FISHERIES REPORT

Warmwater Streams and Rivers

Tennessee Wildlife Resources Agency--Region IV

Report 15-05

2014

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REPORT NO. 15-05
WARMWATER STREAM FISHERIES REPORT
REGION IV
2014

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TENNESSEE WILDLIFE RESOURCES AGENCY

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Cover: Smallmouth Bass, Powell River.

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INTRODUCTION

The fish fauna of Tennessee is the most diverse in the United States, with approximately 307 species of native fish and about 30 to 33 introduced species (Etnier and Starnes 1993). Streams in Region IV, except for a few in Anderson, Campbell, Claiborne, and Scott counties (Cumberland River System streams) are in the Ridge and Valley and Blue Ridge physiographic provinces of the upper Tennessee River drainage basin. The main river systems in the region are the Clinch, Powell, Little Tennessee, mainstream Tennessee River, French Broad, Nolichucky, Holston, and Big South Fork Cumberland River.

Streams and rivers across the state are of considerable value as they provide a variety of recreational opportunities. These include fishing, canoeing, swimming, and other riverine activities that are unmatched by other aquatic environments. Streams and rivers are also utilized as water sources both commercially and domestically. The management and protection of this resource is recognized by Tennessee Wildlife Resources Agency (TWRA) and has been put forth in the Strategic Plan (TWRA 2014) as a primary goal.

The main purpose of this project is to collect baseline information on game and non-game fish and macroinvertebrate populations in the region. This baseline data is necessary to update and expand our Tennessee Aquatic Database System (TADS) and aid in the management of fisheries resources in the region.

Efforts to survey the region's streams have led to many cooperative efforts with other state and federal agencies. These have included the Tennessee Department of Environment and Conservation (TDEC), Tennessee Valley Authority (TVA), U.S. Forest Service (USFS), Oak Ridge National Laboratory (ORNL), and the National Park Service (NPS).

The information gathered for this project is presented in this report as river and stream accounts. These accounts include an introduction describing the general characteristics of the survey site, a study area and methods section summarizing site location and sampling procedures, a results section outlining the findings of the survey(s), and a discussion section, which allows us to summarize our field observations and make management recommendations.

METHODS

The streams to be sampled and the methods required are outlined in TWRA field request No. 04-14. Three rivers and 16 streams were sampled and are included in this report. Surveys were conducted from April to August 2014. A total of 35 (IBI, CPUE) fish and four benthic macroinvertebrate samples were collected.

SAMPLE SITE SELECTION

Index of Biotic Integrity (IBI) sample sites were selected that would give the broadest picture of impacts to the watershed. We typically located our sample site in close proximity to the mouth of a stream to maximize resident species collection. However, we positioned survey sites far enough upstream to decrease the probability of collecting transient species. Large river sampling sites were selected based on historical sampling locations and available access points. Typically we selected sample areas in these rivers that represented the best available habitat for any given reach being surveyed. Sampling locations were delineated in the field utilizing hand held Geographical Positioning Units (GPS) and then digitally re-created using a commercially available software package.

WATERSHED ANALYSIS

Watershed size and/or stream order has historically been used to create relationships for determining maximum expected species richness for IBI analysis. This has been accomplished by plotting species richness for a number of sites against watershed areas and/or stream orders (Fausch et al. 1984). We chose to use watershed area (kilometer^2) to develop our relationships as this variable has been shown to be a more reliable metric for predicting maximum species richness. Watershed areas (the area upstream of the survey site) were determined from USGS 1:24,000 scale maps.

FISH COLLECTIONS

A percentage of the fish data collected in this report was accomplished by employing an Index of Biological Integrity (Karr et al. 1986). Fish were collected with standard electrofishing (backpack) and seining techniques. A 5 x 1.3 meter seine was used to make hauls in shallow pool and run areas. Riffle and deeper run habitats were sampled with a seine in conjunction with a backpack electrofishing unit (100-600 VAC). An area approximately the length of the seine^2 (i.e., 5 meters x 5 meters) was electrofished in a downstream direction. A person with a dipnet assisted the person electrofishing in collecting those fish, which did not freely drift into the seine. Timed (5-min duration) backpack electrofishing runs were used to sample shoreline habitats. In both cases (seining or shocking) an estimate of area (meter^2) covered on each pass was calculated. Fish collections were made in all habitat types within the selected survey reach. Collections were made repeatedly for each habitat

type until no new species was collected for three consecutive samples for each habitat type. All fish collected from each sample were enumerated. Anomalies (e.g., parasites, deformities, eroded fins, lesions, or tumors) were noted along with occurrences of hybridization. After processing, the captured fish were either held in captivity or released into the stream where they could not be recaptured. In larger rivers, a boat was used in conjunction with the backpack samples to effectively sample deep pool habitat. Timed (10-min duration) runs were used until all habitat types had been depleted.

Streams sampled for the Cumberland Habitat Conservation Plan (HCP) utilized two techniques for collecting fish data. Catch-per-unit-effort samples (CPUE) were calculated for all target species covered under the HCP. Site lengths for these streams were typically 200 meters and were sampled by a one pass electrofishing run utilizing one backpack electrofishing unit.

Catch-per-unit-effort samples were conducted in three rivers during 2014. Timed boat electrofishing runs were made in pool and shallower habitat where navigable. Efforts were made to sample the highest quality habitat in each sample site and include representation of all habitat types typical to the reaches surveyed. Total electrofishing time was calculated and used to determine our catch-effort estimates (fish/hour).

Generally, fish were identified in the field and released. Problematic specimens were preserved in 10% formalin and later identified in the lab or taken to Dr. David A. Etnier at the University of Tennessee Knoxville (UTK) for identification. Most of the preserved fish collected in the 2014 samples will be catalogued into our reference collection or deposited in the University of Tennessee Research Collection of Fishes. Common and scientific names of fishes used in this report are after Page et al. (2013), Powers and Mayden (2007) and Etnier and Starnes (1993).

BENTHIC COLLECTIONS

Qualitative benthic samples were collected from each IBI fish sample site and at four other locations for a total of eight samples. These were taken with aquatic insect nets, by rock turning, and by selected pickings from as many types of habitat as possible within the sample area. Taxa richness and relative abundance are the primary considerations of this type of sampling. Taxa richness reflects the health of the benthic community and biological impairment is reflected in the absence of pollution sensitive taxa such as Ephemeroptera, Plecoptera, and Trichoptera (EPT).

Large particles and debris were picked from the samples and discarded in the field. The remaining sample was preserved in 70% ethanol and later sorted in the laboratory. Organisms were enumerated and attempts were made to identify specimens to species level when possible. Many were identified to genus, and most were at least identified to family. Dr. David A. Etnier (UTK) examined problematic specimens and either made the determination or confirmed our identifications. Comparisons with identified specimens in our aquatic invertebrate collection were also useful in making determinations. For the most part, nomenclature of aquatic insects used in this report follows Brigham et al. (1982) and Louton (1982). Names of stoneflies (Plecoptera) are after Stewart and Stark (1988) and caddisflies are after

Etnier et al. (1998). Benthic results are presented in tabular form with each stream account.

