent sediments were observed covering the hard substrate and the bottom of the pools. Low dissolved oxygen was probable in restricting the macroinvertebrate fauna and may have resulted from high organic enrichment and low flows inherent in slate belt streams.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Lick Cr	NC 8	05/10/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	8	03040103	353647	801024	12-126-3	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	28	--	10	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	80	0	0	20 -- dirt bike track on left

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Denton's WWTP; Instream Waste Concentration = 100%	NC0026689	0.8

Water Quality Parameters

Temperature (°C)	15.8
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	123
pH (s.u.)	6.5

Water Clarity	Very slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	4
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)	78

Site Photograph



Substrate	Cobble, boulder, bedrock
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/10/06	2006-40	14	44	Good-Fair
04/19/01	2001-27	16	44	Good-Fair
04/23/96	96-31	14	44	Good-Fair

Most Abundant Species	Redbreast Sunfish	Exotic Species	Green Sunfish
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Species Change Since Last Cycle	Losses -- Golden Shiner, Eastern Mosquitofish, Pumpkinseed, and Fantail Darter. Gains -- Highfin Shiner and Largemouth Bass.
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Data Analysis

Watershed -- drains the Town of Denton and the southeastern corner of Davidson County; site is ~ 3 mi. below the WWTP outfall. WWTP provides constant flows during droughts; WWTP with rare violations for biochemical oxygen demand, fecal coliform bacteria, and nickel from June 2001 to June 2006 (BIMS query 12/14/2006). **Habitat** -- a typical Carolina Slate Belt type stream; pools; runs; short and shallow riffles (a function of low flow); good riparian on right with bluff. **2006** -- slight decrease in the total species diversity and darter diversity; slight improvements in the percentages of omnivores and piscivores; continued high percentage of tolerant fish, primarily Redbreast Sunfish. **1996 - 2006** -- total habitat scores average ~ 75; specific conductance averages ~ 75 µS/cm; gradual improvements in the trophic metrics; dominant species are Redbreast Sunfish and Bluehead Chub; 20 species known from site, but no intolerants; NCIBI score and rating consistent at 44 and Good-Fair, respectively.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cabin Cr	SR 2536	05/11/06	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	8	03040103	353406	801046	12-127-(2)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	18.7	--	8	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	65	0	35	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)	8.0
Specific Conductance (µS/cm)	102
pH (s.u.)	6.3

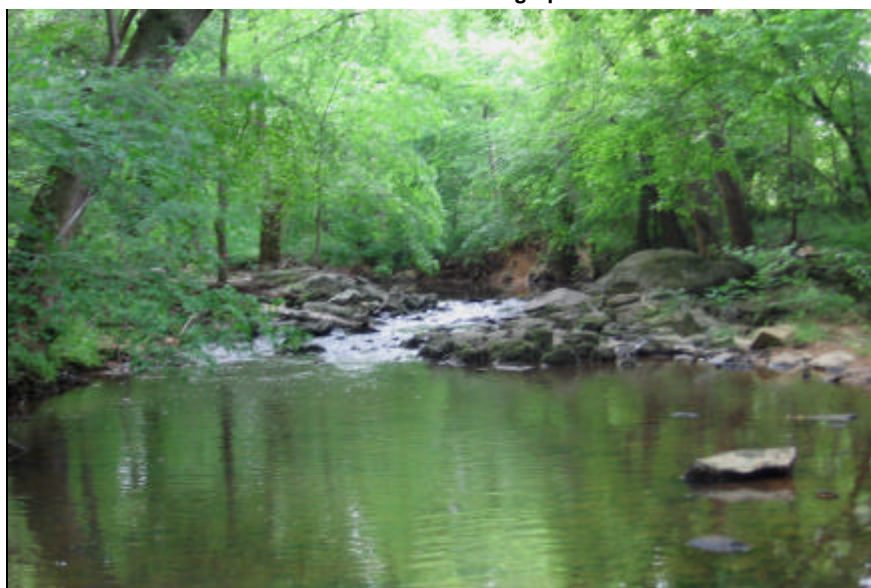
Water Clarity

Clear, tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	4
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	69

Site Photograph



Substrate Cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/11/06	2006-41	16	38	Fair
05/01/01	2001-34	15	48	Good
04/24/96	96-32	12	52	Good

Most Abundant Species

Bluegill

Exotic Species

Black Bullhead, Green Sunfish, Redear Sunfish, and Yellow Perch

Species Change Since Last Cycle

Losses -- Spotted Sucker, Margined Madtom, and Largemouth Bass. **Gains** -- Notchlip Redhorse, Black Bullhead, Chain Pickerel, and Pumpkinseed.

Data Analysis

Watershed -- small drainage area in the southeastern corner of Davidson County, south of the Town of Denton; ~ 0.8 mi. above Tuckertown Reservoir. **Habitat** -- a typical Carolina Slate Belt type stream; short, but rare riffles (a function of low flow); pools; good riparian on left (bordered by NCWRC Gamelands). **2006** -- decrease in the number of fish; skewed trophic metrics (91% of all fish were insectivores); increase in the percentage of disease (popeye in Bluegill). **1996 - 2006** -- consistently elevated specific conductance, > 100 µS/cm; total habitat scores ~ 70; number of fish has declined from 252 to 142 to 116 since 1996; total species at site = 22, including 7 species of sunfish, but only 1 species of minnow, never any Redlip Shiner or intolerant species; Bluegill usually the dominant species; Fantail Darter not collected since 1996; proximity to reservoir influences species assemblage and is also a barrier to recolonization after prolonged droughts.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
UWHARRIE R	SR 1406	05/16/06	GOOD

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
RANDOLPH	9	3040103	13-2-(0.5)	354556	795933

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-III	40.7	10	0.2

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

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

Water Quality Parameters

Temperature (°C)	15.6
Dissolved Oxygen (mg/L)	10.5
Specific Conductance (µS/cm)	142
pH (s.u.)	6.8

Water Clarity	Slightly Turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	8
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
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)	55

Site Photograph



Substrate	Gravel with some sand and rubble
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/16/06	9902	72	24	5.8	4.5	Good
08/09/01	8556	NA	18	NA	5.3	Good-Fair

Taxonomic Analysis

Increases in mayfly, stonefly and caddisfly taxa, along with the presence of sensitive taxa like *Paraleptophlebia*, *Dolophilodes* and *Chimarra* helped improve the 2001 bioclassification of Good-Fair to the current Good rating. Mayfly richness led this improvement, with a net gain of 4 taxa.

Data Analysis

The upper Uwharrie River drains the southern portions of High Point and Archdale then passes through a mostly agricultural/rural section above this site. The upper portion of the drainage falls outside of the Carolina Slate Belt and has more sediment entering the system that in this lower section. Some of this transition is apparent at this site with the substrate consisting of relatively large proportion of fine gravel and coarse sand. Some bank erosion is evident though the riparian area remains mostly intact. Benthic macroinvertebrate results suggest a slight improvement in water quality conditions since prior sampling in 2001.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Uwharrie R	SR 1406	05/02/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Randolph	9	03040103	354556	795933	13-2-(0.5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	41.3	--	10	0.4	No

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)	14.4
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	131
pH (s.u.)	7.2

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	3
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	68

Site Photograph



Substrate Sand, bedrock, slate, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/02/06	2006-30	22	58	Excellent
10/26/99	99-71	15	52	Good
06/15/99	99-49	20	56	Excellent
04/14/99	99-13	18	58	Excellent
04/24/96	96-33	24	54	Excellent

Most Abundant Species

Bluegill

Exotic Species

Swallowtail Shiner, Green Sunfish, and Redear Sunfish

Species Change Since Last Cycle

Losses -- Rosyside Dace, Whitefin Shiner, Warmouth, and Piedmont Darter. **Gains** -- Creek Chub, White Sucker; Pumpkinseed (all collected for the first time at the site), and Redear Sunfish.

Data Analysis

Watershed -- drains northwestern Randolph County, including the Town of Archdale, the southwest portion of the City of High Point, and the I-85 and US 29/70 corridors; upstream from Lake Reese; borders the Southern Outer Piedmont. **Habitat** -- shallow sandy runs, boulder runs/chutes; side pools and snags; bluffs on left; forested riparian zones. **2006** -- 1 of 3 sites with 4 species of suckers; only 2 species of darters (Tessellated Darter and Fantail Darter), Piedmont Darter is rare at the site. **1996 - 2006** -- an abundant and species-rich site, 28 species known from the site; dominant species include Bluehead Chub, Swallowtail Shiner, Brassy Jumprock, Bluegill, and Redbreast Sunfish; data were summarized in BAU Memorandum 20061121; the fish community qualifies as High Quality Waters, if so petitioned; although the river did not qualify as Outstanding Resource Waters as detailed in BAU Memorandum 20021028.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
UWHARRIE R	SR 1143	09/27/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
RANDOLPH	9	03040103	13-2-(1.5)	353348	795832

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	291.5	14	0.6

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

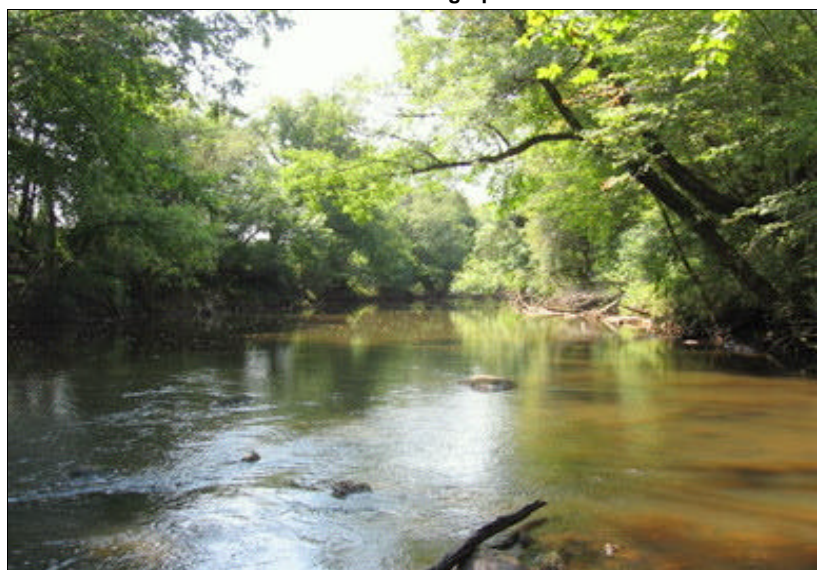
Temperature (°C)	20.4
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	104
pH (s.u.)	6.3

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	14
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	1
Total Habitat Score (100)	69

Site Photograph



Substrate	Boulder with cobble and gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/27/06	10055	92	19	5.9	4.2	Good-Fair
08/09/01	8553	84	27	5.7	4.9	Good
08/08/96	7136	72	19	5.2	4.7	Good

Taxonomic Analysis

A significant drop in EPT taxa richness occurred from 2001 to 2006 and consisted of 4 less mayflies, one less stonefly, and 3 less caddisflies. Also EPT abundance was significantly less in 2006 (EPT N = 73) than in either subsequent sampling years (118 in 1996 and 111 in 2001). Sensitive species such as the stonefly *Neoperla* and the caddisfly *Ceraclea ancylus* were abundant while only two tolerant EPT taxa were abundant, the caddisfly *Cheumatopsyche* and the mayfly *Maccaffertium modestum*. A high diversity of beetles and snails (including the intolerant *Elimia*) existed within the stream. A higher number of oligochaete and chironomid taxa than in previous years served to increase the biotic index slightly and included organic enrichment indicators *Polypedilum illinoense* gr and *P. flavum* (abundant in 2006 though they were also abundant or common in 1996 and 2001). The first state record of the dragonfly *Dythemis* occurred at this site in 2006. Other notable taxa included the caddisflies *Ceraclea neffi* (15th state record) and *Trienodes perna*.

Data Analysis

The Uwharrie River at SR 1143 drains adjacent agricultural lands and has no major NPDES dischargers. Initial sampling of this site was postponed 45 days due to high turbidity. This may have served to allow the emergence of more than a few EPT taxa thus, in effect, reducing the bioclassification from Good to Good-Fair. Support for this assertion may be seen in the low EPT biotic index (lower than in 1996 and 2001). However, water degradation may also be occurring as evidenced by the year to year increase in the biotic index. Overall, no major water quality problems were observed at this site.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
UWHARRIE R	NC 109	08/11/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
MONTGOMERY	9	03040103	13-2-(17.5)	352551	800105

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV, B	361	31	0.3

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

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

Water Quality Parameters

Temperature (°C)	26.3
Dissolved Oxygen (mg/L)	5.3
Specific Conductance (µS/cm)	101
pH (s.u.)	6.6

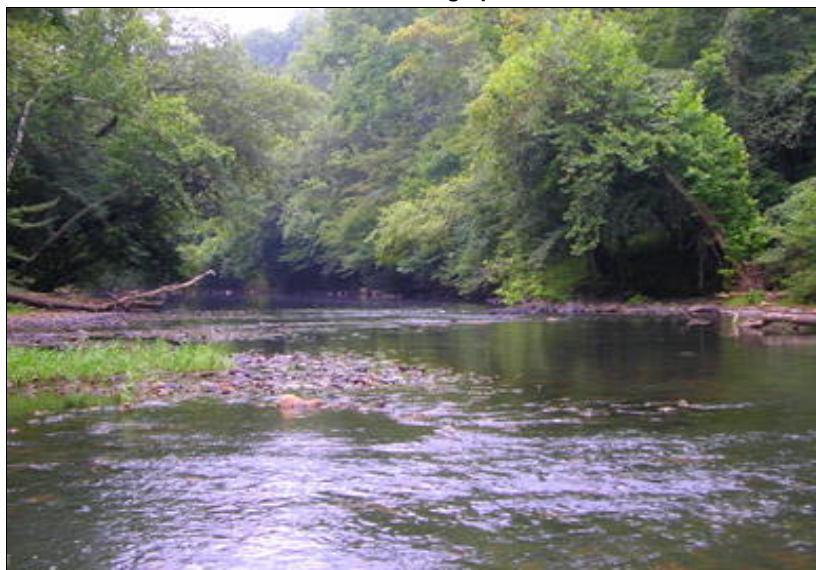
Water Clarity

slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	6
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	83

Site Photograph



Substrate

boulder, cobble and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/11/06	10051	118	35	5.2	3.8	Excellent
08/08/01	8551	89	33	5.0	3.9	Excellent
08/08/96	7135	80	27	5.3	4.1	Good
07/23/90	5389	81	30	5.2	4.2	Good
07/15/88	4612	101	30	5.3	3.9	Good

Taxonomic Analysis

EPT taxa richness has increased slightly over the last few sampling cycles ensuring an Excellent bioclassification rating. The biotic index, however, did increase slightly reflecting the higher number of chironomid and oligochaete taxa (27 and 16 in 2006, respectively and 17 and 1 in 2001). However, overall there were many intolerant taxa that were abundant such as the mayfly *Leucrocota*, the stonefly *Neoperla*, and the caddisflies *Ceraclea ancylus*, *Paranyctiophylax celta*, *Lepidostoma* and *Polycentropus*. Many infrequently collected taxa were also collected at this site such as the caddisflies *Ceraclea maculata* (rare), *Hydropsyche mississippiensis* (abundant), *Helicopsyche borealis* (common), *Triaenodes injustus* (common), *Oecetis sp A* (rare) and *Mystacides* (rare).

Data Analysis

The Uwharrie river at NC 109 is surrounded mostly by forest with some agricultural land use. Of note was the extreme abundance of periphyton, filamentous algae and podostemum and the associated mollusc fauna on the substrate indicating probable nutrient enrichment from upstream. Overall, the Uwharrie River demonstrates stable conditions and excellent water quality.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
L UWHARRIE R	SR 1405	05/16/06	GOOD

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
RANDOLPH	9	3040103	13-2-1	354552	800015

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-III	48.4	12	0.2

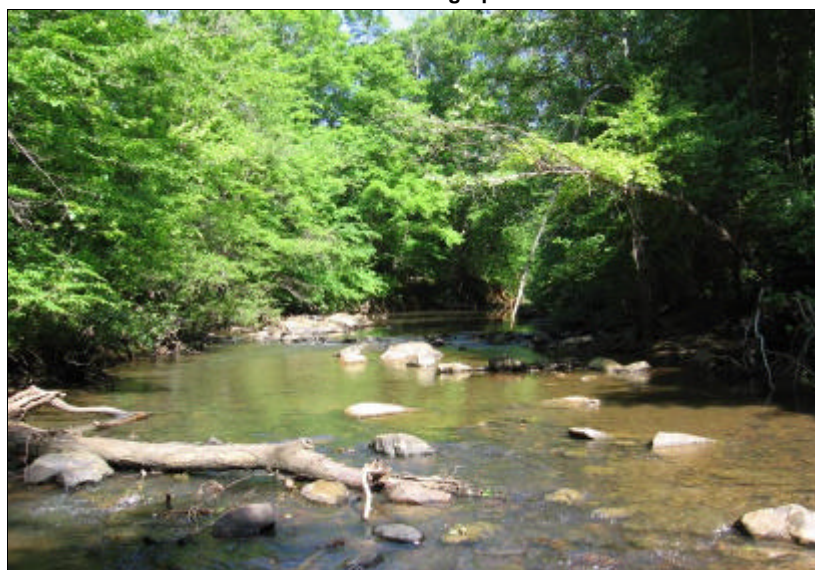
Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100			

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

Water Quality Parameters

Temperature (°C)	14.7
Dissolved Oxygen (mg/L)	9
Specific Conductance (µS/cm)	133
pH (s.u.)	6.4
Water Clarity	Clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	86

Substrate	Mix of gravel, rubble, boulder
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/16/06	9904	75	18	5.6	4.4	Good
08/09/01	8555	NA	18	NA	4.7	Good-Fair
08/08/96	7141	NA	14	NA	4.3	Good-Fair

Taxonomic Analysis

EPT taxa richness in 2006 was identical to that of 2001 though EPT biotic index reflected a shift toward less tolerant species; improving the site's bioclassification from Good-Fair to Good. Mayfly abundance notably decreased between the sampling events with several taxa decreasing from abundant to common even though number of mayfly taxa increased from 8 to 11. caddisfly taxa decreased from 7 in 2001 to 3 in 2006.