WATER QUALITY MEASUREMENTS

Basic water quality data were taken at most sites in conjunction with the fishery and benthic samples. The samples included temperature, pH, and conductivity. Data were taken from midstream and mid-depth at each site, using a YSI model 33 S-C-T meter. Scientific Products™ pH indicator strips were used to measure pH. Stream velocities were measured with a Marsh-McBirney Model 201D current meter. The Robins-Crawford "rapid crude" technique (as described by Orth 1983) was used to estimate flows. Water quality parameters were recorded and are included with each stream account.

DATA ANALYSIS

Twelve metrics described by Karr et al. (1986) were used to determine an IBI score for each stream surveyed. These metrics were designed to reflect fish community health from a variety of perspectives (Karr et al. 1986). Given that IBI metrics were developed for the mid-western United States, many state and federal agencies have modified the original twelve metrics to accommodate regional differences. Such modifications have been developed for Tennessee primarily through the efforts of TWRA (Bivens et al. 1995), TVA, and Tennessee Tech University. In developing our scoring criteria for the twelve metrics we reviewed pertinent literature [North American Atlas of Fishes (Lee et al. 1980), The Fishes of Tennessee (Etnier and Starnes 1993), various TWRA Annual Reports and unpublished data] to establish historical and more recent accounts of fishes expected to occur in the drainages we sampled. Scoring criteria for the twelve metrics were modified according to watershed size. Watersheds draining less than 13 kilometer^2 were assigned different scoring criteria than those draining greater areas. This was done to accommodate the inherent problems associated with small stream samples (e.g., lower catch rates and species richness). Young-of-the-year fish and non-native species were excluded from the IBI calculations. After calculating a final score, an integrity class was assigned to the stream reach based on that score. The classes used follow those described by Karr et al. (1986).

Karr et al. (1986) criteria Total IBI score (sum of the 12 metric ratings)	Integrity Class	Attributes
58-60	Excellent	Comparable to the best situations without human disturbance; all regionally expected species for the habitat and stream size, including the most intolerant forms, are present with a

		full array of size classes; balanced trophic structure.
48-52	Good	Species richness somewhat below expectation, especially due to the loss of the most intolerant forms; some species are present with less than optimal abundance or size distributions; trophic structure shows some signs of stress.
40-44	Fair	Signs of additional deterioration include loss of intolerant forms, fewer species, highly skewed trophic structure (e.g., increasing frequency of omnivores and green sunfish or other tolerant species); older age classes of top predators may be rare.
28-34	Poor	Dominated by omnivores, tolerant forms, and habitat generalists; few top carnivores; growth rates and condition factors commonly depressed; hybrids and diseased fish often present.
12-22	Very poor	Few fish present, mostly introduced or tolerant forms; hybrids common;

	disease, parasites fin damage, and other anomalies regular.
No fish	Repeated sampling finds no fish.

Catch-per-unit-effort analysis was performed for three large rivers sampled during 2014. Total time spent electrofishing at each site was used to calculate the CPUE estimates for each species collected. Length categorization analysis (Gabelhouse 1984) was used to calculate Proportional Stock Density (PSD) and Relative Stock Density (RSD) for black bass and rock bass populations sampled. Catch per unit effort samples were also calculated for streams being monitored for the HCP.

Benthic data collected for the 2014 surveys were subjected to a biotic index that rates stream condition based on the overall taxa tolerance values and the number of Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa present. The North Carolina Division of Environmental Management (NCDEM) has developed a bioclassification index and associated criteria for the southeastern United States (Lenat 1993). This technique rates water quality according to scores derived from taxa tolerance values and EPT taxa richness values. The final derivation of the water quality classification is based on the combination of scores generated from the two indices. The criteria used to generate the biotic index values and EPT values are as follows:

Score	Biotic Index Values	EPT Values
5 (Excellent)	< 5.14	> 33
4.6	5.14-5.18	32-33
4.4	5.19-5.23	30-31
4 (Good)	5.24-5.73	26-29
3.6	5.74-5.78	24-25
3.4	5.79-5.83	22-23
3	5.84-6.43	18-21
2.6	6.44-6.48	16-17
2.4	6.49-6.53	14-15
2	6.54-7.43	10-13
1.6	7.44-7.48	8-9
1.4	7.49-7.53	6-7
1 (Poor)	> 7.53	0-5

The overall result is an index of water quality that is designed to give a general state of pollution regardless of the source (Lenat 1993). Taxa tolerance rankings were based on those given by NCDEM (2006) with minor modifications for taxa, which did not have assigned tolerance values.

Little River

Introduction

Little River originates in Sevier County on the north slope of Clingmans Dome, in the Great Smoky Mountains National Park. It flows in a northwesterly direction for about 95 kilometers, past Elkmont in the National Park, and Townsend, Walland, and Maryville in Blount County, and joins the Tennessee River near river mile 635.6. Fort Loudoun Reservoir, impounds the lower 6.8 miles of Little River with another 1.5 miles being impounded by the low head dam at Rockford (located at the backwaters of Fort Loudoun). In all, a little over eight river miles are impounded. Another 0.75 mile or so is impounded by Perrys Milldam downstream of Walland, near river mile 22. A third low head dam is located in Townsend near river mile 33.6. The river has a drainage area of approximately 982 km^2 at its confluence with the Tennessee River. The upper reach of the river (upstream of Walland) is located in the Blue Ridge physiographic province, and then transitions into the Ridge and Valley province from Walland to Fort Loudoun Reservoir. Little River is a very scenic stream in the Great Smoky Mountains National Park. There, it drains an area containing some of the most spectacular scenery in the southeastern United States. The Little River fishery within the National Park boundary is primarily wild rainbow and brown trout with smallmouth bass in the lower reaches. An excellent trout fishery exists, and is managed by the National Park Service. Little River's gradient becomes moderate as it leaves the National Park and flows through the Tuckaleechee Valley from Townsend to Walland. Excellent populations of smallmouth bass and rock bass exist there, and rainbow trout are stocked in spring and fall as water temperatures allow. This portion of the river has many developed campgrounds and is a popular recreation destination for tourists. While not as developed as Pigeon Forge, the Townsend area has grown significantly over the past two decades. Downstream of Walland, Little River leaves the mountains and no longer displays the extreme clarity and attractive rocky bottom of its upper reaches. Here it enters the Ridge and Valley province and resembles the more typical large

Little River at Perrys Mill

river habitat with lower gradient and large deep pools interspersed with shallow shoal areas. Downstream of Perrys Milldam, the fishery, while still primarily smallmouth bass and rock bass, declines in quality relative to the upstream reach. This is probably related to limited availability of preferred smallmouth bass habitat. Near the small community of Rockford, Little River flows into a surprisingly large (given the size of the stream) embayment of Fort Loudon Lake. The Little River forms the boundary between Blount County and Knox County for the last few miles of its course.

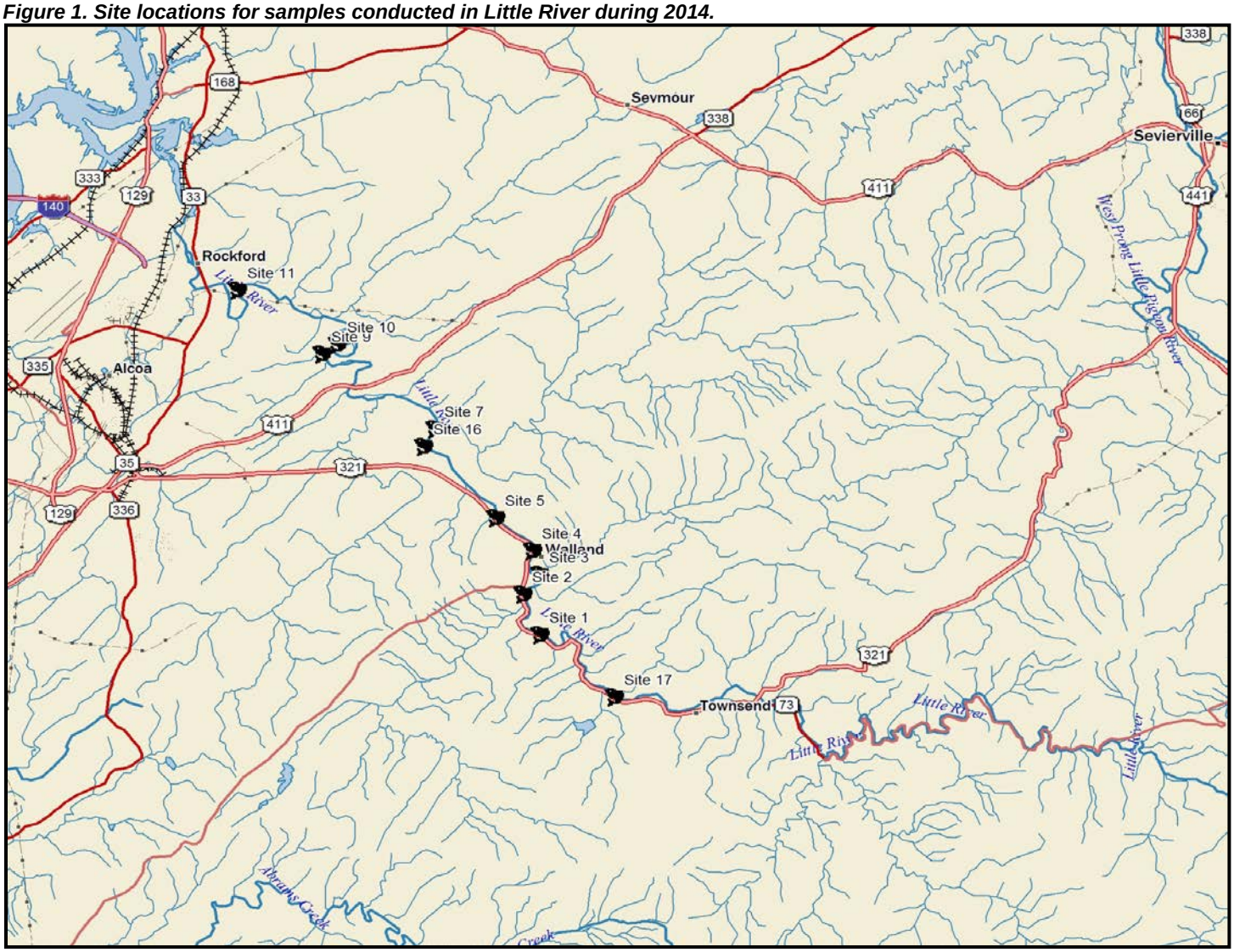
Little River represents an important recreational resource for the state both in consumptive and non-consumptive uses. It supports an active tubing/rafting industry and is an important recreational resource for local residents and tourists alike. It is also the municipal water source of the cities of Alcoa and Maryville. It provides critical habitat for species of special concern and is home to over 50 species of fish (four listed federally). Additionally, its upper reach supports one of east Tennessee's better warm water sport fisheries. It provides anglers with the opportunity to catch all species of black bass, rock bass, and even stocked rainbow trout when water temperatures allow.

Study Area and Methods

Our 2014 survey of Little River consisted of two IBI sites (Coulters Bridge and Townsend) and nine CPUE black bass/rock bass samples. We cooperated with several agencies in conducting the two IBI samples between July 8 and 11. CPUE samples were conducted on April 10 and 11. The Coulters Bridge site (16) is located in the Ridge and Valley Province of Blount County while the Townsend site (17) lies in the transitional zone between the Blue Ridge and the Ridge and Valley Provinces (Figure 1).

Public access along the river is primarily limited to bridge crossings and small "pull-outs" along roads paralleling the river. There are several primitive launching areas for canoes or small boats and one developed access area managed by the Agency (Perrys Mill).

Figure 1. Site locations for samples conducted in Little River during 2014.



Fish were collected by boat electrofishing in accordance with the standard large river sampling protocols (TWRA 1998). Fixed-boom electrodes were used to transfer 2-3 amps DC at all sites. This current setting was determined effective in narcotizing all target species (black bass and rock bass). All sites were sampled during daylight hours and had survey durations ranging from 600 to 1900 seconds. Catch-per-unit-effort (CPUE) values were calculated for each target species at each site. Length categorization indices were calculated for target species following Gabelhouse (1984). For IBI sites, fish were collected according to the criteria described in the methods section of this report. Both backpack and boat electrofishing were used to collect samples at both stations. Qualitative benthic macroinvertebrates samples were collected at both stations and analyzed to produce a biotic index score similar to those derived for the fish IBI.

In our survey sites, the riparian habitat consisted primarily of wooded shorelines with interspersed agricultural fields. Submerged woody debri was fairly common in most of our sample areas along with large boulder in the upper reaches. The river substrate was predominately boulder/cobble in riffle areas and bedrock with

interspersed boulder/cobble in the pool habitat. The prevalence of boulders decreased somewhat as we proceeded downstream and the abundance of gravel and cobble increased. Water temperatures ranged from 15 C to 22 C and conductivity varied from 50 to130 µs/cm for those stations where values were recorded (Table 1).

Table 1. Physiochemical and site location data for black bass and rock bass samples conducted in Little River during 2014.