Data Analysis

The Little Uwharrie River drains a relatively undisturbed forested watershed. The rocky substrate of the site is slightly embedded with silt. The riffle sampled is somewhat uncharacteristic of the more sandy nature of other sections of the river. Results of this sampling event indicate that water quality has remained consistent or possibly improved during the previous ten years.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Little Uwharrie R	SR 1405	05/02/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Randolph	9	03040103	354552	800010	13-2-1	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	42.9	--	13	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)	13.5
Dissolved Oxygen (mg/L)	9.9
Specific Conductance (µS/cm)	106
pH (s.u.)	6.5

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	87

Site Photograph



Substrate Gravel, cobble, boulder outcrops

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/02/06	2006-29	23	56	Excellent

Most Abundant Species

Redlip Shiner and Bluehead Chub

Exotic Species

Swallowtail Shiner and Green Sunfish.

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains northwestern Randolph County, a small portion of eastern Davidson County, including the area south of the City of Thomasville, and the US 64 corridor. **Habitat** -- pools; two good riffles; snags; large dead trees across channel; good riparian zones. **2006** -- high abundance and species diversity including 3 species of darters, 4 species of sunfish and bass, 3 species of suckers, and 2 intolerant species; data were summarized in BAU Memorandum 20061121.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
CARAWAY CR	SR 1331	05/15/06	GOOD-FAIR

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
RANDOLPH	9	3040103	13-2-3	354257	795546

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	42.9	12	0.1

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	80	10	10	

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)	8.1
Specific Conductance (µS/cm)	128
pH (s.u.)	6.5

Water Clarity

Slightly Turbid

Habitat Assessment Scores (max)

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

Site Photograph



Substrate

Gravel with some sand and rubble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/15/06	9906	74	17	5.8	4.9	Good-Fair
08/09/01	8554	NA	18	NA	4.3	Good-Fair
08/08/96	7139	NA	17	NA	4.7	Good-Fair

Taxonomic Analysis

Taxa observed in 2006 sampling indicated a slight increase in mayfly taxa including the sensitive *Paraleptophlebia* though previously abundant or common taxa including *Isonychia* and *Leucrocota* were absent. Caddisfly taxa declined in abundance and stonefly taxa remained fairly stable. The sensitive stonefly genus *Neoperla* was collected in 2006. EPT biotic index increased slightly between 2002 and 2006 indicating a slightly more tolerant community.

Data Analysis

This site on Caraway Creek lies south of US 64 in an area of the creek with a fairly broad floodplain and is bounded in many cases by agricultural fields. Upstream, the creek drains a mostly forested watershed between Shepherd and Caraway Mountains after passing the town of Hillsville. As previously recorded, some stream bank erosion was evident. With limited substrate, canopy, and pools, the site's habitat rating of 59 ranked fairly low among other sites sampled in the subbasin. The benthic community observed appears fairly consistent for the previous ten years

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Caraway Cr	SR 1331	05/08/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Randolph	9	03040103	354257	795549	13-2-3	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	43.9	--	12	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)	15.4
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	117
pH (s.u.)	6.3

Water Clarity

Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	12
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	79

Site Photograph



Substrate Gravel, sand, cobble, bedrock boulders

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/08/06	2006-31	19	54	Excellent

Most Abundant Species

Redbreast Sunfish and Bluehead Chub

Exotic Species

Redear Sunfish

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains west-central Randolph County; the US 311 corridor traverses its headwaters northwest of the City of Asheboro, and the US 64 corridor dissects the lower one-third of the watershed west of Asheboro. **Habitat** -- two good riffles, runs; side snags and pools; good riparian zones. **2006** -- good species diversity including 3 species of darters, 4 species of sunfish and bass, 2 species of suckers, and 2 intolerant species; data were summarized in BAU Memorandum 20061121.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Betty McGees Cr	SR 1107	05/08/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Randolph	9	03040103	353638	795724	13-2-5	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	8	--	5	0.3	Yes

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)	14.0
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	90
pH (s.u.)	6.3

Water Clarity

Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	73

Site Photograph



Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/08/06	2006-32	18	52	Good
04/16/01	2001-15	15	52	Good
04/18/96	96-24	14	54	Excellent

Most Abundant Species

Bluehead Chub

Exotic Species

Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

Losses -- Largemouth Bass. **Gains** -- Eastern Mosquitofish (first time collected at the site), Margined Madtom, Bluegill, and Redear Sunfish (first time collected at the site).

Data Analysis

Watershed -- drains a small rural area in southwestern Randolph County including the northern portion of the Birkhead Wilderness Area in the USFS Uwharrie National Forest. **Habitat** -- a typical Carolina Slate Belt stream; short and shallow riffles; side snags; a few pools; poor quality (Chinese privet), but wide riparian zones; water withdrawal structure within reach may affect stream during low flow periods. **2006** -- increase in the number of species from 15 to 18; increase in the percentage of species with multiple age groups; data were summarized in BAU Memorandum 20061120. **1996 - 2006** -- specific conductance has averaged ~ 95 µS/cm; total species at site = 19; number of species has increased from 14 to 15 to 18 since 1996; Bluehead Chub and Redbreast sunfish dominant species; NCIBI scores and ratings range from a high Good to a low Excellent.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
BARNES CR	SR 1303	05/16/06	EXCELLENT

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
MONTGOMERY	9	3040103	13-2-18-(0.5)	352619	795956

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV, ORW	23.3	12	0.5

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

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

Water Quality Parameters

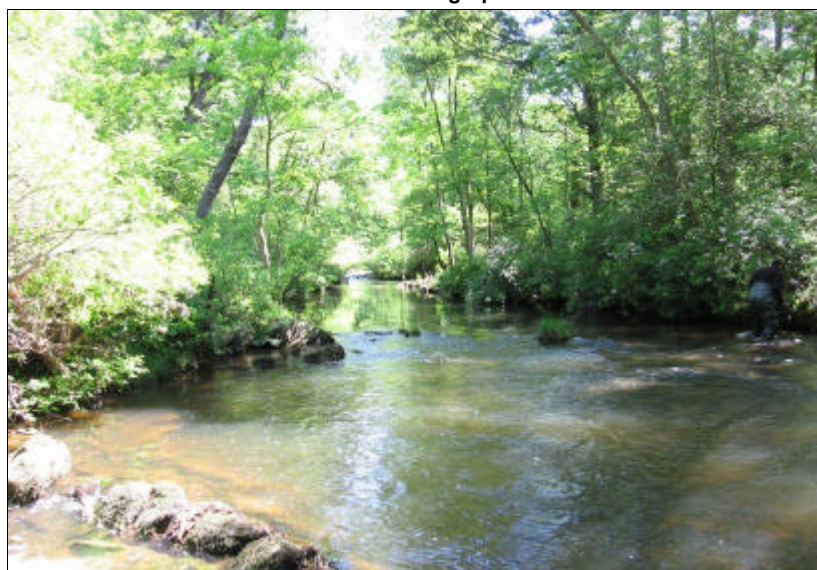
Temperature (°C)	15.3
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	55
pH (s.u.)	6.4

Water Clarity	Slightly Turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	11
Pool Variety (10)	8
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	90

Site Photograph



Substrate	Bedrock with boulder and rubble
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/15/06	9908	95	37	5	4.2	Excellent
09/28/01	8637	79	38	4.1	3	Excellent
08/09/01	8552	108	40	4.2	3.5	Excellent
08/07/86	7134	99	36	4.4	3.4	Excellent
08/01/85	3573	87	29	4.8	4	Excellent

Taxonomic Analysis

Total and EPT taxa abundance remained fairly consistent at this site in 2006 relative to previous years. An increase in overall biotic index and EPT biotic index may indicate a shift toward slightly more tolerant taxa in since 2001 sampling. A decline on trichopterian taxa may reflect low flow encountered during sampling and minimized stream-edge root mats. Midge taxa increased from 15 in 2001 to 32 in 2006, the greatest number yet recorded at the site.

Data Analysis

Barnes Creek drains from the Uwharrie National Forest, a mostly undisturbed, and relatively mountainous terrain. The rocky, slate-belt substrate of the stream, mostly bedrock, provides quite good habitat for a variety of species; many of which are found more often in more western/northern North Carolina mountain regions. This site has an ORW designation and has maintained Excellent water quality (as measured by benthic community for two decades of sampling.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Barnes Cr	SR 1303	05/09/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	9	03040103	352617	795956	13-2-18-(0.5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,ORW	22.4	--	8	0.4	Yes

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)	14.2
Dissolved Oxygen (mg/L)	10.2
Specific Conductance (µS/cm)	51
pH (s.u.)	6.4

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	15
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	96

Site Photograph



Substrate Cobble, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/09/06	2006-35	17	58	Excellent
04/16/01	2001-16	16	54	Excellent
10/17/97	97-86	12	44	Good-Fair
04/22/96	96-25	10	48	Good

Most Abundant Species

Bluehead Chub and Redlip Shiner

Exotic Species

Smallmouth Bass

Species Change Since Last Cycle

Losses -- Rosyside Dace and Creek Chub. Gains -- Flat Bullhead and Chain Pickerel.

Data Analysis

Watershed -- drains rural northwestern Montgomery and southwestern Randolph counties; no municipalities in watershed. **Habitat** -- second greatest habitat score of any fish site in 2006; good riffles and pools; angular bedrock and boulders; *Podostemum*; water slightly stained. Lowest specific conductance of any fish community site in the Piedmont in 2006. 2006 -- lower than expected percentage of species with multiple age groups. **1996 - 2006** -- consistently high total habitat scores; specific conductance ~ 45 µS/cm; total species at site = 23, including 3 species of darters and 3 species of suckers; dominant species are Bluehead Chub, Redbreast Sunfish, and Redlip Shiner; 1996 sample collected near bridge, 1997 data collected after very high flows in 1996 followed by low flows in 1997; 1996 - 2006 data were summarized in BAU Memorandum 20061121.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
DUTCHMANS CR	SR 1150	08/10/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
MONTGOMERY	9	03040103	13-2-24	352247	800149

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV	3.5	3	0.1

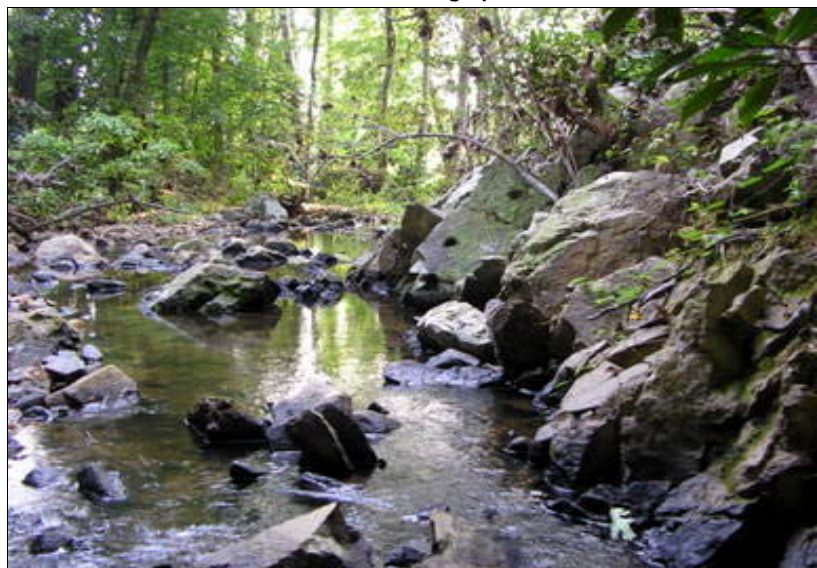
Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	100	0	0	0

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

Water Quality Parameters

Temperature (°C)	26.6
Dissolved Oxygen (mg/L)	5.9
Specific Conductance (µS/cm)	62
pH (s.u.)	6.5
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	15
Pool Variety (10)	9
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)	4
Total Habitat Score (100)	92

Substrate	boulder, cobble with some gravel and bedrock
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10050	---	30	---	3.6	Excellent
08/08/01	8550	---	26	---	3.0	Not Rated
08/07/96	7133	63	29	3.8	3.1	Excellent

Taxonomic Analysis

The 2006 sample garnered more EPT than any other sampling year. Abundant intolerant taxa dominated the fauna by two to one (to tolerant taxa) and included the mayflies *Leucrocota* and *Paraleptophlebia*, the stonefly *Acroneuria abnormis*, and the caddisfly *Chimarra*. Other notable intolerant taxa include the mayfly *Diphetor hageni* and *Epeorus rubidus* as well as the caddisflies *Anisocentropus pyraloides*, *Rhyacophila*, and *Paranyctiophylax moestus*.

Data Analysis

A small streams reference site, Dutchmans Creek's watershed lies entirely in an undeveloped portion of the Uwharrie Mountains. This stream contains an intolerant faunal assemblage that is typical of streams with excellent water quality. Though not rated in 2001 because of low flows, the 2006 sampling occurred during flow typical of a small stream and thus was assigned an Excellent rating. Of note was an extremely high wrack line and a reworked upstream segment from extreme highflows that in all probability occurred during a spate of hurricanes in 2004.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mountain Cr	SR 1720	03/22/04	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	8	03040104	352148	800657	13-5-(0.7)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	14	--	9	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	40	0	40	20 (rural residential)

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

Water Quality Parameters

Temperature (°C)	8.5
Dissolved Oxygen (mg/L)	12.0
Specific Conductance (µS/cm)	96
pH (s.u.)	6.8

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	8
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	81

Site Photograph



Substrate Cobble, slate

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
03/22/04	2004-01	16	50	Good
04/17/01	2001-18	15	46	Good-Fair
04/18/96	96-23	13	50	Good

Most Abundant Species

Bluehead Chub

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Gains -- Highfin Shiner, Flat Bullhead, and Pumpkinseed. **Losses** -- Brassy Jumprock and Redear Sunfish.

Data Analysis

Watershed -- drains semi-rural, east-central Stanly County; tributary to Lake Tillery (Pee Dee River) at Morrow Mountain State Park. **Habitat** -- a typical Carolina Slate Belt type stream; high quality instream habitats; angled bedrock; open canopy at the bridge; open forested riparian zones; water easily silted with periphyton; slick rocks with thick periphyton; bluegreen algal mats on some rocks; livestock with access to the stream causing bank erosion, breaks in the riparian zones, and nutrient enrichment. **2004** -- only 1 species of darter collected; no intolerant species; and percentage of tolerant fish moderately elevated. **1996 - 2004** -- specific conductance has averaged ~ 90 µS/cm; 18 species are known from the site, but no intolerant species and only 1 species of darter present; lack of intolerant species and the low diversity of darters are the result of Lake Tillery serving as a recolonization barrier; dominant species is consistently the Bluehead Chub; 2004 data were summarized in Biological Assessment Unit Memorandum F-20040501.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
L MOUNTAIN CR	SR 1720	08/10/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
STANLY	8	03040104	13-5-1-(2)	352253	800647

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV	8.5	5	0.1

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

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

Water Quality Parameters

Temperature (°C)	25.5
Dissolved Oxygen (mg/L)	5.3
Specific Conductance (µS/cm)	192
pH (s.u.)	6.6

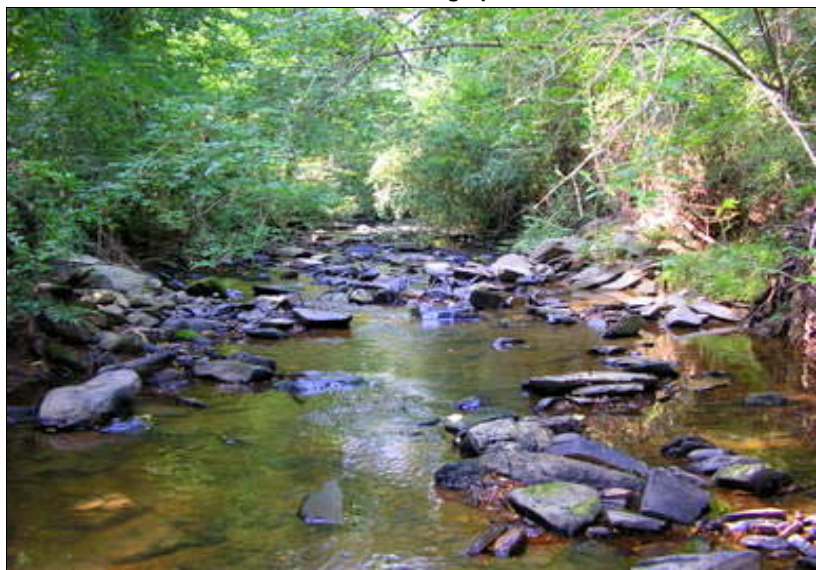
Water Clarity

slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	14
Pool Variety (10)	4
Riffle Habitat (16)	14
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	76

Site Photograph



Substrate

boulder, rubble gravel sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10049	53	10	6.2	5.9	Fair
08/08/01	8547	54	12	5.9	5.8	Fair
08/07/96	7130	---	11	---	5.9	Fair

Taxonomic Analysis

The number of EPT taxa collected has remained stable since the first collection in 1996. Though the 2006 collection included two new taxa for this site (intolerant caddisflies *Polycentropus* and *Diplectrona modesta*), these taxa were rare in abundance. One intolerant stonefly (*Eccopectura xanthenes*) was also collected though it too was rare. Abundant taxa at the site (the caddisflies *Cheumatopsyche* and *Hydropsyche betteni*, the omnipresent mayfly *Maccaffertium modestum* and the snail *Elimia*) were highly tolerant with the exception of intolerant *Elimia*. A midge, *Dicrotendipes noemodestus*, a species indicative of organic enrichment, was present in abundance.