Site Code	Site	Quad	River Mile	Latitude	Longitude	Mean Width (m)	Length (m)	Temp. C	Cond. µs/cm	Secchi (m)
420140601	1	Kinzel Springs	26.6	35.70190	-83.81320	-	-	11.5	45.1	-
420140602	2	Kinzel Springs	25.1	35.71550	-83.81870	-	-	11.6	45.8	-
420140603	3	Kinzel Springs	24.6	35.72240	-83.81280	-	-	12.1	45.4	-
420140604	4	Kinzel Springs	23.8	35.73050	-83.81550	-	-	13.0	47.7	-
420140605	5	Kinzel Springs	22.6	35.74160	-83.82940	-	-	13.1	49.0	-
420140607	7	Wildwood	19.7	35.77180	-83.85190	-	-	11.2	100	-
420140609	9	Maryville	15.3	35.79710	-83.89400	-	-	12.4	78.6	-
420140610	10	Maryville	14.1	35.80020	-83.88840	-	-	12.9	79.3	-
420140611	11	Maryville	10.6	35.81880	-83.92520	-	-	13.0	91.7	-
420140616	16	Wildwood	20.0	35.76580	-83.85630	-	-	-	-	-
420140617	17	Kinzel Springs	29.8	35.68160	-83.78500	-	-	-	-	-

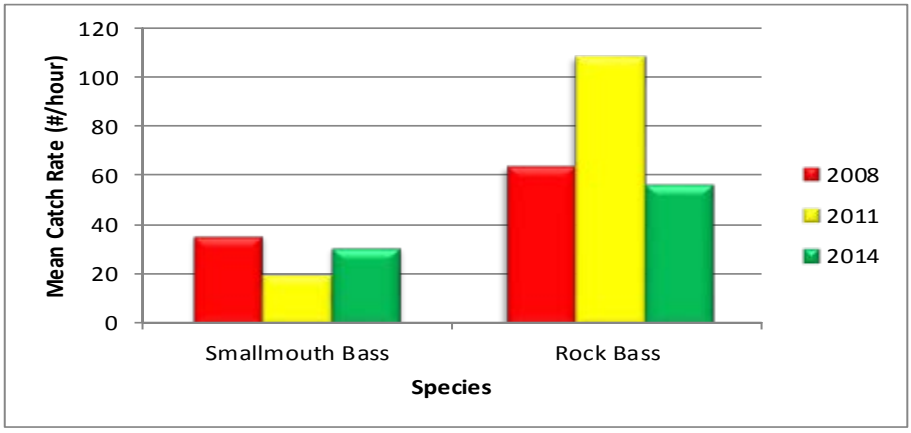
Results

CPUE estimates for smallmouth bass averaged 30.5/hour (SD 16.2) in 2014 (Table 2). This was up 51% from the 2011 value (20.2) but was still lower than the value observed in 2008 (35.5). Mean rock bass estimate was 56.1/hour (SD 30) which was a substantial decrease of 48% from the previous sample (Figure 2). The CPUE estimate for spotted bass was 0.5 (SD 1.6). The only spotted bass collected was at site 9 below Perrys Mill. No largemouth bass were collected from any of the sampling stations.

Table 2. Catch per unit effort and length categorization indices of target species collected in Little River during 2014.

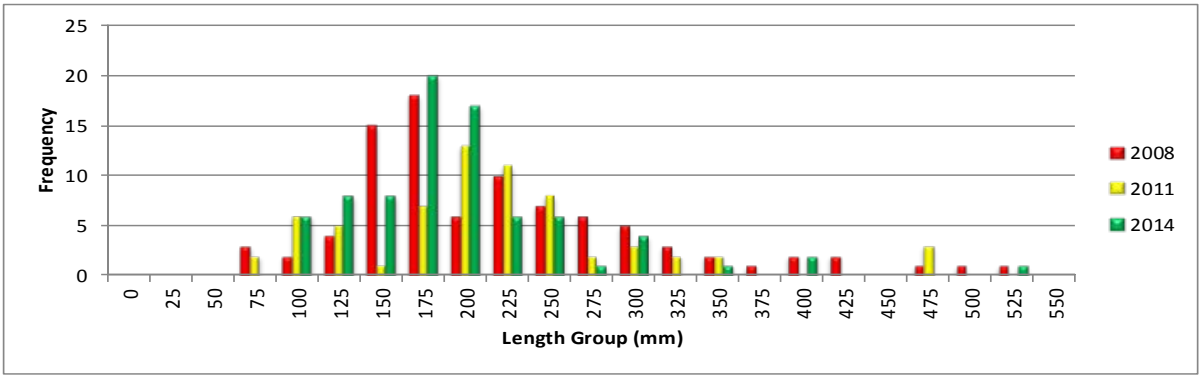
Site Code	Smallmouth Bass CPUE	Spotted Bass CPUE	Largemouth Bass CPUE	Rock Bass CPUE
420140601	50	-	-	58
420140602	52	-	-	88
420140603	20	-	-	72
420140604	31	-	-	51
420140605	8	-	-	-
420140607	24	-	-	28
420140609	20	5	-	60
420140610	20	-	-	48
420140611	50	-	-	100
MEAN	30.5	0.5	-	56.1
STD. DEV.	16.2	1.6	-	30.0
	Length-Categorization Analysis PSD = 16.6	**Length-Categorization Analysis** PSD = 0	**Length-Categorization Analysis** PSD = 0	**Length-Categorization Analysis** PSD = 17.3
	RSD-PREFERRED = 7.4	RSD-PREFERRED = 0	RSD-PREFERRED = 0	RSD-PREFERRED = 0.8
	RSD-MEMORABLE = 1.8	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0
	RSD- TROPHY = 1.8	RSD- TROPHY = 0	RSD- TROPHY = 0	RSD- TROPHY = 0

Figure 2. Trends in mean catch rate of smallmouth bass and rock bass collected in Little River between 2008 and 2014.



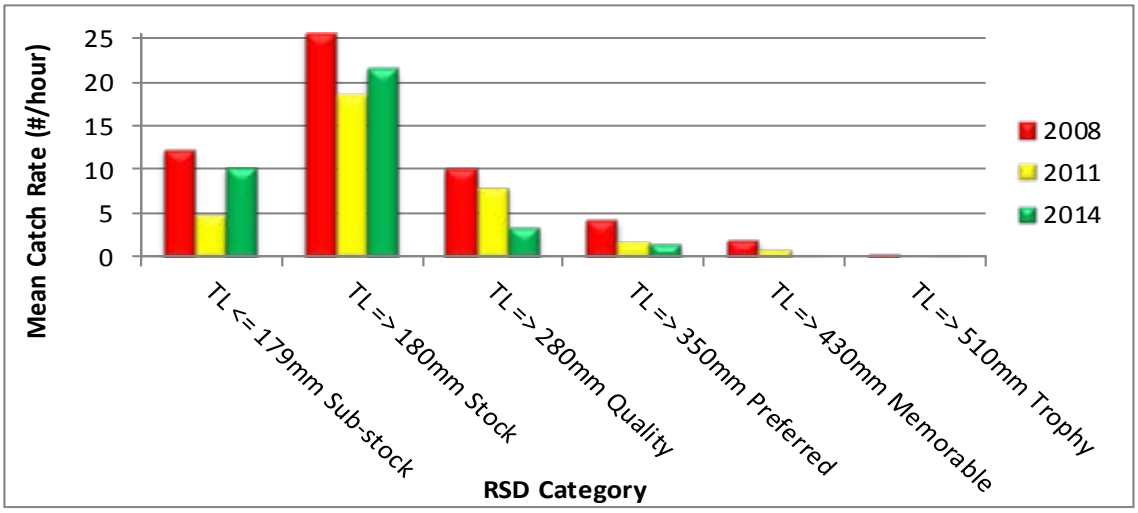
Our observation of mean catch for sport species was not untypical for east Tennessee rivers. Our highest catches were associated with two species, smallmouth bass and rock bass. Spotted bass and largemouth bass followed suit with much lower densities and typical ranking (spotted bass usually higher than largemouth bass). The size distribution was somewhat similar in 2014 when compared to 2011. Representation was fairly consistent across most size classes with the exception of those over 12 inches where very few fish were observed in 2014. We did collect one bass in excess of 20 inches in the 2014 samples (Figure 3). Given the severe drought in 2007 there may be some residual recruitment effects for the larger size classes of bass as it takes about 7 years to produce a 14 inch smallmouth bass there (Wolbert 2014).

Figure 3. Length frequency distributions for smallmouth bass collected in Little River between 2008 and 2014.



Length categorization analysis indicated the relative stock density (RSD) of preferred smallmouth bass (TL ≥ 350 mm) was 7.4 (Table 2). RSD for memorable (TL ≥ 430 mm) and trophy (TL ≥ 510 mm) size bass were 1.8 and 1.8, respectively. The PSD of smallmouth bass (ratio of quality size bass to stock size bass) was 16.6. Our highest catch for the reported RSD categories was for bass of stock size (length ≥ 180mm) (Figure 4).

Figure 4. Relative stock density (RSD) catch per unit effort for smallmouth bass collected in Little River between 2008 and 2014.

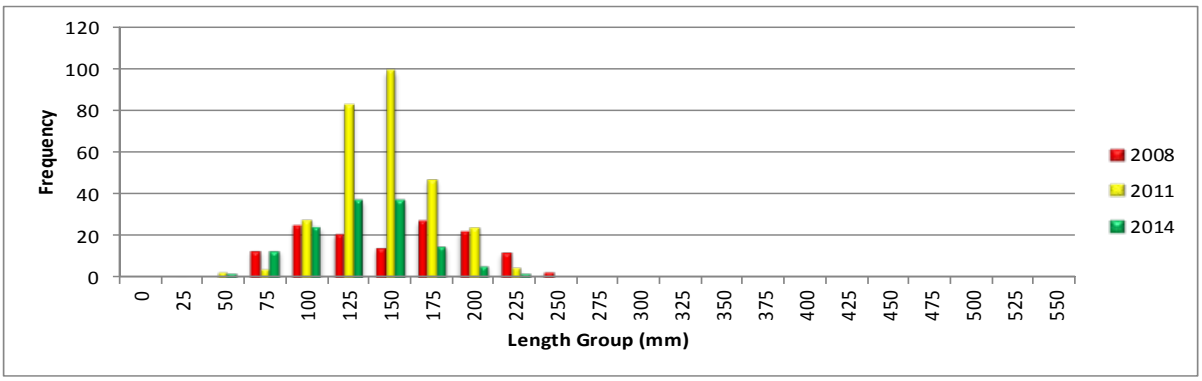


There was only one spotted bass collected from the Little River in 2014 (6 in 2011). This fish was 224 mm in length and was collected in the lower reaches of the river. Given the scarcity of spotted bass in Little River, no real inferences about their contribution to the fishery can be made. However, they do persist in the river and may offer some opportunity to anglers.

No largemouth bass were collected during the 2014 survey. Due to the low abundance of largemouth bass in this river, little can be said about population density and size structure. However, they do persist in the river and may offer some opportunity to anglers.

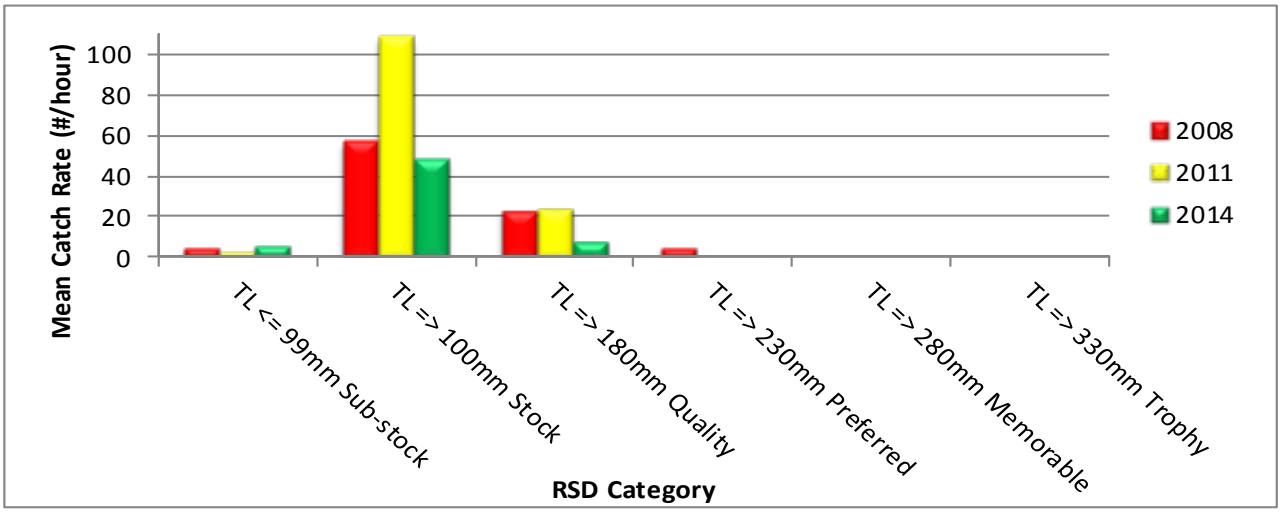
Individuals in the 100 to 175 mm range represented the majority of rock bass in our Little River sample during 2014 (Figure 5). Since these fish are long lived and slow growing there are most likely persisting impacts from the drought in 2007. A significant amount of the preferred shoreline habitat was dewatered during this event.

Figure 5. Length frequency distributions for rock bass collected in Little River between 2008 and 2014.



Relative stock density (RSD) analysis indicated the value for preferred rock bass (TL $\geq$ 230 mm) was 0.8. RSD for both memorable (TL $\geq$ 280 mm) and trophy (TL $\geq$ 330 mm) size rock bass was 0. The PSD (ratio of quality size to stock size) of rock bass was 17.3. Catch by RSD category illustrated general declines from the 2011 sample (Figure 6).

Figure 6. Relative stock density (RSD) catch per unit effort for rock bass collected in Little River between 2008 and 2014.