Data Analysis

Approximately 1.5 miles downstream of the Badin WWTP, Little Mountain Creek exhibits the intermittent flow characteristic of slate belt streams. Low flows during the summer months fail to dilute the effluent from the WWTP resulting in elevated specific conductance. An increase in the EPT BI is most likely due to lower abundances of EPT collected in 2006 as compared to 2001 (43 and 70, respectively). It is probable that low flows and organic enrichment are prohibiting an improvement in water quality as habitat was not restrictive.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Clarks Creek	SR 1110	08/22/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Montgomery	10	03040104	13-16	351236	800230

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	30.7	3	0.2

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)	25.6
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	86
pH (s.u.)	6.9

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	12
Pool Variety (10)	7
Riffle Habitat (16)	14
Left Bank Stability (7)	3
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	81

Site Photograph



Substrate	Rubble, boulder, gravel, bedrock
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/22/06	10081	NA	21	NA	4.3	Good
08/08/01	8549	NA	18	NA	4.9	Good-Fair
08/07/96	7132	82	26	5.8	5.2	Good-Fair

Taxonomic Analysis

This site has been sample twice using EPT methodology (2001 and 2006). The 2006 collection resulted in two previously uncollected (at this location) intolerant mayfly taxa (*Habrophlebiodes sp.* and *Habrophlebia vibrans*) as well as one new intolerant caddisfly record (*Pycnopsyche sp.*).

Data Analysis

The first time addition of several intolerant mayfly and caddisfly taxa at this location resulted in an improved Good bioclassification for 2006. However, the minimum EPT needed for a Good bioclassification for a Piedmont stream is 21. As a result, the 2006 Good bioclassification was borderline. Indeed, the EPTN was identical (91) from 2001 to 2006. These data suggest stable conditions upstream of this stream segment. Currently, the most important influence on this slate belt system is likely related to low summer flows.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Clarks Cr	SR 1110	06/24/04	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	10	03040104	351234	800230	13-16	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	32.6	--	7	0.3	Yes

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

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

Water Quality Parameters

Temperature (°C)	24.3
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	62
pH (s.u.)	--

Water Clarity	Slightly tannin stained
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
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)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	86

Site Photograph



Substrate	Cobble, bedrock
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/04	2004-107	25	54	Excellent
04/12/01	2001-14	19	54	Excellent

Most Abundant Species	Bluehead Chub	Exotic Species	Green Sunfish, Redear Sunfish, and Yellow Perch.
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Species Change Since Last Cycle

Gains -- Coastal Shiner, Yellow Bullhead, Flat Bullhead, Speckled Killifish, Pumpkinseed, Warmouth, Bluegill, Redear Sunfish, sunfish hybrid, and Largemouth Bass. **Losses** -- Creek Chub, Rosyside Dace, Satinfish Shiner, Notchlip Redhorse, and Brassy Jumprock.

Data Analysis

Watershed -- drains southwestern Montgomery County, including the western area of the Town of Mount Gilead; site is ~ 1.2 miles below site sampled in 2001 (difference in drainage area is 6.6 square miles); tributary to Pee Dee River immediately below Lake Tillery, site is ~ 1.5 miles from the creek's mouth. **Habitat** -- a typical Carolina Slate Belt type streams; riffles (good short and long shallow riffles), runs, pools, snags, and deadfalls. **2004** -- seven species of sunfish collected; moderately elevated percentage of omnivores+herbivores; sampled as part of a NCSU Urban Fish Study. **2001 and 204** -- 29 species known from the creek, including 3 species of darters, 4 species of suckers, and 7 species of sunfish; increase in the percentage of omnivores+herbivores in 2004 and decrease in the percentage of insectivores; site qualifies as High Quality Waters if so petitioned.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Brown Cr	SR 1230	04/12/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	10	03040104	345252	801806	13-20	Triassic Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	25.2	--	6	0.3	No

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)	14.0
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	126
pH (s.u.)	6.1

Water Clarity

Slightly turbid, tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	6
Pool Variety (10)	7
Riffle Habitat (16)	4
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	58

Site Photograph



Substrate Sand, cobble, clay, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/12/06	2006-14	18	44	Good-Fair
04/10/01	2001-09	20	52	Good
04/16/96	96-16	17	50	Good

Most Abundant Species

Bluegill

Exotic Species

Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

Losses -- Bowfin, Creek Chubsucker, Black Bullhead, Eastern Mosquitofish, Mud Sunfish, and Black Crappie. **Gains** -- Rosyside Dace, Bluehead Chub (first record for Brown Creek watershed), Yellow Bullhead, and Swamp Darter.

Data Analysis

Watershed -- originates in Chesterfield County, SC, flows through the southeastern corner of Union County into southwestern Anson County; site is in the upper part of the watershed and borders the Carolina Slate Belt and Sand Hills. **Habitat** -- snags; a couple of shallow riffles (a function of low flow); side pools; unstable banks. **Specific conductance** elevated (low flow effect?); has steadily increased from 92 to 102 to 126 µS/cm since 1996; no NPDES facilities in watershed. **2006** -- lowest percentage of species with multiple age classes of any fish site, 9 of 18 species with only 1 or 2 fish/species; number of fish declined substantially; no suckers, no intolerant species. **1996 - 2006** -- a species rich site (n = 25), including 9 species of sunfish, but no intolerant species; dominant species include Pirate Perch, Whitemouth Shiner, Bluegill, Redbreast Sunfish, and Carolina Darter. Carolina Darter, a species of Special Concern, consistently collected. Low flow affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cedar Cr	SR 1709	04/10/06	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	10	3040104	350237	800020	13-21	Triassic Basins

Stream	Classification	Drainage Area (mi2)	Elevation (ft)	Stream (m)	Width	Average (m)	Depth	Reference Site
	C	8.6	--	4		0.2		Yes

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)	16.4
Dissolved Oxygen (mg/L)	9.3
Specific Conductance (µS/cm)	125
pH (s.u.)	6.0

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	6
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	72

Site Photograph



Substrate Sand, gravel, cobble, woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/10/06	2006-07	10	36	Fair
04/10/01	2001-07	12	46	Good-Fair
06/10/96	96-67	12	40	Fair

Most Abundant Species

Creek Chub

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- Redlip Shiner and Yellow Bullhead. Gains -- none.

Data Analysis

Watershed -- small, rural drainage area in northeastern Anson County, northeast of the Town of Wadesboro; no municipalities; tributary to the Pee Dee River; stream may go intermittent during low flow periods; borders the Carolina Slate Belt. **Habitat** -- very shallow and sandy runs; gravel and cobble riffles; snags; loss of habitats due to low flow. **2006** -- specific conductance elevated (low flow effect?); decrease in the number of species and a substantial decline in the number of fish from 472 and 484 in 1996 and 2001 to 119 in 2006; increase in the percentage of tolerant fish; Redlip Shiner declined from 112 in 2001 to 0 in 2006. **1996 - 2006** -- specific conductance has steadily increased from 85 to 107 to 125 µS/cm since 1996, no NPDES facilities in watershed; habitat scores average ~ 70; total species at site = 12, but no intolerant species or piscivores; reproduction usually good. Low flow affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Little R	SR 1127	05/08/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Randolph	15	03040104	353322	795043	13-25-(1)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	24.7	--	12	0.4	No

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)	14.3
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	71
pH (s.u.)	6.4

Water Clarity

Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	14
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	94

Site Photograph



Substrate Cobble, boulder, slick rocks

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/08/06	2006-33	19	56	Excellent
04/14/99	99-12	14	52	Good

Most Abundant Species

Bluehead Chub and Redlip Shiner

Exotic Species

Redear Sunfish

Species Change Since Last Cycle

Losses -- Sandbar Shiner. **Gains** -- Rosyside Dace, Creek Chub, Creek Chubsucker, Snail Bullhead, Warmouth, and Redear Sunfish.

Data Analysis

Watershed -- drains southern Randolph County, south of the City of Asheboro; headwaters in Asheboro near the intersection of US 49/64/220. **Habitat** -- very high quality (3rd greatest in 2006 of any fish site); a typical Carolina Slate Belt type stream (riffles, runs, pools, undercut banks, root mats, boulder pools); great riparian zones. **2006** -- diverse and overall abundant, but 8 of 19 species represented by only 1 or 2 fish per species; decrease in the number of fish from 1999, but increase in the diversity of suckers; slightly less dominance by Bluehead Chub than in 1999. **1999 and 2006** -- 20 species known from site; dominant species both years were Bluehead Chub and Redlip Shiner.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Little River	SR 1340	08/24/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Montgomery	15	03040104	13-25-(11.5)	352311	794956

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C, HQW	105.5	20	0.3

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)	24.2
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	80
pH (s.u.)	6.8
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	4
Riffle Habitat (16)	9
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	74

Substrate	Bedrock, rubble, boulder, gravel, sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/24/06	10085	105	34	5.1	3.8	Excellent
08/13/01	8581	93	30	4.6	3.4	Excellent
08/22/96	7198	98	39	5.1	3.9	Excellent
07/15/88	4613	106	40	4.8	3.7	Excellent
07/31/85	3611	104	40	4.3	3.6	Excellent

Taxonomic Analysis

EPT and overall taxa richness have been remarkably consistent at this location for the last 20 years. Nevertheless, several new EPT taxa were collected in 2006 and included the burrowing mayfly *Ephemera sp.*, the stonefly *Acroneuria arenosa*, and the caddisflies *Micrasema wataga*, and *Helicopsyche borealis*.

Data Analysis

Nearly every community metric at this station has remained stable since sampling started 20 years ago. These data demonstrate stable and favorable water quality in the Little River watershed upstream of this location.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Little River	NC 731	08/23/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Montgomery	15	03040104	13-25-(19)	351147	795605

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Triassic Basins	C, HQW	252	25	0.3

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)	26.5
Dissolved Oxygen (mg/L)	9
Specific Conductance (µS/cm)	78
pH (s.u.)	6.5

Water Clarity	clear
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	17
Bottom Substrate (15)	11
Pool Variety (10)	4
Riffle Habitat (16)	9
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	76

Site Photograph



Substrate	Gravel, sand, rubble, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10082	85	31	4.7	4	Excellent
08/15/01	8589	72	29	5	4.3	Good
08/21/96	7196	76	29	5.3	4.2	Good

Taxonomic Analysis

The 2006 sample produced both the highest EPT taxa richness and total taxa richness values ever measured at this station. New, intolerant EPT taxa for this location included the mayfly *Stenonema lenati*, the stoneflies *Paragnetina sp.*, *Acroneuria arenosa*, and the caddisflies *Agapetus sp.*, *Hydropsyche incommoda*, and *Psychomyia flavida*. In addition, the number of pollution tolerant oligochaetes have decreased from three in 1996 to only one in 2006. These data suggest slightly improved conditions in this portion of the Little River watershed.

Data Analysis

Every community metric has exhibited gradual improvement since sampling was initiated at this site in 1996. In addition, the EPTN has increased from 106 (1996), to 118 (2001), to 164 in 2006. These data suggest improving conditions along this segment of the Little River.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
West Fork Little River	SR 1311	08/24/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Montgomery	15	03040104	13-25-15	352855	795103

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	19.4	5	0.3

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)	23.9
Dissolved Oxygen (mg/L)	4.9
Specific Conductance (µS/cm)	72
pH (s.u.)	6.6
Water Clarity	clear

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	82

Substrate	Rubble, bedrock, boulder, gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/24/06	10086	NA	26	NA	4	Good
08/13/01	8580	38	26	4.2	4	Excellent
08/22/96	7199	NA	30	NA	4	Excellent

Taxonomic Analysis

Although the 2006 sample decreased to a Good bioclassification, the EPT taxa richness has been quite stable since 1996. Nevertheless, a new intolerant mayfly taxa (*Habrophlebiodes sp.*) was collected (at this site) for the first time as was the intolerant caddisfly (*Psilotreta frontalis*). In addition, the long lived, intolerant stonefly *Acroneuria abnormis* was common here in 2006 and has either been common or abundant from each of the previous samples. These data suggest, that despite the lowered bioclassification in 2006, the West Fork Little River catchment remains stable.

Data Analysis

Although the bioclassification was down in 2006, the EPT sample produced the same number of EPT taxa as did the more intensive (Full-Scale) sample from 2001 and was only two EPT taxa short of receiving an Excellent bioclassification. In addition, the EPTBI has been identical from each of the three sample efforts. Also, the EPTN in 2006 (132) was higher than that measured in 1996 (113) and was down just slightly (most likely the result of the more intense Full-Scale sample) from the 143 measured in 2001. These data suggest stable conditions in this stream segment.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
W Fk Little R	SR 1311	05/09/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	3040104	352855	795101	13-25-15	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	19	--	9	0.4	Yes

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

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

Water Quality Parameters

Temperature (°C)	13.7
Dissolved Oxygen (mg/L)	9.4
Specific Conductance (µS/cm)	56
pH (s.u.)	6.3

Water Clarity

Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	15
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	97

Site Photograph



Substrate Cobble, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/09/06	2006-34	19	52	Good
04/17/01	2001-20	16	52	Good
04/23/96	96-30	14	56	Excellent

Most Abundant Species

Bluehead Chub and Redlip Shiner

Exotic Species

None

Species Change Since Last Cycle

Losses -- Whitemouth Shiner and White Sucker. **Gains** -- Golden Shiner, Creek Chub, Flat Bullhead, Chain Pickerel, and Eastern Mosquitofish.

Data Analysis

Watershed -- drains rural northeastern Montgomery and southwestern Randolph counties; no municipalities. **Habitat** -- very high quality habitats (greatest score of any fish site in 2006); a typical Carolina Slate Belt stream; high gradient riffles; plunge pools; great riparian. **2006** -- diverse and very abundant (n = 1,131), but only 1 species of sunfish; open canopy at new bridge and some nutrients contributed to dominance by Bluehead Chub (38% of all fish collected). **1996 - 2006** -- 23 species known from site, but only 1 native species of sunfish, Pumpkinseed and Bluegill not collected at the site and Green Sunfish not collected since 1996; dominant species have been Bluehead Chub and Redlip Shiner; Bluehead Chub dominance has increased from 13 to 29 to 38% since 1996, may signify increase in nonpoint nutrient sources.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Densons Cr	SR 1323	07/27/04	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	03040104	352313	795206	13-25-20-(9)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	30.2	--	7	0.3	Yes

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)	25.9
Dissolved Oxygen (mg/L)	6.0
Specific Conductance (µS/cm)	55
pH (s.u.)	6.0

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

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

Site Photograph



Substrate Cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/27/04	2004-137	20	44	Good-Fair

Most Abundant Species

Redbreast Sunfish

Exotic Species

Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2004.

Data Analysis

Watershed -- drains rural, central/north-central Montgomery County, north of the Town of Troy; site is above an old breached dam and ~1,000 ft. below the Town of Troy Reservoir dam; riparian zone is part of the Town of Troy's protected buffer corridor funded through the Clean Water Management Trust Fund. **Habitat** -- a typical Carolina Slate Belt type stream (very rocky with good instream and riparian habitats); riffles, side snags, deadfalls, angular rock; low flow; stream became very turbid when walking in the channel. **2004** -- high percentage of tolerant fish present (Flat Bullhead, Eastern Mosquitofish, Redbreast Sunfish and Green Sunfish); suckers absent, represented by only young-of-year (Creek Chubsucker, White Sucker, Brassy Jumprock, and Spotted Sucker); three other species also represented solely by young-of-year (Golden Shiner, Whitemouth Shiner, and Black Crappie); stream probably went dry during 2002 drought; sampled as part of a NCSU Urban Fish Study. Carolina Darter, a species of Special Concern, was collected. A low flow affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Bridgers Cr	SR 1519	04/26/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	3040104	351937	795101	13-25-24	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,HQW	7.3	--	6	0.3	Yes

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	60	0	35	5 -- residential

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

Water Quality Parameters

Temperature (°C)	19.4
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	74
pH (s.u.)	5.8

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	7
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	91

Site Photograph



Substrate Cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/26/06	2006-28	15	54	Excellent
04/22/96	96-27	17	52	Good

Most Abundant Species

Highfin Shiner

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- Brassy Jumprock, Warmouth, and Largemouth Bass. **Gains** -- Creek Chub and Green Sunfish.