Angler Survey

The angler survey program was modified in 2012 to incorporate a more comprehensive sampling scheme that would include river fisheries. During 2014, an angler survey was conducted in Little River from the Park Boundary downstream to Davis Ford. This is the first occurrence of this type of survey on the river and has provided much needed information that will aid in the management of this resource. The following information (from Black 2015) summarizes the data collected and gives detailed information regarding the use of the fisheries resource in Little River.

MONTHLY ANGLING EFFORT FOR ALL ANGLERS - 2014

LOCATION=LITTLE RIVER

MONTH	ANGLER HOURS	RELATIVE STANDARD ERROR	HOURS PER ACRE	ANGLER TRIPS	TRIPS PER ACRE	PERCENT EFFORT
01 JANUARY	0	.	.	.	.	0.0
02 FEBRUARY	212	71.4	.	53	.	1.9
03 MARCH	497	47.5	.	130	.	4.4
04 APRIL	1003	30.0	.	229	.	8.8
05 MAY	2407	32.2	.	566	.	21.2
06 JUNE	2513	30.0	.	704	.	22.1
07 JULY	1270	30.5	.	329	.	11.2
08 AUGUST	909	43.7	.	253	.	8.0
09 SEPTEMBER	1027	31.7	.	343	.	9.0
10 OCTOBER	962	26.0	.	289	.	8.5
11 NOVEMBER	286	39.8	.	99	.	2.5
12 DECEMBER	260	58.2	.	77	.	2.3
TOTAL	**11346**			**3072**		

MONTHLY CATCH STATISTICS FOR ALL ANGLERS - 2014

LOCATION=LITTLE RIVER

MONTH	NUMBER FISH CAUGHT	RSE FOR CATCH	FISH CAUGHT PER HOUR	RSE FOR CATCH RATE	NUMBER FISH HARVESTED	RSE FOR HARVEST	FISH HARVESTED PER HOUR	RSE FOR HARVEST RATE
02 FEBRUARY	102	.	0.48	.	0	.	0.00	.
03 MARCH	50	99.3	0.10	80.2	50	99.3	0.10	80.2
04 APRIL	682	45.8	0.68	33.3	130	56.0	0.13	45.9
05 MAY	2888	34.5	1.20	11.9	770	54.1	0.32	41.7
06 JUNE	2915	40.6	1.16	26.3	754	37.4	0.30	21.5
07 JULY	1613	36.8	1.27	19.8	241	73.7	0.19	64.5
08 AUGUST	1045	46.2	1.15	13.7	127	46.1	0.14	13.4
09 SEPTEMBER	462	60.6	0.45	49.2	31	120.8	0.03	100.0
10 OCTOBER	616	76.2	0.64	69.7	154	68.2	0.16	62.8
11 NOVEMBER	186	80.5	0.65	64.6	23	119.0	0.08	100.0
12 DECEMBER	88	108.3	0.34	79.8	21	135.9	0.08	100.0
TOTAL	**10647**				**2301**			

SUMMARY OF SPECIES CATCH STATISTICS - 2014

LOCATION=LITTLE RIVER

SPECIES	TOTAL NUMBER FISH CAUGHT	RSE FOR CATCH	SPECIES CATCH COMPOSITION (%)	INTENDED NUMBER CAUGHT	TOTAL NUMBER FISH HARVESTED	RSE FOR HARVEST	SPECIES HARVEST COMPOSITION (%)	INTENDED NUMBER HARVESTED	% OF CAUGHT FISH RELEASED	AVERAGE WEIGHT (LBS)	NUMBER FISH RECORDED
RAINBOW TROUT	3656	21.3	34.3	3460	2098	23.5	91.2	2065	42.6	.	129
ROCK BASS	7	432.2	0.1	0	0	.	0.0	0	100.0	.	0
BLUEGILL	371	131.1	3.5	300	203	144.7	8.8	203	45.3	.	15
SMALLMOUTH BASS	4638	23.0	43.6	3965	0	.	0.0	0	100.0	.	0
SPOTTED BASS	537	160.3	5.0	0	0	.	0.0	0	100.0	.	0
LARGEMOUTH BASS	346	146.4	3.2	0	0	.	0.0	0	100.0	.	0

SUMMARY OF FISHING EFFORT AND CATCH RATES FOR INTENDED SPECIES GROUPS - 2014

LOCATION=LITTLE RIVER

INTENDED SPECIES	ANGLER HOURS	RSE FOR ANGLER HOURS	ANGLER TRIPS	PERCENT EFFORT	NUMBER CAUGHT PER HOUR	RSE FOR CATCH PER HOUR	NUMBER HARVESTED PER HOUR	RSE FOR HARVEST PER HOUR	NUMBER OF INTERVIEWS
RAINBOW TROUT	5285	15.3	1412	46.6	0.91	28.2	0.63	35.6	81
ANY TROUT	47	110.2	14	0.4	0.60		0.00		1
SMALLMOUTH BASS	3067	17.1	859	27.0	1.12	28.0	0.00		60
ANY SPECIES	2948	19.3	785	26.0	0.83	89.7	0.12	96.6	30
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TOTAL	**11347**		**3070**						

SUMMARY OF RELATIVE SPECIES CATCH RATES WITHIN TARGET GROUPS - 2014

LOCATION=LITTLE RIVER

TARGET GROUP	SPECIES WITHIN TARGET GROUPS	RELATIVE CATCH RATE	RELATIVE HARVEST RATE
ANY TROUT			
	RAINBOW TROUT	0.60	0
ANY BLACK BASS			
	ANY BLACK BASS	0.00	0
	SMALLMOUTH BASS	1.29	0
	SPOTTED BASS	0.00	0
	LARGEMOUTH BASS	0.00	0

SUMMARY OF TRIP EXPENDITURES AND CONSUMER SURPLUS FOR INTENDED SPECIES - 2014

LOCATION=LITTLE RIVER

INTENDED SPECIES	TOTAL TRIP EXPENDITURES	TOTAL CONSUMER SURPLUS	TOTAL VALUE BY ANGLERS	NUMBER OF INTERVIEWS
RAINBOW TROUT	30200	8830	39020	81
ANY TROUT	170	170	350	1
SMALLMOUTH BASS	15040	4760	19810	60
ANY SPECIES	8970	2200	11170	30
TOTAL	**54380**	**15960**	**70350**	**172**

SUMMARY OF SOCIOLOGICAL QUESTIONS – 2014

LOCATION=LITTLE RIVER

DISTRIBUTION OF STATES OF RESIDENCE OF INTERVIEWED ANGLERS

STATE	NUMBER ANGLERS INTERVIEWED	PERCENT CONTRIBUTION
NC	22	8.0
TN	234	85.4
OTHERS	18	6.6

DISTRIBUTION OF COUNTIES OF RESIDENCE OF INTERVIEWED ANGLERS

COUNTY	NUMBER ANGLERS INTERVIEWED	PERCENT CONTRIBUTION
BLOUNT	181	77.4
KNOX	39	16.7
OTHERS IN TN	14	6.0

DISTRIBUTION OF ONE-WAY MILEAGE OF ANGLERS INTERVIEWED

ONE-WAY MILES TRAVELED	NUMBER ANGLERS INTERVIEWED	PERCENT CONTRIBUTION
A) 0-25	219	79.9
B) 26-100	33	12.0
C) 101-250	12	4.4
D) > 250	10	3.6