Data Analysis

Watershed -- drains a small, rural area in east-central Montgomery County; no municipalities; tributary to the Little River; stream may go dry during low flow periods. **Habitat** -- a typical Carolina Slate Belt type stream; good riparian zones; riffles; shallow pools; undercuts; water clear, but stained. **2006** -- no intolerant species; slight increase in the number of fish and in the percentage of species with multiple age classes. **1996 and 2006** -- total number of species = 19, but no intolerant species, maybe related to flow and size of stream, Fieryblack Shiner, Highback Chub, and Piedmont Darter may not inhabit very small Carolina Slate Belt streams; Carolina Darter, a species of Special Concern, collected both years.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Rocky Cr	SR 1549	05/09/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	3040104	351800	795429	13-25-30-(0.5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,HQW	24.6	0	8	0.4	Yes

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

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)	10.0
Specific Conductance (µS/cm)	47
pH (s.u.)	6.5

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	70

Site Photograph



Substrate Cobble, boulder, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/09/06	2006-36	15	54	Excellent
04/17/01	2001-19	18	54	Excellent

Most Abundant Species

Redlip Shiner

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- Whitemouth Shiner, Fathead Minnow, Creek Chubsucker, Spotted Sucker, Flat Bullhead, and Piedmont Darter. **Gains** -- Creek Chub, Green Sunfish, and Largemouth Bass.

Data Analysis

Watershed -- drains rural central Montgomery County; one tributary (Warner Creek) drains the Town of Troy; tributary to the Little River. Habitat -- three shallow riffles; *Podostemum*; runs, side snags, undercuts, poor quality (Chinese privet) riparian zones. **2006** -- decline in the number of fish; diversity of suckers and darters slightly lower than expected. **2001 and 2006** -- consistent percentages and dominance by Redlip Shiner and Bluehead Chub; 21 species known from site; no change in NCIBI scores or ratings.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cheek Cr	SR 1563	04/26/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	3040104	351424	794914	13-25-36	Carolina Slate Belt/Triassic Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	10	--	5	0.3	Yes

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)	18.6
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	77
pH (s.u.)	6.1

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	8
Riffle Habitat (16)	12
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)	83

Site Photograph



Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/26/06	2006-27	17	58	Excellent
10/26/99	99-72	18	56	Excellent
06/15/99	99-48	18	56	Excellent
04/13/99	99-09	16	58	Excellent
09/21/98	98-70	14	58	Excellent

Most Abundant Species

Bluehead Chub and Redlip Shiner

Exotic Species

Green Sunfish (collected for first time in 2006 from the watershed)

Species Change Since Last Cycle

Losses -- Whitemouth Shiner, Brassy Jumprock, and Redear Sunfish. **Gains** -- Flat Bullhead and Green Sunfish.

Data Analysis

Watershed -- drains a small, rural area in southeastern Montgomery County; no municipalities; timbered watershed; tributary to the Little River. **Habitat** -- a typical Carolina Slate Belt type stream (shallow riffles, pools, snags, and undercuts); riparian zones bordered by NCWRC Gamelands and USFS Uwharrie National Forest. **2006** -- Brassy Jumprock not collected, had been present in all previous collections. **1998 - 2006** -- consistently high total habitat scores, average = 88; specific conductance averages ~ 75 µS/cm; for its size, an abundant and diverse community, 20 species known from site; dominant species include Bluehead Chub, Redlip Shiner, Highback Chub, and Redbreast Sunfish; Special studies conducted in 1998 and 1999. Qualifies as High Quality Waters with Excellent ratings and habitats, if so petitioned.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cheek Cr	SR 1541	04/26/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	3040104	350950	795402	13-25-36	Carolina Slate Belt/Triassic Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	32.3	0	7	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	19.8
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	110
pH (s.u.)	6.0

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	7
Riffle Habitat (16)	4
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	58

Site Photograph



Substrate Gravel, sand, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/26/06	2006-26	21	50	Good
04/23/96	96-29	19	54	Excellent

Most Abundant Species

Tessellated Darter, Redbreast Sunfish, and Green Sunfish

Exotic Species

Comely Shiner and Green Sunfish (both collected for the first time in 2006 from the watershed).

Species Change Since Last Cycle

Losses -- American Eel, Rosyside Dace, Highback Chub, Highfin Shiner, and Brassy Jumprock. **Gains** -- Whitemouth Shiner, Comely Shiner, Yellow Bullhead, Eastern Mosquitofish, Green Sunfish, Bluegill, and Largemouth Bass.

Data Analysis

Watershed -- drains rural southeastern Montgomery County; no municipalities, timbered and agricultural watershed; 3X larger than upper site on Cheek Creek; site is 0.5 mi. above confluence with the Little River. **Habitat** -- entrenched; good forested bluff on right; bare and unstable vertical banks; large trees as deadfalls; low flow conditions. Specific conductance doubled between 1996 and 2006 (55 vs. 110 µS/cm, respectively). **2006** -- high diversity, but low abundance; high percentage of tolerant fish, Green Sunfish abundance equal to that of the Redbreast Sunfish. **1996 and 2006** -- 26 species known from site; Tessellated Darter the dominant species, Bluehead Chub and Redbreast Sunfish also abundant; percentage of tolerant fish increased from 19 to 44% due to abundance of Green Sunfish; Fantail Darter not known from watershed.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Mountain Creek	SR 1150	08/21/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Richmond	10	03040104	13-28-(4)	350521	795007

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV, CA	64	11	0.3

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

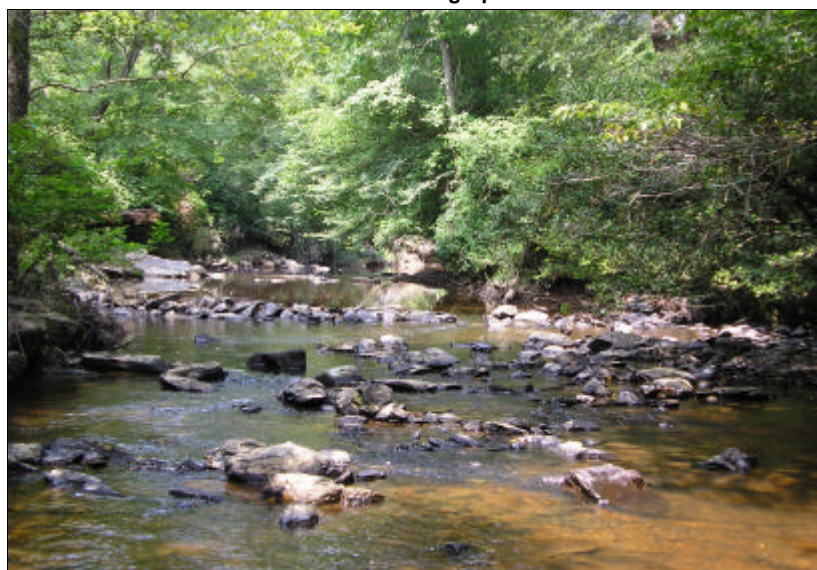
Temperature (°C)	24.7
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	88
pH (s.u.)	6.7

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	17
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	13
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	79

Site Photograph



Substrate	Rubble, Gravel, Sand, Boulder, Bedrock, and Silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10076	NA	32	NA	4	Excellent
08/15/01	8588	NA	25	NA	3.7	Good
08/21/96	7194	NA	30	NA	3.9	Excellent

Taxonomic Analysis

The 2006 sample produced the highest EPT richness ever measured at this location and taxa collected for the first time included the mayflies (*Plauditus punctiventris*, *Baetis flavistriga*, *Habrophlebiodes* sp., *Plauditus dubius*, *Proclleon* sp.) and the stonefly, *Acroneuria arenosa*.

Data Analysis

In addition to producing the highest EPT richness, the 2006 sample also produced the highest EPTN (149) measured at this location. With the exception of the 2001 sample, this segment of Mountain Creek has maintained a very stable EPT richness. While EPT taxa richness declined in 2001, the EPTBI and EPTN remained similar to values measured from the 1996 sample and was only three EPT taxa short of an Excellent rating. Overall, these data suggest favorable and stable water quality in the Mountain Creek catchment.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mountain Cr	SR 1150	04/25/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	10	3040104	350519	795007	13-28-(0.5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	65.1	--	12	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	0	10 road, SR 1150

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

Water Quality Parameters

Temperature (°C)	26.0
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	62
pH (s.u.)	6.2

Water Clarity

Clear, slightly stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	80

Site Photograph



Substrate Cobble, gravel, sand, bedrock, boulder outcrops

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/25/06	2006-25	20	56	Excellent
04/15/96	96-12	16	52	Good

Most Abundant Species

Redlip Shiner

Exotic Species

Roanoke Bass (collected for the first time from the watershed in 2006; 161 and 180 mm total length).

Species Change Since Last Cycle

Losses -- Fieryblack Shiner, Brassy Jumprock, and Pirate Perch. **Gains** -- Rosyside Dace, Dusky Shiner, Coastal Shiner, Sandbar Shiner, Creek Chub, Flat Bullhead, and Roanoke Bass.

Data Analysis

Watershed -- drains rural, north-northwestern region of Richmond County; the Town of Ellerbee drains into Little Mountain Creek; tributary to Blewett Falls Reservoir. **Habitat** -- a typical Carolina Slate Belt type stream; some good deep, rocky pools. **2006** -- high diversity and abundance; Redlip Shiner very abundant. **1996 and 2006** -- 23 species known from site; substantially more species and fish in 2006 than in 1996, especially numbers of Bluehead Chub, Redlip Shiner, Redbreast Sunfish, Fantail Darter, and Tessellated Darter.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ROCKY R	SR 2420	08/21/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
MECKLENBURG	11	03040105	13-17	352830	804647

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	13	6	0.2

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Rocky River WWTP	NC0046728	>1MGD

Water Quality Parameters

Temperature (°C)	26
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	375
pH (s.u.)	7.3
Water Clarity	slightly turbid

Site Photograph



Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10057	48	9	6.6	6.1	Fair
08/21/01	8597	41	8	6.7	6.3	Fair
08/19/96	7164	N/A	7	N/A	5.8	Fair
03/26/85	3416	64	13	6.4	4.9	Fair

Taxonomic Analysis

New EPT taxa at this site are *Lype diversa* and *Proclonen*. The habitat score was 38 at this site and habitat may be a limiting factor. Tolerant taxa such as *Baetis intercalaris*, *Huydropsyche betteni*, *Boyeria vinosa* and *Physella* were abundant. There were no intolerant taxa present in 2006.

Data Analysis

This sampling location is in the upper Rocky River watershed, but is below the Mooresville/Rocky River WWTP which discharges to Dye Branch. This reach of the river is very small compared to downstream locations. Rocky River at SR 2420 has been sampled four times since 1985 and has received a bioclassification of Fair each time. However, the 1985 sample had the most EPT taxa (13) and the Lowest EPT BI of all the sampling efforts. Thus, a slight trend of decreasing water quality since 1985 is present.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Rocky R	SR 1608	05/12/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	11	03040105	352831	804648	13-17	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	13.4	--	6	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Mooresville's Rocky River WWTP; Instream Waste Concentration = 94%	NC0046728	5.2

Water Quality Parameters

Temperature (°C)	13.7
Dissolved Oxygen (mg/L)	6.6
Specific Conductance (µS/cm)	362
pH (s.u.)	6.6

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	2
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	52

Site Photograph



Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/12/06	2006-45	16	50	Good
04/14/99	99-14	11	32	Poor
04/17/96	96-18	10	34	Poor

Most Abundant Species

Bluehead Chub and Redlip Shiner

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- none. **Gains** -- Spottail Shiner, Green Sunfish, Warmouth, Tessellated Darter, and Piedmont Darter.

Data Analysis

Watershed -- drains small portions of southeastern Iredell, northeastern Mecklenburg, and northwestern Cabarrus counties, including the Town of Mooresville. **WWTP** -- flow is augmented by discharge; specific conductance declined 25% since 1999 (fewer textile dischargers); WWTP with rare violations for fecal coliform bacteria, lead, and total suspended solids over the period June 2001 to June 2006 (BIMS query 12/14/2006). **Habitat** -- soft, shifting sand; snags; entrenched; sloughing banks; stick riffles; snags in the current. **2006** -- 3rd greatest specific conductance of any fish site in 2006; increases in the numbers of species and fish; darters collected for the first time from the site; percentages of omnivores and diseased fish lower in 2006 than in 2001. **1996 - 2006** -- consistently low total habitat scores (~ 50); 16 species known from site, all collected in 2006; no suckers or piscivores ever collected from the site; dominant species usually Bluehead Chub and Rosyside Dace. Special Study conducted in 1999.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ROCKY R	US 601	08/29/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CABARRUS	12	03040105	13-17	351926	803059

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	392	15	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Rocky River WWTP	NC0036269	34.0 MGD
Chemical Specialties Inc.	NC0006351	0.025 MGD
Mallard Creek WWTP	NC0030210	12.0 MGD
Rocky River WWTP	NC0046728	5.2 MGD

Water Quality Parameters

Temperature (°C)	27.5
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	327
pH (s.u.)	6.3

Water Clarity

slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	8
Bottom Substrate (15)	5
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	56

Site Photograph



Substrate

Mostly sand with some gravel, cobble and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/29/06	10069	53	13	6.4	5.5	Good-Fair
07/02/02	8847	40	9	6.8	6.5	Fair
08/22/01	8601	48	15	6.6	5.8	Fair
08/20/96	7168	56	19	6.1	5.5	Good-Fair
07/12/89	4978	66	19	6.3	5.4	Good-Fair

Taxonomic Analysis

Although *Caenis* was not collected in 2006 as in years past, *Lepidostoma* and *Chimarra* were present for the first time. Common and Abundant indicator taxa such as *Argia*, *Ophiogomphus*, *Tanytarsus*, *Limnodrilous hoffmeisteri* and two leech taxa suggest that this reach is stressed by low DO and nutrient enrichment. Intolerant taxa present in 2006 include *Lepidostoma* (TV=0.9) and *Nectopsyche* (TV=2.9).

Data Analysis

This site is located about one mile below the Rocky River WWTP which has an IWC of greater than 70%. It is also located below Kannapolis. This site rated Good-Fair in 1989 and 1996, fell to Fair in 2001 and the drought year of 2002, and then most recently received a bioclassification of Good-Fair in 2006. During 2002, only 9 EPT taxa were collected, as compared to 13-19 during the other years. The influence of the WWTP would be expected to increase in years of low flow. The Good-Fair rating in 2006 indicates some recovery toward the ratings found in 1989 and 1996.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ROCKY R	SR 1943	08/29/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
STANLY	14	03040105	13-17	350951	801222

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	1232	40	0.4

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)
Lomg Creek WWTP	NC0024244	16.0 MGD
Monroe WWTP	NC0024333	10.4 MGD
Rocky River WWTP	NC0036269	34.0 MGD
Chemical Specialties Inc.	NC0006351	0.025 MGD
Mallard Creek WWTP	NC0030210	12.0 MGD
Rocky River WWTP	NC0046728	5.2 MGD

Water Quality Parameters

Temperature (°C)	27.2
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	247
pH (s.u.)	7.3

Water Clarity	slightly turbid
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Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	8
Pool Variety (10)	0
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	60

Substrate	Good mix of boulder, cobble, gravel, and sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/29/06	10068	63	21	5.4	4.5	Good
08/23/01	8607	62	24	5.1	4.2	Good
08/21/96	7175	68	22	5.4	4.6	Good
07/24/90	5391	80	28	5.4	5.2	Good

Taxonomic Analysis

This site has only been sampled twice. As a result ten EPT taxa were not present in 2006 that were collected in 2001 and eight taxa were present in 2006 which have never been seen at this location. No particular stressor is suggested by the indicator taxa present in this reach. Several intolerant taxa were present at this location; *Psephenus herricki* (TV=2.4), *Microcyloepus pusillus* (TV=2.1), *Stenonema lenati* (TV=2.3), *Leucrocota* (TV=2.4) *Heptagenia* (TV=2.6) *Elimia* (TV=2.5), *Acroneuria mela* (TV=0.9), and *Hydropsyche demora* (TV=2.1).