DISTRIBUTION OF NUMBER OF DAYS IN TRIPS OF INTERVIEWED ANGLERS

NUMBER DAYS IN TRIP	NUMBER ANGLERS INTERVIEWED	PERCENT CONTRIBUTION
A) 1	153	87.9
B) 2-5	17	9.8
C) 6-10	4	2.3

Collaborative community assessments of Little River have been ongoing since the 1980's. These surveys have primarily focused on evaluating relative health changes in the fish community. Two Index of Biotic Integrity surveys were conducted in July 2014, one at Coulters Bridge (river mile 20) and one at Townsend (river mile 29.8). A total of 51 fish species were collected at the Coulters Bridge site while 32 were observed at Townsend. Overall, the IBI analysis indicated the fish community was in good to excellent condition at Coulters Bridge (IBI score 56). The condition of the fish community decreased slightly from the value observed in 2013 (58). At the upper most station, Townsend, the stream rated good to excellent also receiving a score of 56. This was a slight increase of two points from the previous sample. (Figure 7). Several rare or endangered species of fish inhabit Little River, and thus, the protection of the watershed is a high priority of managing agencies and local conservation groups. Table 3 lists the species and number of fish collected at the two IBI stations.

Figure 7. Trends in the Index of Biotic Integrity (IBI) at two stations in Little River (1987-2014).

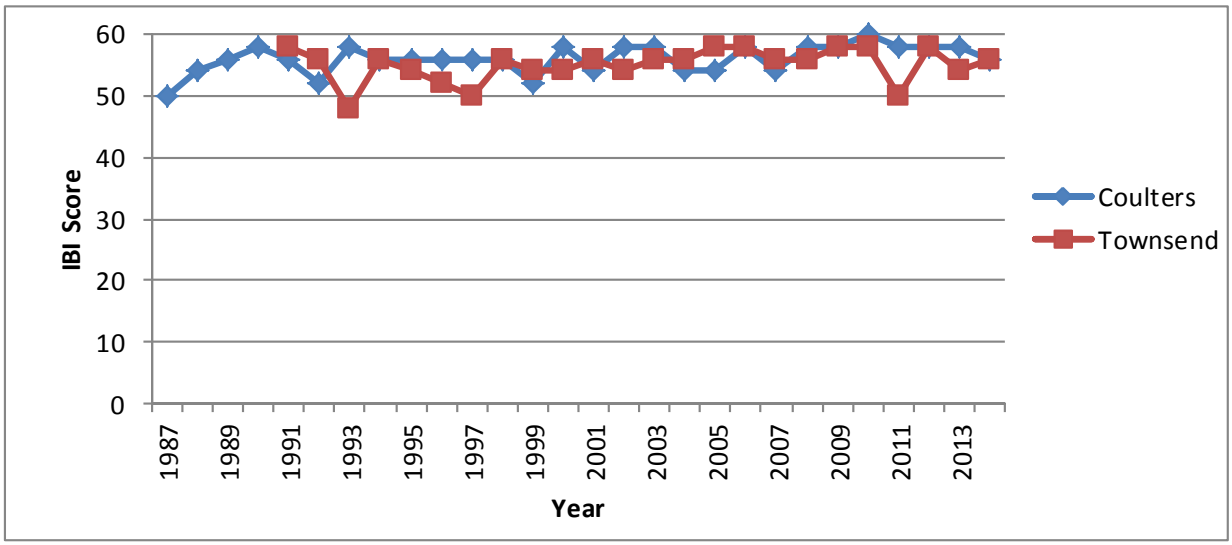


Table 3. Fish species collected at two Little River IBI stations 2014.

Site	Species	Number Collected
420140616 (Coulters Bridge)	*Ambloplites rupestris*	65
420140616 (Coulters Bridge)	*Aplodinotus grunniens*	2
420140616 (Coulters Bridge)	*Campostoma oligolepis*	143
420140616 (Coulters Bridge)	*Carpiodes cyprinus*	1
420140616 (Coulters Bridge)	*Cottus carolinae*	47
420140616 (Coulters Bridge)	*Cyprinella galactura*	82
420140616 (Coulters Bridge)	*Cyprinella spiloptera*	10
420140616 (Coulters Bridge)	*Cyprinus carpio*	1
420140616 (Coulters Bridge)	*Dorosoma cepedianum*	4
420140616 (Coulters Bridge)	*Erimystax insignis*	6
420140616 (Coulters Bridge)	*Etheostoma blennioides*	27
420140616 (Coulters Bridge)	*Etheostoma camurum*	9
420140616 (Coulters Bridge)	*Etheostoma jessiae*	3
420140616 (Coulters Bridge)	*Etheostoma rufilineatum*	558
420140616 (Coulters Bridge)	*Etheostoma tennesseense*	21
420140616 (Coulters Bridge)	*Etheostoma vulneratum*	2
420140616 (Coulters Bridge)	*Etheostoma zonale*	23
420140616 (Coulters Bridge)	*Fundulus catenatus*	9
420140616 (Coulters Bridge)	*Hybopsis amblops*	82
420140616 (Coulters Bridge)	*Hypentelium nigricans*	36
420140616 (Coulters Bridge)	*Lepisosteus osseus*	8
420140616 (Coulters Bridge)	*Lepomis auritus*	39
420140616 (Coulters Bridge)	*Lepomis cyanellus*	6
420140616 (Coulters Bridge)	*Lepomis macrochirus*	3
420140616 (Coulters Bridge)	*Luxilus chrysocephalus*	5
420140616 (Coulters Bridge)	*Luxilus coccogenis*	50
420140616 (Coulters Bridge)	*Lythrurus lirus*	14
420140616 (Coulters Bridge)	*Micropterus dolomieu*	9
420140616 (Coulters Bridge)	*Micropterus punctulatus*	3
420140616 (Coulters Bridge)	*Micropterus salmoides*	1
420140616 (Coulters Bridge)	*Minytrema melanops*	1
420140616 (Coulters Bridge)	*Moxostoma anisurum*	1
420140616 (Coulters Bridge)	*Moxostoma carinatum*	12
420140616 (Coulters Bridge)	*Moxostoma duquesnei*	64
420140616 (Coulters Bridge)	*Moxostoma erythrurum*	53
420140616 (Coulters Bridge)	*Nocomis micropogon*	67
420140616 (Coulters Bridge)	*Notropis leuciodus*	156
420140616 (Coulters Bridge)	*Notropis micropteryx*	283
420140616 (Coulters Bridge)	*Notropis photogenis*	60
420140616 (Coulters Bridge)	*Notropis telescopus*	14
420140616 (Coulters Bridge)	*Notropis volucellus*	106
420140616 (Coulters Bridge)	*Noturus eleutherus*	28
420140616 (Coulters Bridge)	*Percina aurantiaca*	10
420140616 (Coulters Bridge)	*Percina caprodes*	2
420140616 (Coulters Bridge)	*Percina evides*	31
420140616 (Coulters Bridge)	*Percina williamsi*	2
420140616 (Coulters Bridge)	*Phenacobius uranops*	11
420140616 (Coulters Bridge)	*Ameiurus natalis*	1
420140616 (Coulters Bridge)	*Gambusia affinis*	2
420140616 (Coulters Bridge)	Hybrid *Lepomis spp.*	1
420140616 (Coulters Bridge)	*Pylodictis olivaris*	1
420140616 (Coulters Bridge)	*Semotilus atromaculatus*	1
420140617 (Townsend)	*Ambloplites rupestris*	39
420140617 (Townsend)	*Campostoma oligolepis*	26
420140617 (Townsend)	*Catostomus commersonii*	1
420140617 (Townsend)	*Cottus carolinae*	122
420140617 (Townsend)	*Cyprinella galactura*	79