Data Analysis

The Rocky River near Norwood is the most downstream monitoring location on the Rocky River. Data has been collected from this area (exact location moved one bridge up in 2001) since 1983, and this data can be found in prior basinwide reports. Although the ratings in both 2001 and 2006 were Good, there has been a slight decrease in water quality based on the Biotic Index and EPT taxa richness. The BI rose from 5.1 to 5.4 in 2006 and the number of EPT taxa fell from 24 in 2001 to 21 in 2006. This, however, was not enough to change the overall bioclassification.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Clarke Cr	SR 1449	07/18/06	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	11	03040105	352451	804507	13-17-4	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	21.9	--	8	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	24.6
Dissolved Oxygen (mg/L)	2.9
Specific Conductance (µS/cm)	194
pH (s.u.)	6.3

Water Clarity

Gray-green turbidity

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	2
Pool Variety (10)	2
Riffle Habitat (16)	0
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	42

Site Photograph



Substrate Sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/18/06	2006-100	9	30	Poor

Most Abundant Species

Redbreast Sunfish and Eastern Mosquitofish

Exotic Species

Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains northeastern Mecklenburg County, including the Town of Huntersville. **Habitat** -- poor quality instream habitats; sandy, shallow runs, side snags. **2006** -- 3rd lowest dissolved oxygen concentration and saturation of any fish site in 2006; less than the water quality standard; lowest NCIBI score of any fish site in 2006; low diversity, no suckers, no intolerant species, 63% of all fish were tolerant species including Golden Shiner, Eastern Mosquitofish, Redbreast Sunfish, and Green Sunfish.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mallard Cr	SR 2467	07/18/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Mecklenburg	11	03040105	351936	804630	13-17-5	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	11.9	--	10	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	30	70	0	0

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

Water Quality Parameters

Temperature (°C)	22.3
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	139
pH (s.u.)	6.1

Water Clarity

Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	4
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	80

Site Photograph



Substrate: Boulder, cobble, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/18/06	2006-99	16	44	Good-Fair
04/19/01	2001-26	20	56	Excellent
06/10/96	96-69	19	50	Good

Most Abundant Species

Spottail Shiner

Exotic Species

Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

Losses -- Rosyside Dace, Highback Chub, Highfin Shiner, White Sucker, Creek Chubsucker, and Brassy Jumprock. **Gains** -- Eastern Mosquitofish and Redear Sunfish.

Data Analysis

Watershed -- drains a small northeast area of the City of Charlotte. **Habitat** -- good for an urban stream; extremely rocky and angular substrate, not channelized, low embeddedness, frequent riffles and shelves, and stable banks. **2006** -- suckers and intolerant species absent; number of Highback Chub (an intolerant species) declined from 96 to 0; increase in the percentage of omnivores, 46% of all fish were Spottail Shiner and Bluehead Chub. **1996 - 2006** -- total habitat scores averages ~ 75; specific conductance elevated, but not extremely high for an urban stream, ~ 140 µS/cm; an abundant and diverse community, 24 species known from the site; dominant species include Bluehead Chub, Redlip Shiner, Spottail Shiner, and Redbreast Sunfish; NCIBI scores and ratings variable, from Good-Fair to Excellent. Low flow affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mallard Cr	SR 1300	07/16/04	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	11	03040105	352001	804006	13-17-5	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	37.5	--	7	0.4	No

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)
Charlotte Mecklenburg Utility Department's Mallard Creek WWTP	NC 0030210	12

Water Quality Parameters

Temperature (°C)	22.6
Dissolved Oxygen (mg/L)	6.0
Specific Conductance (µS/cm)	385
pH (s.u.)	6.7

Water Clarity	Slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	9
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	2
Left Bank Stability (7)	1
Right Bank Stability (7)	1
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	47

Site Photograph



Substrate	Sand
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/16/04	2004-126	18	46	Good-Fair

Most Abundant Species	Spottail Shiner	Exotic Species	Channel Catfish and Green Sunfish
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Species Change Since Last Cycle	N/A; new site in 2004.
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Data Analysis

Watershed -- drains the northeastern metropolitan Charlotte area; site is ~2.3 miles below WWTP and ~ 0.6 miles above the mouth. **Habitat** -- lots of large, coarse, woody debris, deadfalls, and tree trunks in the creek; woody debris riffles; sandy runs; and undercuts; unstable and eroding banks. **2004** -- chlorine smell and very elevated specific conductance; very high percentage of omnivores present including Spottail Shiner (63% of all the fish), indicative of nutrient enrichment and favorable sandy run habitats; Creek Cub and Rosyside dace represented only by young-of-year; low flow and easily silted; sampled as part of a NCSU Urban Fish Study.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Reedy Cr	SR 1136	07/18/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	11	03040105	351812	803541	13-17-8	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	30.9	--	5	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	70	0	30	0

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

Water Quality Parameters

Temperature (°C)	24.7
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	329
pH (s.u.)	6.2

Water Clarity

Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	2
Left Bank Stability (7)	0
Right Bank Stability (7)	0
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	46

Site Photograph



Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/18/06	2006-101	17	46	Good-Fair
04/18/01	2001-24	17	46	Good-Fair

Most Abundant Species

Spottail Shiner and Bluehead Chub

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- White Sucker, Brassy Jumprock, Flat Bullhead, Margined Madtom, and Redear Sunfish. **Gains** -- Gizzard Shad, Sandbar Shiner, Warmouth, Largemouth Bass, and Piedmont Darter.

Data Analysis

Watershed -- drains northeastern Mecklenburg and southwestern Cabarrus counties, including the northeast City of Charlotte metropolitan area. Downstream (but distance greater than 1 mi.) from seven WWTP and one WTP with a combined flow of 2.3 MGD (largest discharger is 0.95 MGD); very high specific conductance. **Habitat** -- sloughing banks contribute large quantities of sand; large, fallen tree trunks provide snags and side pools; severe erosion and sediment transport. **2006** -- high percentage of omnivores, ~ 50% of all the fish were Spottail Shiner and Bluehead Chub; no suckers. **2001 and 2006** -- low total habitat scores, specific conductance increased 1.5 times between 2001 and 2006; 22 species known from site, dominant species are Bluehead Chub and Spottail Shiner; no change in NCIBI scores or ratings.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
CODDLE CR	NC 49	08/21/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CABARRUS	11	03040105	13-17-6-(5.5)	352034	803646

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	74	10	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)
N/A		

Water Quality Parameters

Temperature (°C)	25.8
Dissolved Oxygen (mg/L)	6.5
Specific Conductance (µS/cm)	202
pH (s.u.)	7.1

Water Clarity	slightly turbid
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Site Photograph



Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10058	65	13	6.3	5.4	Fair
07/31/03	9119	48	12	6.6	5.8	Fair
08/21/01	8598	67	14	6.6	5.7	Fair
08/19/96	7165	N/A	13	N/A	5.4	Fair

Taxonomic Analysis

Two caddisfly taxa, *Pycnopsyche* and *Oecetis nocturna*, were collected at this site for the first time in 2006. No stoneflies have been seen at this site since 1996. Common and abundant indicator taxa such as *Calopteryx*, *Argia*, *Pisidium*, *Caenis*, *Conchapelopia gr*, *Rheocricotopus robacki*, and *Physella* suggest that low DO and organic enrichment may be issues at this location. Only two intolerant taxa were found in 2006, *Pycnopsyche* (TV=2.5) and *Nectopsyche* (TV=2.9).

Data Analysis

This location is below the Concord metropolitan area and receives urban runoff. Coddle Creek at NC 49 has received a Fair rating for each sampling event since 1996. The Biotic Index has remained fairly stable over that time period ranging from 6.3 to 6.6. In 2003, the sample collected contain much fewer taxa than in 2001 and 2006. This may be due to drought conditions in 2002. Overall, biotic conditions at this site improved slightly from 2001.

Substrate	primarily sand with some gravel
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Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
IRISH BUFFALO CR	SR 1132	09/29/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CABARRUS	12	03040105	13-17-9-(2)	352050	803252

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	45	8	0.2

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
N/A		

Water Quality Parameters

Temperature (°C)	26.5
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	182
pH (s.u.)	8
Water Clarity	slightly turbid

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	10
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)	66

Substrate	Mostly sand with some cobble, boulders and gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/29/06	10070	54	12	6.5	6.1	Fair
08/19/96	7166	58	15	6	5.3	Good-Fair

Taxonomic Analysis

Five EPT taxa were not present in 2006 as in years previous, however, *Acentrella* and *Paracloedes minutus* were collected for the first time at this site. Tolerant taxa such as *Baetis intercalaris*, *Stenonema modestum*, *Hydropsyche betteni*, *Cheumatopsyche*, *Calopteryx*, *Polypedilum illinoense* and *Corbicula fluminea* were abundant. However, no particular stressor was evident based on indicator taxa collected. The only intolerant taxon present was *Nectopsyche* (TV=2.9).

Data Analysis

This monitoring site is below Concord and receives urban runoff, but no large point source discharges. This site rated Good-fair in 1996 and Fair in 2006. This drop in bioclassification was due to a higher Biotic Index and lower EPT taxa richness in 2006. Reduced water quality over the ten year period is indicated by the data. Another possible cause for the decline in bioclassification might be the thick coating of algae that was covering all the rocks in the stream. This algae was identified as *Cymbella*.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Irish Buffalo Cr	SR 1132	05/12/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	12	03040105	352054	803254	13-17-9-(2)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	45.4	--	10	0.4	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	0	45	5 -- residential

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

Water Quality Parameters

Temperature (°C)	14.2
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	206
pH (s.u.)	7.0

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	75

Site Photograph



Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/12/06	2006-46	18	54	Excellent
04/19/01	2001-25	22	50	Good
04/17/96	96-20	20	52	Good

Most Abundant Species

Bluehead Chub and Fantail Darter

Exotic Species

Threadfin Shad and Green Sunfish

Species Change Since Last Cycle

Losses -- Highback Chub, Golden Shiner, Whitemouth Shiner, Creek Chubsucker, Pumpkinseed, Redear Sunfish, and Largemouth Bass. **Gains** -- Gizzard Shad, Threadfin Shad, and Brassy Jumprock.

Data Analysis

Watershed -- drains southwestern Rowan County and northern Cabarrus County, including the cities of Kannapolis and Concord; impounded upstream by Kannapolis Lake. Habitat -- borders the Carolina Slate Belt; cobble riffles; shallow, snag pools; a couple of fast runs. **2006** -- numbers of species and fish declined, but no appreciable change; some nutrient enrichment as evident by an higher than expected percentage of omnivores; species of shad likely migrants from the Rocky River. **1996 - 2006** -- high specific conductance (~ 200 µS/cm) from urban runoff, no known point source dischargers upstream; total habitat scores better in 2006 than 2001 (related to flow and re-vegetation of banks); 2 of 3 scores > 70; an abundant and diverse community; 26 species known from site; Bluehead Chub and Redlip Shiner have been the dominant species; NCIBI scores and ratings vary between medium Good and low Excellent.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Coldwater Cr	NC 73	05/12/06	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	12	03040105	352457	803321	13-17-9-4-(1.5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	34.6	--	7	0.2	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	40	5	30	25 -- soccer complex

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)	7.7
Specific Conductance (µS/cm)	202
pH (s.u.)	6.1

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	8
Bottom Substrate (15)	3
Pool Variety (10)	3
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	40

Site Photograph



Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/12/06	2006-47	14	36	Fair
04/18/01	2001-23	17	44	Good-Fair
04/17/96	96-19	19	52	Good

Most Abundant Species

Whitemouth Shiner

Exotic Species

None

Species Change Since Last Cycle

Losses -- Redlip Shiner, Highback Chub, Yellow Bullhead, Eastern Mosquitofish, and Fantail Darter.
Gains -- White Sucker and Margined Madtom.

Data Analysis

Watershed -- drains southwestern Rowan and northern Cabarrus counties, including the cities of Kannapolis and Concord; impounded upstream by lakes Fisher and Concord. **Habitat** -- riffles absent; shallow channel filled with sand; snags; unstable banks; ATVs with access to stream and evidence of being in the stream. **2006** -- declines in the number of fish and species; skewed trophic metrics, only one Bluehead Chub collected and 97% of all fish were insectivores. **1996 - 2006** -- specific conductance from urban runoff has increased from 130 in 1996 to 202 µS/cm in 2006, no known point source dischargers upstream; consistently low (~45) total habitat scores; total species at site = 22, but declining since 1996; dominant species are Whitemouth Shiner, Speckled Killifish, and Redbreast Sunfish; loss of intolerant species; declines in sunfish diversity and percentages of species with multiple age classes; and slight increase in the percentage of tolerant fish; NCIBI scores and ratings have gradually declined from Good in 1996 to Fair in 2006.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
COLDWATER CR	NC 49	08/22/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CABARRUS	12	03040105	13-17-9-4-(1.5)	352236	803211

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	57.6	10	0.4

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)
N/A		

Water Quality Parameters

Temperature (°C)	24.4
Dissolved Oxygen (mg/L)	6.4
Specific Conductance (µS/cm)	101
pH (s.u.)	5.9
Water Clarity	turbid

Site Photograph



Habitat Assessment Scores (max)

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

Substrate	sand with some gravel and silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/22/06	10059	N/A	13	N/A	5.9	Fair
08/21/01	8600	N/A	15	N/A	5.5	Good-Fair
08/19/96	7167	N/A	14	N/A	5.1	Good-Fair

Taxonomic Analysis

Although the mayfly *Procladius* was seen for the first time in 2006, the stonefly *Eccopectura xanthenes* was not collected as it has been in the past. In fact no stoneflies were present in the 2006 sample as in previous years. The only intolerant taxon present in 2006 was *Serratella deficiens* (TV=2.8).

Data Analysis

Coldwater Creek drains Kannapolis and Concord before its confluence with Irish Buffalo Creek below this site. The bioclassification at Coldwater Creek NC 49 fell from Good-Fair in 2001 to Fair in 2006. In fact, the EPT Biotic Index has increased from 5.1 in 1996 to 5.5 in 2001 to 5.8 in 2006. This indicates a trend of decreasing water quality at this location. EPT taxa richness, however, has only changed slightly. The site was very turbid when sampled after a thunderstorm the night before.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Dutch Buffalo Cr	NC 200	07/16/04	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	12	03040105	352127	802551	13-17-11-(5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	98.2	--	8	0.3	No

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

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)	6.3
Specific Conductance (µS/cm)	157
pH (s.u.)	6.9

Water Clarity	Clear
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Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	9
Bottom Substrate (15)	3
Pool Variety (10)	7
Riffle Habitat (16)	2
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	46

Site Photograph



Substrate	Sand
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/16/04	2004-127	14	42	Good-Fair
04/18/01	2001-22	19	52	Good
04/17/96	96-21	17	44	Good-Fair

Most Abundant Species	Spottail Shiner	Exotic Species	Green Sunfish and Redear Sunfish
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Species Change Since Last Cycle	Gains -- Flat Bullhead, Pumpkinseed, and sunfish hybrid. Losses -- Whitemouth Shiner, Highfin Shiner, Redlip Shiner, Highback Chub, Notchlip Redhorse, Speckled Killifish, and Largemouth Bass.
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Data Analysis

Watershed -- drains semi-rural eastern and northeastern Cabarrus and a small southeastern portion of Rowan counties; includes the Town of Mount Pleasant; site is ~ 0.6 miles above mouth and ~ 4.5 miles below the SR 2622 basinwide site sampled in 1996 and 2001, difference in the drainage area is 3.8 square miles. **Habitat** -- deadfalls, snags, undercuts, woody debris riffles, severe bank erosion, pools and sandy runs. **2004** -- low flow and easily silted; suckers absent; moderate total species diversity and abundance of tolerant fish (Satinfin Shiner, Creek Chub, Flat Bullhead, Redbreast Sunfish, Green Sunfish, and sunfish hybrids); high percentage of omnivores (Spottail Shiner and Bluehead Chub); Rosyside Dace, Speckled Killifish, Notchlip Redhorse, Brassy Jumprock, and Largemouth Bass represented only by young-of-year; sampled as part of a NCSU Urban Fish Study. **1996 - 2004** -- increase in the percentages of tolerant fish and omnivores+herbivores; 24 species known from the two lower reaches of the creek, not especially species rich for a stream of its size. A low flow affected stream in 2004.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Clear Cr	SR 3181	06/23/04	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Mecklenburg	12	03040105	351230	803447	13-17-17	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	12.6	--	6	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	23.5
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	146
pH (s.u.)	--

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	11
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	1
Total Habitat Score (100)	66

Site Photograph



Substrate Cobble, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/04	2004-102	19	54	Excellent

Most Abundant Species

Bluehead Chub

Exotic Species

Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2004.

Data Analysis

Watershed -- drains northeastern Mecklenburg County, including the Town of Mint Hill. **Habitat** -- a typical Carolina Slate Belt type stream; pools, short and shallow riffles, snags, deadfalls, unstable banks, and a narrow riparian zone along the right shoreline. **2004** -- a very abundant and diverse community for a stream with a relatively small watershed; only one species of sucker present; White Sucker represented only by young-of-year; creek dried-up during the 2002 drought (anecdotal comment from nearby landowner), if so, then fish community repopulated the creek very quickly; sampled as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
GOOSE CR	US 601	08/22/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
UNION	12	03040105	13-17-18	350914	803206

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	24	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)
N/A		

Water Quality Parameters

Temperature (°C)	24.8
Dissolved Oxygen (mg/L)	5.7
Specific Conductance (µS/cm)	165
pH (s.u.)	0

Water Clarity	slightly turbid
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Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	5
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	60

Substrate	Mostly sand with a mix of other substrates
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/22/06	10060	67	11	6.9	6.6	Fair
08/22/01	8603	48	5	7.2	6.0	Poor
04/21/98	7550	47	10	7.4	5.9	Poor
08/20/96	7170	N/A	2	N/A	6	Poor

Taxonomic Analysis

The mayflies *Isonychia*, *Baetis intercalaris*, and *Paracloeodes minutus* as well as the caddisfly *Hydroptila* were collected at this site for the first time in 2006. Common and Abundant indicator taxa such as *Caenis*, *Conchapelopia gr*, *Tanytarsus*, *Calopteryx*, *Argia*, *Dicrotendipes neomodestus*, *C/O SP1*, *Limnodrilus hoffmeisteri*, *Helisoma*, *Physella*, and three species of leeches suggest that low DO conditions and nutrient enrichment may be occurring at this site. *Psephenus herricki* was the only intolerant taxa present in 2006.

Data Analysis

Goose Creek is a small tributary of the Rocky River. The Goose Creek watershed is important as habitat for rare mussel species. Increasing development in the watershed has focused protection efforts in this area. The bioclassification at Goose Creek US 601 increased from Poor in 2001 to Fair in 2006. This trend can be seen in the decrease of the biotic Index from 7.4 in 1998 to 6.9 in 2006. In addition, total richness increased from 48 in 2001 to 67 in 2006 while the EPT abundance increased from 23 to 58 during the same time period. These changes indicate an increase in water quality over the past 5 years.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
CROOKED CR	SR 1547	08/23/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
UNION	12	03040105	13-17-20	350842	802818

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	47	10	0.2

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)
Crooked Cr WWTP #2	NC0069841	1.9 MGD

Water Quality Parameters

Temperature (°C)	25.7
Dissolved Oxygen (mg/L)	7
Specific Conductance (µS/cm)	319
pH (s.u.)	0

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

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

Site Photograph



Substrate	Mostly cobble and gravel with few boulders and sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10061	63	11	6.3	5.8	Good-Fair
08/22/01	8604	68	18	5.9	5.2	Good-Fair
08/20/96	7171	N/A	12	N/A	4.6	Fair

Taxonomic Analysis

Although *Asiopanax dolani* and *Oecetis persimilis* were found for the first time at this site in 2006, both *Neoperla* and *Stenacron interpunctatum* were not present as they were in previous years. Common and abundant indicator taxa such as *Caenis*, *Argia*, *Helisoma*, *Conchelopodia gr*, *Procladius*, *Dicrotendipes neomodestus*, *Tanytarsus*, *C/O SP1*, and *Physella* suggest that Low DO and nutrient enrichment may be problems at this location. *Psephenus herricki* (TV=2.4) and *Asiopanax* (TV=1.4) were the only intolerant taxa present.

Data Analysis

This site on Crooked Creek assesses water quality in the entire watershed, including the upstream WWTP. The Biotic Index at this location has increased from 5.9 in 2001 to 6.3 in 2006, at the same time that EPT taxa richness has dropped from 18 to 11. This indicates a decrease in water quality at this site in the past 10 years, despite the Good-Fair ratings in both 2001 and 2006. EPT taxa richness in 2006 was similar to the value in 1996 when the site was rated Fair, despite a more intense sampling method in 2006.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Crooked Cr	SR 1547	07/19/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	12	03040105	350841	802817	13-17-20	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	47.3	--	12	0.3	No

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)
Union County's Crooked Creek WWTP No. 2; Instream Waste Concentration = 100%	NC0069841	1.9

Water Quality Parameters

Temperature (°C)	25.8
Dissolved Oxygen (mg/L)	6.2
Specific Conductance (µS/cm)	473
pH (s.u.)	6.7

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)	8
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	85

Site Photograph



Substrate	Cobble, boulder, gravel
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Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/19/06	2006-105	20	48	Good

Most Abundant Species	Bluehead Chub and Redbreast Sunfish	Exotic Species	Green Sunfish
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Species Change Since Last Cycle	N/A; new site in 2006.
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Data Analysis

Watershed -- drains northwestern Union and a small part of southeastern Mecklenburg counties, including the cities of Indian Trail and Matthews. **WWTP** -- highest specific conductance of any fish site in 2006; WWTP augments flow during drought periods; WWTP with frequent violations between 2002 and 2006 for biochemical oxygen demand; violations rare for total suspended solids; proceeded to enforcement and Notice of Violations (BIMS query 12/14/2006). **Habitat** -- a typical Carolina Slate Belt type stream; pools and short, shallow riffles. **2006** -- abundant and diverse fauna; percentage of tolerant fish (primarily Redbreast Sunfish) moderately high; suckers absent, only represented by young-of-year Creek Chubsucker and White Sucker. Carolina Darter, a species of Special Concern, collected at the site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Island Cr	SR 1118	04/13/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	14	03040105	351151	802226	13-17-26	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	19.2	--	8	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	13.4
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	106
pH (s.u.)	5.8

Water Clarity

Clear, but easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	14
Pool Variety (10)	9
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	83

Site Photograph



Substrate Cobble, bedrock, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/13/06	2006-17	18	54	Excellent
04/11/01	2001-13	20	54	Excellent

Most Abundant Species

Bluehead Chub and Tessellated Darter

Exotic Species

Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

Losses -- Rosyside Dace, Greenfin Shiner, Whitefin Shiner, Highback Chub, White Sucker, and Notchlip Redhorse. **Gains** -- Spottail Shiner, Bluegill, Redear Sunfish, and Largemouth Bass.

Data Analysis

Watershed -- drains the southwest corner of Stanly County; primarily rural with small towns of Stanfield and Oakboro. **Habitat** -- a typical Carolina Slate Belt type stream; bedrock and cobble riffles; side deadfalls; undercuts with roots; flocculent periphyton; low flow. **2006** -- a substantial decline in the number of fish (from 472 in 2001 to 194 in 2006); loss of two species of suckers and an intolerant species; but an increase in the diversity of sunfish and the percentage of piscivores. **2001 and 2006** -- 24 species known from the site; Bluehead Chub dominant species; no change in NCIBI scores or ratings. Carolina Darter, a species of Special Concern, was collected in 2001 and 2006. Qualifies as High Quality Waters with Excellent ratings and habitats, if petitioned.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LONG Cr	SR 1401	08/23/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Stanly	13	03040105	13-17-31	352251	801450

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	27	6	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)

Water Quality Parameters

Temperature (°C)	24.2
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	221
pH (s.u.)	6.8
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	14
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	78

Site Photograph



Substrate	Rubble, boulder, sand, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10083	NA	17	NA	4.9	Good-Fair
08/20/01	8594	NA	17	NA	5.1	Good-Fair

Taxonomic Analysis

EPT taxa richness has been identical at this location since sampling commenced in 2001. Although total EPT taxa richness has not changed, there were several, largely pollution intolerant EPT taxa collected at this location for the first time and included the mayfly *Heptagenia marginalis*, the stonefly *Eccopectura xanthenes*, and the caddisflies *Diplectrona modesta*, and *Polycentropus sp.*

Data Analysis

The new additional EPT taxa collected at this location in 2006 helped lower the EPTBI slightly from 2001 levels. In addition, while EPT richness was identical, EPTN increased slightly from 77 in 2001 to 83 in 2006. Overall, these data suggest stable conditions in the Long Creek watershed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Long Cr	off SR 1900	06/24/04	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	13	03040105	351959	801251	13-17-31	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	32.9	--	8	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	0	25	25 (Town of Albemarle's WWTP)

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)	6.1
Specific Conductance (µS/cm)	226
pH (s.u.)	--

Water Clarity

Clear

Habitat Assessment Scores (max)

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

Site Photograph



Substrate Cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/04	2004-106	18	50	Good

Most Abundant Species

Redbreast Sunfish

Exotic Species

Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2004.

Data Analysis

Watershed -- drains north-central Stanly, including the City of Albemarle, northeastern Cabarrus, and a very small portion of southeastern Rowan counties; site is on WWTP property, but above the WWTP discharge and above the confluence with Little Long Creek; site is ~ 2.8 miles below Long Lake. **Habitat** -- a typical Carolina Slate Belt type stream; shallow, cobble runs; some snags; some urban debris in the creek and along the banks. **2004** -- elevated specific conductance (urban runoff); no intolerant species; high percentage of tolerant fish, including Golden Shiner, White Sucker, Flat Bullhead, Redbreast Sunfish, and Green Sunfish; large specimens of Redbreast Sunfish and Largemouth Bass; sampled as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LONG CR	SR 1917	08/23/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
STANLY	13	03040105	13-17-31	351326	801533

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	196	10	0.4

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)
Oakboro WWTP	NC0043532	0.9 MGD
Long Creek WWTP	NC0024244	16.0 MGD

Water Quality Parameters

Temperature (°C)	28.2
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	270
pH (s.u.)	0
Water Clarity	colored (from dyes)

Site Photograph



Habitat Assessment Scores (max)

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

Substrate	Good mix of boulder, cobble, gravel and sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10065	72	22	5.8	5.1	Good
08/23/01	8606	71	20	5.8	4.9	Good-Fair
08/22/96	7177	64	14	5.7	5.3	Good-Fair
07/12/89	4976	76	22	6.1	5.2	Good-Fair
07/24/86	3859	88	12	6.8	5.6	Fair
09/02/83	3068	59	15	6.6	4.9	Fair

Taxonomic Analysis

Several EPT taxa were first collected at this site in 2006; *Heterocloeon curiosum*, *Stenonema lenati*, *Stenacron interpunctatum*, *Acronuria arenosa*, *Ceraclea ancylus*, *Lepidostoma*, *Neophylax oligius*, and *Oecetis persimilis*. Common and abundant indicator taxa such as *Caenis*, *Argia*, *Helisoma*, *Physella* and two species of leeches suggest that low DO may be a stressor in this reach. Intolerant taxa found in 2006 include *Psephenus herricki* (TV=2.4), *Leucrocota* (TV=2.4), *Stenonema lenati* (TV= 2.3) and *Pyrallidae* (TV=2). Thousands of the snail, *Amnicola*, covered the rocks.

Data Analysis

Albemarle's WWTP is located above this site and its discharge makes up much of the flow. The water had a red tinge in 2006 as has been noted in prior sampling. The rating at this location has increased from Fair in 1983 to Good in 2006. However, over the past 10 years, the biotic Index has remained fairly stable, with changes in the number of EPT taxa making the slight increase in bioclassification from Good-Fair to Good.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Big Bear Cr	SR 1134	06/24/04	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	13	03040105	352001	802009	13-17-31-5	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	55.6	--	6	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	23.0
Dissolved Oxygen (mg/L)	5.6
Specific Conductance (µS/cm)	112
pH (s.u.)	--

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	7
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

Cobble, slate, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/04	2004-105	16	46	Good-Fair

Most Abundant Species

Bluehead Chub

Exotic Species

Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2004.

Data Analysis

Watershed -- drains rural west-central Stanly and northeastern Cabarrus counties; no municipalities in the watershed. **Habitat** -- a typical Carolina Slate Belt type stream; angular bedrock pools and riffles; shallow pools and riffles; slick rocks; good riparian zones along both banks. **2004** -- low flow; intolerant species absent; indications of nutrient enrichment (dominance by Bluehead Chub and an abundance of other omnivores such as White Sucker, Creek Chubsucker, and Yellow Bullhead); Pirate Perch represented only by young-of-year; sampled as part of a NCSU Urban Fish Study. Data collected in 1996 and 2001 were from a site at NC 73, ~ 4 miles upstream and with a drainage area of 19.1 square miles.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
BIG BEAR CR	SR 1225	08/23/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Stanly	13	03040105	13-17-31-5	351917	801944

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	58.1	6	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)

Water Quality Parameters

Temperature (°C)	27.8
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	97
pH (s.u.)	6.7

Water Clarity	slightly turbid
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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)	9
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	80

Site Photograph



Substrate	Bedrock, Boulder, Rubble
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10084	NA	21	NA	5	Good
08/20/01	8595	NA	22	NA	4.5	Good

Taxonomic Analysis

EPT taxa collected for the first time (at this site) in 2006 included the mayflies *Baetis intercalaris*, *Eurylophella sp.*, *Stenonema vicarium*, and the caddisflies *Hydroptila sp.*, *Oecetis persimilis*, and *Trienodes perna*. The slate-belt indicators (mayflies) *Stenonema vicarium* and *Stenonema femoratum* were both present at this site in 2006.

Data Analysis

The overall EPT community richness has remained stable along this reach of Big Bear Creek since 2001. In addition, the EPTN was remarkably similar from 2001 (90) to 2006 (91). The slight increase in the 2006 EPTBI value from the 2001 sample was partially the result of the addition of one pollution tolerant mayfly (*Baetis intercalaris*) and one facultative caddisfly (*Hydroptila sp.*). Overall, these data suggest generally stable and favorable water quality in Big Bear Creek.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Stony Run	SR 1970	04/13/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	13	03040105	351452	801734	13-17-31-5-5	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	19.7	--	8	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	65	0	30	5 -- residential

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

Water Quality Parameters

Temperature (°C)	14.6
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	108
pH (s.u.)	6.3

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	15
Pool Variety (10)	10
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	92

Site Photograph



Substrate Cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/13/06	2006-18	12	46	Good-Fair

Most Abundant Species

Bluehead Chub

Exotic Species

Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains southwestern Stanly County, including the Town of Oakboro; tributary to Big Bear Creek. **Habitat** -- high quality habitats; a typical Carolina Slate Belt type stream; angular bedrock slick with periphyton; low flow. **2006** -- dominance by the omnivorous Bluehead Chub and abundant periphyton indicative of nonpoint nutrient inputs; Green Sunfish was the most abundant sunfish and has displaced the Redbreast Sunfish; three species of darters and one intolerant species collected. Low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Richardson Cr	NC 207	07/19/06	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	14	03040105	345715	803242	13-17-36-(3.5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV, CA	32.6	0	12	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	22.6
Dissolved Oxygen (mg/L)	1.8
Specific Conductance (µS/cm)	170
pH (s.u.)	5.8

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	0
Left Bank Stability (7)	2
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	66

Site Photograph



Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/19/06	2006-103	12	30	Poor
04/11/01	2001-11	14	46	Good-Fair

Most Abundant Species

Green Sunfish

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- Whitemouth Shiner, Highfin Shiner, Creek Chubsucker, Redbreast Sunfish, Carolina Darter, and Tessellated Darter. **Gains** -- White Catfish, Yellow Bullhead, Flat Bullhead, and Black Crappie.

Data Analysis

Watershed -- drains south-central Union County, including a portion of the City of Monroe; suburban/rural with poultry operations, no WWTPs upstream. **Habitat** -- a typical Carolina Slate Belt stream; primarily one long pool, no riffles; entrenched with eroded banks; good canopy; Chinese privet riparian zone on right; cattle excluded from stream; low flow; periphyton thick at beginning of reach in open canopy area. **2006** -- elevated specific conductance and 2nd lowest dissolved oxygen concentration and saturation (early morning) of any fish site in 2006, less than the water quality standard; very few fish and low diversity; 1 of 5 sites with no Redbreast Sunfish; no darters, suckers, or intolerant species; high percentage of tolerant fish; skewed trophic metrics; few species with multiple age classes, 8 of 12 species represented by only 1 or 2 fish per species. **2001 and 2006** -- Green Sunfish has displaced the Redbreast Sunfish; percentage of tolerant fish increased from 36 to 61%. Low flow-affected stream.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
RICHARDSON CR	SR 1649	08/23/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
UNION	14	03040105	13-17-36-(5)	350420	802430

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	156	22	0.3

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)
Monroe WWTP	NC0024333	10.4 MGD

Water Quality Parameters

Temperature (°C)	25.4
Dissolved Oxygen (mg/L)	6.6
Specific Conductance (µS/cm)	600
pH (s.u.)	0

Water Clarity	slightly turbid
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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)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	81

Site Photograph



Substrate	Good mix of boulder, cobble, gravel and sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10063	57	14	5.9	5.4	Good-Fair
08/23/01	8609	46	10	6.4	6.2	Fair
08/20/96	7172	46	12	6.2	5.6	Fair
07/24/90	5392	57	10	6.9	6.1	Fair
07/08/87	4132	57	10	6.9	5.9	Fair

Taxonomic Analysis

Baetis tricaudatus, *Chimarra* and *Leucotrichia pictipes* were collected for the first time at this site in 2006. No clear stressor was suggested from indicator taxa present in this reach. Intolerant taxa present were *Baetis tricaudatus* (TV=1.6) and *Pyrallidae* (TV=2).

Data Analysis

This sampling site is located midway in the Richardson Creek watershed, and is located below the Town of Monroe and its WWTP. Substrate here was typical of Slate Belt streams. Richardson Creek at SR 1649 rated Fair in four samples since 1987. In 2006 the bioclassification increased to Good-Fair due to a decrease in Biotic Index and an increase in the number of EPT taxa found at the site. This suggests increasing water quality in the past 5 years.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
RICHARDSON CR	SR 1600	08/23/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ANSON	14	03040105	13-17-36-(5)	350929	801411

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	235	18	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Monroe WWTP	NC0024333	10.4 MGD

Water Quality Parameters

Temperature (°C)	28
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	296
pH (s.u.)	0

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)	12
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	76

Site Photograph



Substrate	Good mix of boulder, cobble, gravel and sand
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10064	N/A	24	N/A	4.2	Good
08/23/01	8608	N/A	24	N/A	4.0	Good
08/21/96	7176	N/A	18	N/A	3.9	Good-Fair

Taxonomic Analysis

Although *Stenacron interpunctatum* and *Hydropsyche phalerata* were not collected in 2006 as in previous years, *Tricorythodes robacki*, *Triaenodes marginatus*, and *Leucotrichia pictipes* were present for the first time at this site. Intolerant taxa found in 2006 include *Leucrocota* (TV=2.4), *Stenacron pallidum* (TV=2.7), *Acroneuria abnormis* (TV=2.1), *Neoperla* (TV=1.5), *Lepidostoma* (TV=0.9), *Ceraclea ancylus* (TV=2.3), *Triaenodes injustus* (TV=2.5), and *Hydropsyche demora* (TV=2.1).

Data Analysis

This site in Anson County is located near the confluence with the Rocky River. Richardson Creek at SR 1600 recieved a Good bioclassification in 2006, the same rating given in 2001. The 1996 rating was Good-Fair. Increases in the number of EPT present account for the increase in 2001 and 2006. The Good rating at this site indicates recovery, as the upstream sampling location had a Good-Fair rating in 2006.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Bearskin Cr	NC 200	07/18/06	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	14	03040105	345946	803123	13-17-36-6	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	14.3	--	4	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	90	0	0	10 -- Union County gas facility

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

Water Quality Parameters

Temperature (°C)	26.9
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	273
pH (s.u.)	6.0

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	14
Pool Variety (10)	9
Riffle Habitat (16)	14
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)	93

Site Photograph



Substrate Cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/18/06	2006-102	9	36	Fair

Most Abundant Species

Bluehead Chub

Exotic Species

Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains central Union County, including the City of Monroe and the US 74/601 corridor; tributary to Richardson Creek; no WWTPs.
Habitat -- very high quality habitats; a typical Carolina Slate Belt type stream; very rocky; runs, riffles, pools, root wads, undercuts, snags; very shallow (low flow). **2006** -- elevated specific conductance from upstream urban nonpoint sources; lower than expected total diversity; no suckers, no intolerant species; five species (Creek Chub, Spottail Shiner, Whitemouth Shiner, Creek Chubsucker, and Largemouth Bass) represented by only young-of-year and not counted in the analyses, would have increased the diversity metrics; high percentage of tolerant species (primarily Redbreast Sunfish and Flat Bullhead) and omnivores (Bluehead Chub). Low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Salem Cr	SR 1006	04/12/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	14	03040105	350430	802206	13-17-36-15	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	23.6	--	11	0.3	No

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)	17.6
Dissolved Oxygen (mg/L)	11.2
Specific Conductance (µS/cm)	195
pH (s.u.)	6.4

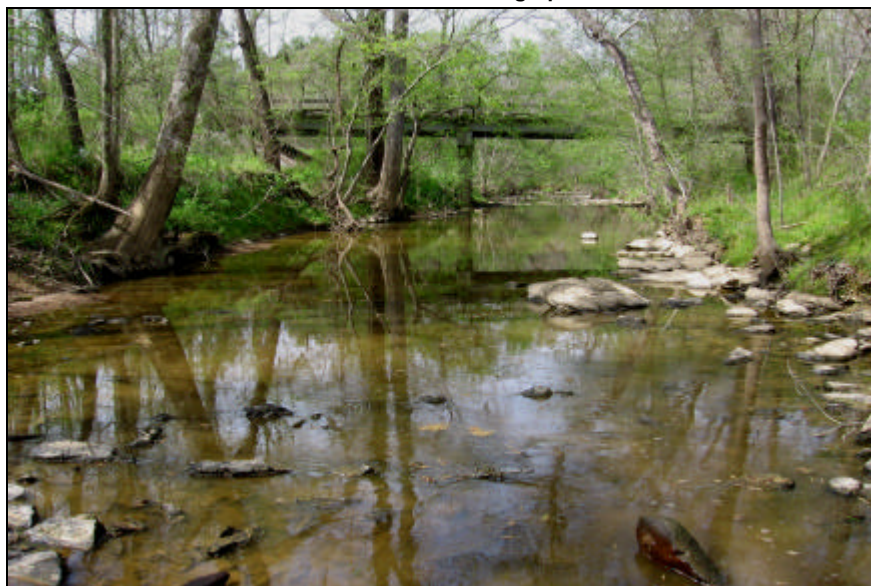
Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	11
Pool Variety (10)	9
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	81

Site Photograph



Substrate Cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/12/06	2006-16	17	46	Good-Fair
04/11/01	2001-12	18	48	Good
06/10/96	96-68	19	36	Fair

Most Abundant Species

Green Sunfish

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- Golden Shiner, Redlip Shiner, Spotted Sucker, Brown Bullhead, Margined Madtom, and Largemouth Bass. **Gains** -- Spottail Shiner, Eastern Mosquitofish, and Pumpkinseed.

Data Analysis

Watershed -- drains eastern Union County, including the north side of the Town of Marshville; tributary to Richardson Creek. **Habitat** -- a typical Carolina Slate Belt type stream; pools, two good riffles, but almost dry; thick filamentous algae; very low flow; left riparian zones logged within last 5 years, but a narrow buffer remains. **2006** -- supersaturation of dissolved oxygen; elevated and slight increase in specific conductance, regional office reports of sanitary sewer overflows in headwaters; decrease in the number of fish collected; increase in the percentage of Green Sunfish and tolerant fish; no Redlip Shiners. **1996 - 2006** -- consistently good total habitat scores (~80); a species-rich site (n = 27), but no intolerant species; dominant species include Highfin Shiner, Whitemouth Shiner, Redbreast Sunfish, Green Sunfish, and Tessellated Darter; Redlip Shiner rare at the site; increase in the percentage of Green Sunfish since 1996; slight change in NCIBI score and rating between 2001 and 2006. A low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cribs Cr	SR 1610	04/12/06	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	14	03040105	350834	801234	13-17-37	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	7.1	--	7	0.2	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	50	0	45	5 -- residential

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

Water Quality Parameters

Temperature (°C)	11.8
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	144
pH (s.u.)	6.3

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	13
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	75

Site Photograph



Substrate

Flat cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/12/06	2006-13	5	26	Poor

Most Abundant Species

Tessellated Darter

Exotic Species

Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- small, rural watershed draining northwest Anson County; no municipalities; site is ~ 1 mile upstream of the confluence with the Rocky River. **Habitat** -- a typical Carolina Slate Belt type stream; very low flow which affected the habitat; short and shallow riffles; shallow pools; thick filamentous algae/periphyton; easily silted with flocculent material. **2006** -- lower than expected total diversity (fewest species at any fish site in 2006); few fish (n = 52); no Redlip Shiner or Redbreast Sunfish; Green Sunfish was the dominant sunfish; no suckers or intolerant species. Low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Lanes Cr	SR 1929	04/12/06	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	14	03040105	345442	802148	13-17-40-(1)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-V	47.8	--	9	0.3	No

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)	11.5
Specific Conductance (µS/cm)	158
pH (s.u.)	6.2

Water Clarity

Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	78

Site Photograph



Substrate Cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/12/06	2006-15	10	36	Fair
04/11/01	2001-10	14	40	Fair

Most Abundant Species

Green Sunfish

Exotic Species

Green Sunfish

Species Change Since Last Cycle

Losses -- Golden Shiner, Highfin Shiner, White Sucker, Eastern Mosquitofish, Margined Madtom, and Pumpkinseed. **Gains** -- Bluegill and Carolina Darter.

Data Analysis

Watershed -- originates in northern Chesterfield County, SC and drains primarily rural southeastern Union and northwestern Anson counties; no municipalities in watershed. **Habitat** -- a typical Carolina Slate Belt type stream; very rocky; abundant filamentous algae and flocculent periphyton; low flow. **2006** -- supersaturation of dissolved oxygen and specific conductance elevated; decrease in the number and diversity of fish; no intolerant species; increase in the percentage of tolerant fish; decrease in the percentage of species with multiple age classes; Green Sunfish displaced the Redbreast Sunfish (from 23 to 61% for Green Sunfish and from 14 to 1% for Redbreast Sunfish); Carolina Darter, a species of Special Concern, collected. **2001 and 2006** -- for its size, but due to flow conditions, not a particular species-rich site, only 16 species known from the site; no intolerant species nor the Redlip Shiner are known from the site. A low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Beaverdam Cr	SR 1005	07/19/06	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	14	03040105	345716	802105	13-17-40-11	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-V	14.9	--	7	0.4	No

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)	23.8
Dissolved Oxygen (mg/L)	1.1
Specific Conductance (µS/cm)	161
pH (s.u.)	5.8

Water Clarity

Slightly turbid, tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	2
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	68

Site Photograph



Substrate Cobble, bedrock, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/19/06	2006-104	9	30	Poor

Most Abundant Species

Bluegill and Green Sunfish

Exotic Species

Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains eastern Union County; no municipalities; poultry operations in rural watershed; tributary to Lanes Creek. **Habitat** -- a typical Carolina Slate Belt type stream; very low flow; pools; dry riffles; eroded banks; entrenched; good canopy; Chinese privet riparian zone on left. **2006** -- lowest dissolved oxygen concentration and saturation of any fish site in 2006; less than the water quality standard; lower than expected total diversity; only 1 of 3 sites in the Piedmont and Mountains with no species of darters; no intolerant species; no Bluehead Chub or Redlip Shiner, no Redbreast Sunfish (displaced by Green Sunfish); high percentage of tolerant species (primarily Green Sunfish and Eastern Mosquitofish). Low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Hardy Cr	SR 1934	04/13/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	14	03040105	351049	801004	13-17-42	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	14.7	--	8	0.3	No

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	85	0	10	5 -- residential

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

Water Quality Parameters

Temperature (°C)	18.9
Dissolved Oxygen (mg/L)	11.0
Specific Conductance (µS/cm)	109
pH (s.u.)	6.2

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	15
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	92

Site Photograph



Substrate Cobble, boulder, bedrock, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/13/06	2006-19	14	50	Good

Most Abundant Species

Green Sunfish

Exotic Species

Green Sunfish

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains southeastern Stanly County, including the small town of Aquadale in its headwaters; rural.; site is 1.6 miles upstream of confluence with Rocky River. **Habitat** -- very high quality habitats; a typical Carolina Slate Belt type stream; very rocky; low flow; pools, short riffles; abundant filamentous algae and periphyton. **2006** -- supersaturation of dissolved oxygen; good species diversity and abundance; 3 species of darters and sunfish, 2 species of suckers, and 1 intolerant species; very high percentage of tolerant fish, the Green Sunfish has displaced the Redbreast Sunfish; no Redlip Shiner. Low flow-affected stream, but not to the extent as observed at other sites.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cartledge Cr	SR 1142	04/10/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	345914	795043	13-35	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	30.2	--	5	0.3	Yes

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)	11.8
Dissolved Oxygen (mg/L)	10.3
Specific Conductance (µS/cm)	67
pH (s.u.)	6.1

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	9
Riffle Habitat (16)	11
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	78

Site Photograph



Substrate Gravel, sand, cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/10/06	2006-06	21	52	Good
04/06/01	2001-05	17	50	Good

Most Abundant Species

Bluehead Chub

Exotic Species

None

Species Change Since Last Cycle

Losses -- Highback Chub, Spotted Sucker, and Green Sunfish. **Gains** -- Rosyside Dace, Coastal Shiner, Sandbar Shiner, Redfin Pickerel, Eastern Mosquitofish, Warmouth, and Piedmont Darter.

Data Analysis

Watershed -- drains rural western Richmond County; headwaters in the Town of Ellerbe; tributary to the Pee Dee River. **Habitat** -- coarse woody debris; riffles; snags; good riparian zones; low flow. **2006** -- increase in numbers and species; diverse, but no suckers; 11 of 21 species with only 1 or 2 fish per species (similar to 2001). **2001 and 2006** -- 24 species known from the site; dominant species are Bluehead Chub and Redlip shiner; slight increase in NCIBI score, but no change in NCIBI rating.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Hitchcock Creek	SR 1486	08/21/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Richmond	16	03040201	13-39-(1)	350028	793939

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Sand Hills	WS-III	15.7	6	0.3

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

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

Water Quality Parameters

Temperature (°C)	26.1
Dissolved Oxygen (mg/L)	5.5
Specific Conductance (µS/cm)	17
pH (s.u.)	5

Water Clarity	clear/tannic
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	9
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)	5
Total Habitat Score (100)	72

Site Photograph



Substrate	sand, gravel, silt
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10023	---	24	---	3.5	Good
08/14/01	8585	---	23	---	3.2	Good
08/19/96	7184	---	21	---	3.3	Good

Taxonomic Analysis

The EPT community at this location has been stable since sampling commenced in 1996 and is typical of a mostly forested catchment. Only three previously uncollected taxa (at this location) were observed in 2006 and included the mayfly *Plauditus punctiventris*, the intolerant, and long-lived stonefly *Acroneuria abnormis*, and the caddisfly *Oecetis nocturna*. Of note, four stonefly taxa (*A. abnormis*, *A. carolinensis*, *A. lycorias*, and *Leuctra*) were all collected in 2006 while each previous sample resulted in only two stonefly taxa.

Data Analysis

The 2006 sample continues to demonstrate the gradual increase in EPT taxa richness observed at this location since 1996. Although the EPTBI increased very slightly over prior samples, the doubling of total stonefly taxa richness in 2006 (relative to the two previous samples) may indicate slightly improved physical conditions along this reach of Hitchcock Creek in 2006.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Hitchcock Cr	SR 1486	04/24/06	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	350028	793939	13-39-(1)	Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	15.7	--	6	0.3	No

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)	20.8
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	18
pH (s.u.)	5.2

Water Clarity

Black water

Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	10
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	96

Site Photograph



Substrate Sand, silt, coarse woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/24/06	2006-21	15	--	Not Rated
04/05/01	2001-01	12	--	Not Rated

Most Abundant Species

Yellow Perch

Exotic Species

Yellow Perch

Species Change Since Last Cycle

Losses -- Bluespotted Sunfish and Sawcheek Darter. **Gains** -- Margined Madtom, Pirate Perch, Lined Topminnow, Black Crappie, and Largemouth Bass.

Data Analysis

Watershed -- drains east-central Richmond County, including the Sand Hills Gamelands; site is ~ 2 mi. downstream from McKinney Lake and ~ 2 mi. upstream of Ledbetter Lake. **Habitat** -- very high quality habitats (2nd greatest habitat score of any fish site in 2006); a typical Sand Hills type stream; runs; single riffle at beginning of reach; good riparian; *Valisneria* **2006** -- lowest specific conductance and pH of any fish site in 2006; Yellow Perch and Black Crappie possible migrants from Ledbetter Lake. **2001 and 2006** -- typical Sand Hills fauna including Spotted Sucker, Chain Pickerel, and Dollar Sunfish; 17 species known from the site.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Hitchcock Creek	SR 1109	08/21/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Richmond	16	03040201	13-39-(10)	345508	794956

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Sand Hills	C	140	11	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Burlington Industries LLC, Richmond Plant	NC0043320	1.2

Water Quality Parameters

Temperature (°C)	26.6
Dissolved Oxygen (mg/L)	10
Specific Conductance (µS/cm)	57
pH (s.u.)	6.6

Water Clarity

tannic

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	8
Pool Variety (10)	5
Riffle Habitat (16)	9
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	70

Site Photograph



Substrate

sand, gravel, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10077	79	32	5.6	4.5	Good
08/15/01	8587	72	21	6.0	4.6	Good-Fair
08/20/96	7188	40	5	7.8	6.4	Poor

Taxonomic Analysis

This site has improved drastically since sampling commenced in 1996. The 2006 sample garnered the most EPT taxa ever collected here as well as the most total taxa. Previously uncollected (at this location) EPT taxa included the intolerant mayflies *Heptagenia pulla*, *Paraleptophlebia*, the stoneflies *Acroneuria abnormis*, *Eccopectura xanthenes*, *Neoperla*, *Paragnetina fumosa*, and a caddisfly rarely collected in North Carolina, *Protoptila*. Moreover, the 2006 collection was the first time any stonefly taxa (several of which are long-lived as nymphs) have been observed here. In addition, a low dissolved oxygen indicator, *Physella* (a gastropod), declined from abundant in 1996 to rare in 2006. Last, the number of pollution tolerant oligochaetes declined from six taxa in 1996 to only three taxa in 2006. These data clearly demonstrate improving conditions along this segment of Hitchcock Creek.

Data Analysis

Every benthic macroinvertebrate metric has improved steadily since the first sample in 1996. Not only have all taxa richness metrics increased and all biotic index measures decreased, but the EPTN has increased from 25 in 1996, to 70 in 2001, to 136 in 2006. These improved metrics correspond well with the conductivity data as this parameter was 305 (µS/cm) in 1996, decreased to 74 (µS/cm) in 2001, and has decreased again to 57 (µS/cm) in 2006. The Laurel Hill Paper Company discharged upstream of this location up until February 1998. The stream continues to recover as a result of the removal of this facility.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Chock Cr	SR 1475	04/25/06	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	345903	794016	13-39-6	Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	13.8	--	6	0.3	No

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)	19.4
Dissolved Oxygen (mg/L)	8.2
Specific Conductance (µS/cm)	30
pH (s.u.)	5.9

Water Clarity

Black water

Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	18
Bottom Substrate (15)	6
Pool Variety (10)	10
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	89

Site Photograph



Substrate Soft sand, muck, and detritus; coarse woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/25/06	2006-24	13	---	Not Rated

Most Abundant Species

Dollar Sunfish and Dusky Shiner

Exotic Species

Yellow Perch

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains eastern Richmond County, northwest of US 1 and NC 177; a tributary to Ledbetter Lake, site is ~ 0.5 mi. above lake. **Habitat** -- high quality habitats; a typical Sand Hills stream; runs; coarse woody debris riffles; *Valisneria*. **2006** - typical Sand Hills fauna including Dusky Shiner, Spotted Sucker, Dollar Sunfish, and Mud Sunfish.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Rocky Fork Cr	SR 1424	04/24/06	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	350207	794204	13-39-8	Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	29.7	--	6	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	18.2
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	23
pH (s.u.)	6.2

Water Clarity

Stained, slightly turbid

Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	10
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	95

Site Photograph



Substrate Sand, silt, detritus, cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/24/06	2006-20	11	--	Not Rated
04/05/01	2001-02	14	--	Not Rated

Most Abundant Species

Redbreast Sunfish

Exotic Species

None

Species Change Since Last Cycle

Losses -- Bluehead Chub, Creek Chubsucker, Snail Bullhead, Chain Pickerel, Warmouth, Largemouth Bass, and Yellow Perch. **Gains** -- Yellow Bullhead, Flat Bullhead, Mud Sunfish, and Dollar Sunfish.

Data Analysis

Watershed -- drains northeast Richmond County, including the Sand Hills Gamelands; tributary to Ledbetter Lake. **Habitat** -- very high quality habitats (2nd greatest habitat score of any fish site in 2006); a typical Sand Hills type stream; runs, boulder outcrops near old mill site; *Valisneria*; good riparian zones; coarse woody debris. **2006** -- low abundance of most species (only 1 or 2 fish per species), but a typical Sand Hills fauna present including Dusky Shiner, Spotted Sucker, Dollar Sunfish, and Mud Sunfish. **2001 and 2006** -- 18 species known from the site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Beaverdam Cr	SR 1486	04/24/06	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	350120	794100	13-39-8-7	Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	4.5	0	3	0.2	Yes

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)	19.2
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	19
pH (s.u.)	5.6

Water Clarity

Blackwater

Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	18
Bottom Substrate (15)	7
Pool Variety (10)	8
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	87

Site Photograph



Substrate Sand, organic detritus

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/24/06	2006-22	8	--	Not Rated
04/15/96	96-13	6	--	Not Rated

Most Abundant Species

Sandhills Chub

Exotic Species

None

Species Change Since Last Cycle

Losses -- Bluehead Chub, Creek Chubsucker, and Redbreast Sunfish. **Gains** -- Sandhills Chub, Yellow Bullhead, Margined Madtom, Bluegill, and Largemouth Bass.

Data Analysis

Watershed -- small watershed draining northeast Richmond County, including the Sand Hills Gamelands; tributary to Ledbetter Lake. **Habitat** -- a typical Sand Hills stream; narrow; very organic substrate; *Panicum* and bay forested riparian zones; logged on upper zones and lower right riparian zones, but ~ 200 ft. buffer remains. **2006** -- very low specific conductance; 2nd lowest of any fish site in 2006; very few fish collected, but the stream is small; Sandhills Chub, a species of Special Concern, collected. **1996 and 2006** -- Typical Sand Hills fauna including Sandhills Chub, Redfin Pickerel, Pirate Perch, and Dollar Sunfish; 11 species known from the small site.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Jones Creek	NC 145	08/21/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Anson	17	03040201	13-42	345415	795551

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	93.9	16	0.3

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)	25.3
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	79
pH (s.u.)	6.6

Water Clarity	slightly turbid
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	11
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	71

Site Photograph



Substrate	sand, gravel, bedrock, boulder, rubble
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10079	66	27	5.7	5.2	Good
08/14/01	8583	74	18	5.9	4.4	Good-Fair
08/20/96	7189	63	17	5.8	4.8	Good-Fair
07/23/90	5388	73	16	5.9	5.0	Good-Fair
07/07/87	4131	70	24	5.9	4.6	Good-Fair

Taxonomic Analysis

The 2006 sample produced the most EPT taxa ever observed at this site and included the following new (for this location) mayflies (*Acentrella alachua*, *Heterocloeon curiosum*, *Proclaeon*), stoneflies (*Eccoptyra xanthenes*), and caddisflies (*Nectopsyche pavidia*, *Oecetis nocturna*, and *Trienodes perna*). In addition, an indicator of organic enrichment and low dissolved oxygen, *Polypedilum illinoense* (a chironomid), was absent from the 2006 collection but was present (common to abundant) in all previous samples. Moreover, there were no oligochaete taxa observed in the 2006 sample whereas all previous samples had at least one oligochaete taxon present. These data suggest slightly improving conditions in the Jones Creek catchment.

Data Analysis

Although EPT taxa richness and EPT abundance were the highest ever observed at this site in 2006, the total taxa richness was less than in all previous samples other than the 1996 collection. Most of this reduction was caused by a substantial decrease in chironomid taxa with only seven taxa present in 2006 whereas 13, 18, 16, and 21 chironomid taxa were collected in 1987, 1990, 1996, and 2001 respectively. The increased number of EPT taxa and decreased chironomid (and oligochaete) taxa accounted for the slight reduction of the BI observed in 2006. These data loosely correlate with a reduction in the conductivity measured at this site since 1996 (93 µS/cm) and 2001 (110µS/cm). These data suggest slightly improved physical conditions in Jones Creek relative to previous samples.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
North Fork Jones Creek	SR 1121	08/21/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Anson	17	03040201	13-42-1-(0.5)	345414	795957

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	35.4	5	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

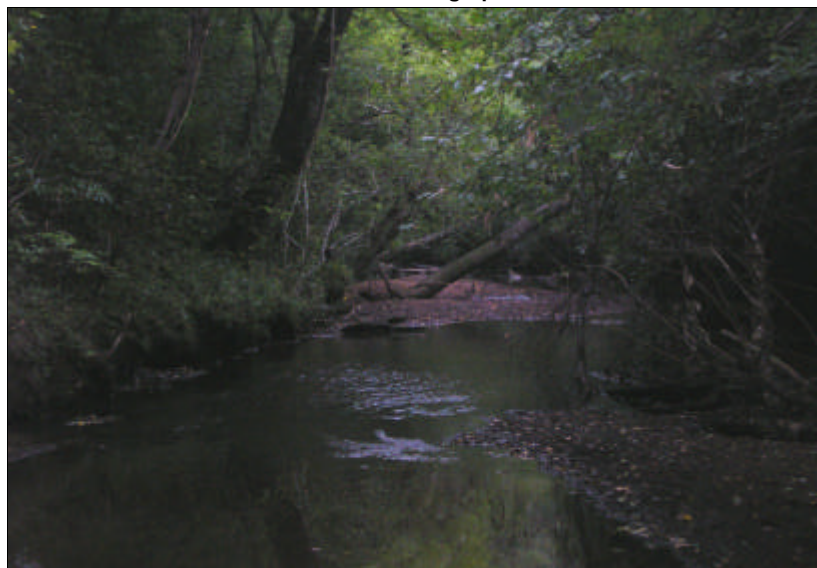
Temperature (°C)	25.3
Dissolved Oxygen (mg/L)	5.6
Specific Conductance (µS/cm)	102
pH (s.u.)	6.2

Water Clarity	clear/tannic
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Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	4
Pool Variety (10)	3
Riffle Habitat (16)	3
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	58

Site Photograph



Substrate	sand, silt, trace of gravel
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Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10078	64	14	6.2	5.3	Good-Fair
08/13/01	8582	63	16	6.1	5.4	Good-Fair
08/20/96	7190	---	11	---	5.1	Fair

Taxonomic Analysis

The 2006 Full-Scale sample produced a nearly identical benthic community to that measured during the last Full-Scale collection in 2001. The only previously uncollected EPT taxa (for this location) included the mayflies *Procladius*, *Platania*, and the tolerant caddisfly *Hydropsyche betteni*. Moreover, nearly all of the remaining non-EPT taxa remained unchanged from the 2001 collection.

Data Analysis

As was noted in the 2001 basinwide assessment document, the 1996 sample was conducted under higher flow conditions. Conversely, the 2001 and 2006 samples were collected under definite low flow conditions. As is the case in a catchment that is dominated by non-point pollution inputs, lower flows tend to improve the benthic community and that is the probable explanation (given the lack of NPDES dischargers upstream) for the differences observed between 1996 and 2001. This phenomenon also accounts for the near-identical metrics between the low flow years of 2001 and 2006.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Fk Jones Cr	SR 1121	04/11/06	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	17	03040201	345415	795957	13-42-1-0.5	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	35.4	---	9	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	11.6
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	86
pH (s.u.)	6.9

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	7
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	63

Site Photograph



Substrate

sand, gravel, a little cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/11/06	2006-09	23	50	Good

Most Abundant Species

Bluehead Chub

Exotic Species

Redear Sunfish

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- drains the south side of Wadesboro and is downstream of Bailey Creek watershed (eastern Wadesboro) in south east Anson County.
Habitats -- sandy runs, snags, small stick riffles, some bedrock outcrops, some small cobble riffles. **2006** -- new fish community monitoring site; high diversity; balanced trophic structure (61% Insectivores including 16% Redlip Shiner, 13% Redbreast Sunfish, and 13% Whitemouth Shiner); water quality approaching the highest bioclassification.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Bailey Cr	SR 1811	04/10/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	17	03040201	345522	800107	13-42-1-3	Carolina Slate Belt/Triassic Uplands

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	13	---	4	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	16.1
Dissolved Oxygen (mg/L)	10.3
Specific Conductance (µS/cm)	90
pH (s.u.)	6.1

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	2
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	1
Right Riparian Score (5)	4
Total Habitat Score (100)	52

Site Photograph



Substrate

sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/10/06	2006-08	14	44	Good-Fair
04/06/01	2001-06	20	52	Good
04/15/96	96-14	19	52	Good

Most Abundant Species

Bluehead Chub

Exotic Species

None

Species Change Since Last Cycle

Losses -- Pumpkinseed, Warmouth, Redear Sunfish, Spottail Shiner, Yellow Bullhead, Margined Madtom, Piedmont Darter. **Gains** -- Redfin Pickerel

Data Analysis

Watershed -- drains the eastern half of Wadesboro in southeast-central Anson County. Atypical substrate for a stream of the Carolina Slate Belt ecoregion. **Habitats** -- sandy runs, snags, undercuts, thin riparian, very silty, thick periphyton. **2006** -- Low flow; six fewer species than in 2001; no intolerants collected. **1996-2006** -- 24 fish species known from this watershed; a decline in the NCIBI score and rating since 2001, may be due to low flow in 2006; conductivity continues to show evidence of nutrient enrichment from urban runoff and agriculture.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Fk Jones Cr	SR 1821	04/11/06	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	17	03040201	345346	800041	13-42-2	Carolina Slate Belt/Triassic Uplands

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	34.6	---	8	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	12.0
Dissolved Oxygen (mg/L)	10.0
Specific Conductance (µS/cm)	65
pH (s.u.)	6.2

Water Clarity

Clear, tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	65

Site Photograph



Substrate

sand, some gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/11/06	2006-10	15	44	Good-Fair
04/10/01	2001-08	18	54	Excellent

Most Abundant Species

Bluehead Chub, Redlip Shiner

Exotic Species

None

Species Change Since Last Cycle

Losses -- Pumpkinseed, Warmouth, Bluegill, Largemouth Bass, Whitemouth Shiner, Sea Lamprey.
Gains -- Golden Shiner, Creek Chub, Redfin Pickerel.

Data Analysis

Watershed -- drains rural south central Anson County; atypical stream for this ecoregion, borders Triassic Uplands Ecoregion. **Habitats** -- sandy runs, snags, some bedrock outcrops; Privet was dense in the riparian zone. **2006** -- the two most abundant species each represented 38% of the sample; Redbreast Sunfish was the only sunfish species collected. **2001-2006** -- 21 species known from this site; 14% fewer total fish collected in 2006; loss of four sunfish species may be flow related; decline of 10 points in NCIBI; water quality rating has dropped by two bioclassifications.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mill Cr	SR 1826	04/11/06	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	16	03040201	345123	795500	13-43	Carolina Slate Belt/Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	18.6	--	7	0.4	Yes

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)	14.4
Dissolved Oxygen (mg/L)	9.9
Specific Conductance (µS/cm)	58
pH (s.u.)	6.3

Water Clarity

Clear, tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	9
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)	5
Total Habitat Score (100)	74

Site Photograph



Substrate Sand, coarse woody debris, cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/11/06	2006-11	26	56	Excellent

Most Abundant Species

Bluehead Chub

Exotic Species

None

Species Change Since Last Cycle

N/A; new site in 2006.

Data Analysis

Watershed -- drains the southeastern corner of Anson County, including the small Town of Morven; rural; tributary to the Pee Dee River; borders the Carolina Slate Belt and Sand Hills. **Habitat** -- characteristics of Piedmont; Sand Hills, and Coastal Plain; Sand Hills habitat score = 91; riffles; runs, coarse woody debris; great riparian zones. New regional reference site. **2006** -- fauna a mixture of Piedmont, Coastal Plain, and Sand Hills species; most species-rich fish site in 2006, including 3 species of darters and 7 species of sunfish; unique species include Sea Lamprey, American Eel, Spotted Sunfish, and Mud Sunfish.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Marks Cr	SR 1104	04/25/06	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	344947	794759	13-45-(2)	Sand Hills

Stream Classification	Drainage Area (mi ²)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	29.9	--	8	0.4	No

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)
City of Hamlet's Hamlet WWTP	NC0047562	1

Water Quality Parameters

Temperature (°C)	18.9
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	49
pH (s.u.)	5.8

Water Clarity

Blackwater

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	18
Bottom Substrate (15)	7
Pool Variety (10)	10
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	90

Substrate Sand, coarse woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/25/06	2006-23	21		Not Rated
04/06/01	2001-04	13		Not Rated

Most Abundant Species

Dusky Shiner

Exotic Species

None

Species Change Since Last Cycle

Losses -- Tadpole Madtom. **Gains** -- Golden Shiner, Creek Chubsucker, Spotted Sucker, Chain Pickerel, Mud Sunfish, Flier, Pumpkinseed, and Largemouth Bass.

Data Analysis

Watershed -- drains southwest Richmond County, including the cities of Hamlet and East Hamlet; tributary to Everetts Lake and the Pee Dee River. **WWTP** -- with frequent violations over the period 2001 to 2004 for biochemical oxygen demand; proceeded to enforcement (BIMS query 12/14/2006); specific conductance low, but elevated for a Sand Hills stream (43 and 49 µS/cm in 2001 and 2006, respectively). **Habitat** -- high quality habitats; Coastal Plain like; pools; snags; runs; good bottomland riparian zones. **2006** -- most species of sunfish (n = 9) of any fish site in 2006; high abundance (n = 238) and diversity (n = 21) for a Sand Hills stream (some enrichment from WWTP?). **2001 and 2006** -- high diversity, 22 species known from the site; fauna includes American Eel, Dusky Shiner, Spotted Sucker, Mud Sunfish, Flier, Bluespotted Sunfish, and Dollar Sunfish.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Deadfall Cr	SR 1109	04/11/06	Poor

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	17	03040201	344850	801026	13-47-2	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	31.5	---	8	0.5	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	16.4
Dissolved Oxygen (mg/L)	11.6
Specific Conductance (µS/cm)	135
pH (s.u.)	6.1

Water Clarity

Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	0
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	64

Site Photograph



Substrate

boulder, gravel, some bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/11/06	2006-12	10	30	Poor

Most Abundant Species

Redbreast Sunfish

Exotic Species

Redear Sunfish

Species Change Since Last Cycle

N/A, new site in 2006

Data Analysis

Watershed -- drains part of south central Anson County to South Carolina; a tributary to Thompson Creek (SC). **Habitats** -- entrenched; one long straight pool of mostly uniform depths with no riffles; abundant algae; very low flow. **2006** -- new fish community monitoring site; very few fish collected (total = 52); no cyprinids collected; high percentage of Insectivores (87% of total, including 7 of 10 species); low fish species abundances due to very low flow and uniform depths; low flow effected stream.