Table 3. Continued.

Site	Species	Number Collected
420140617 (Townsend)	*Erimystax insignis*	6
420140617 (Townsend)	*Etheostoma blennioides*	5
420140617 (Townsend)	*Etheostoma rufilineatum*	257
420140617 (Townsend)	*Etheostoma tennesseense*	14
420140617 (Townsend)	*Etheostoma zonale*	10
420140617 (Townsend)	*Fundulus catenatus*	7
420140617 (Townsend)	*Hybopsis amblops*	4
420140617 (Townsend)	Hybrid *Lepomis spp.*	1
420140617 (Townsend)	*Hypentelium nigricans*	31
420140617 (Townsend)	*Ichthyomyzon greeleyi*	6
420140617 (Townsend)	*Lepomis auritus*	6
420140617 (Townsend)	*Lepomis cyanellus*	2
420140617 (Townsend)	*Lepomis macrochirus*	2
420140617 (Townsend)	*Lethenteron appendix*	5
420140617 (Townsend)	*Luxilus chrysocephalus*	3
420140617 (Townsend)	*Luxilus coccogenis*	118
420140617 (Townsend)	*Lythrurus lirus*	4
420140617 (Townsend)	*Micropterus dolomieu*	2
420140617 (Townsend)	*Moxostoma duquesnei*	26
420140617 (Townsend)	*Nocomis micropogon*	18
420140617 (Townsend)	*Notropis leuciodus*	166
420140617 (Townsend)	*Notropis micropteryx*	8
420140617 (Townsend)	*Notropis photogenis*	14
420140617 (Townsend)	*Notropis telescopus*	62
420140617 (Townsend)	*Notropis volucellus*	6
420140617 (Townsend)	*Oncorhynchus mykiss*	1
420140617 (Townsend)	*Percina evides*	3
420140617 (Townsend)	*Percina burtoni*	1

Benthic macroinvertebrates collected in our sample at Townsend comprised 33 families representing 50 identified genera (Table 4). The most abundant group in our collection was the mayflies comprising 23.5% of the total sample. Overall, a total of 58 taxa were identified from the sample of which 32 were EPT. Based on the EPT taxa richness and overall biotic index of all species collected, the relative health of the benthic community was classified as "Good" (4.0).

Table 4. Taxa list and associated biotic statistics for benthic macroinvertebrates collected from Little River at Townsend 2014.

ORDER	FAMILY	SPECIES	NUMBER
AMPHIPODA			
	Crangonyctidae	*Synurella*	2
ANELLIDA			
	Hirudinea		1
COLEOPTERA			
	Dryopidae	*Helichus* adults	3
	Elmidae	*Macronychus glabratus* adults	5
		Optioservus trivittatus adult	1
		Promoresis elegans adults	5
		Stenelmis larva	1
	Psephenidae	*Psephenus herricki* larvae & adults	13
	Staphylinidae	*Stenus* larva & adult	2
DIPTERA			
	Athericidae	*Atherix lantha*	7
	Chironomidae	larvae and pupa	33
	Tipulidae	*Hexatoma*	1
		Tipula	1
EPHEMEROPTERA			
	Baetidae	*Acentrella*	6
		Baetis	7
		Barbaetis benfieldi	1
	Ephemerellidae	*Serratella deficiens*	2
		Serratella sp.	6
	Heptageniidae	*Leucrocuta*	7
		Maccaffertium modestum	17

Table 4. Continued.

ORDER	FAMILY	SPECIES	NUMBER
		Rhithrogena	1
	Isonychiidae	*Isonychia*	16
	Leptohyphidae	*Tricorythodes*	2
GASTROPODA			
	Pleuroceridae	*Leptoxis*	11
		Pleurocera sp. with stripes	7
HEMIPTERA			
	Gerridae	*Rheumatobates* nymph & adult	2
	Nepidae	*Ranatra nigra*	1
	Veliidae	*Rhagovelia obesa* nymph & adult	3
HYDRACARINA			2
MEGALOPTERA			
	Corydalidae	*Corydalus cornutus*	3
		Nigronia serricornis	1
ODONATA			
	Aeshnidae	*Boyeria vinosa*	8
	Coenagrionidae	*Argia*	2
	Gomphidae	*Gomphus lividus*	7
		Hagenius brevistylus	5
		Hylogomphus adelphus	6
		Ophiogomphus incurvatus	1
		Stylogomphus albistylus	4
	Macromiidae	*Macromia*	5
PELECYPODA			
	Corbiculidae	*Corbicula fluminea*	4
PLECOPTERA			
	Leuctridae	*Leuctra*	2
	Perlidae	*Paragnetina media*	1
		Perlesta	11
	Pteronarcyidae	*Pteronarcys dorsata*	2
TRICHOPTERA			
	Brachycentridae	*Brachycentrus lateralis*	14
		Micrasema wataga	8
	Hydropsychidae	*Ceratopsyche sparna*	3
		Hydropsyche franclemonti	2
		Hydropsyche venularis	6
		Hydropsyche sp.	1
	Leptoceridae	*Mystacides sepulchralis*	1
		Nectopsyche exquisita	4
		Triaenodes ignitus	4
		Triaenodes perna	1
	Limnephilidae	*Pycnospyche luculenta* group	1
		Pycnospyche scabripennis group	1
	Polycentropodidae	*Polycentropus*	5
	Rhyacophilidae	*Rhyacophila fuscula*	1
		Total	280

TAXA RICHNESS = 58 EPT TAXA RICHNESS = 32 BIOCLASSIFICATION = 4.0 (GOOD)

Benthic macroinvertebrates collected in our sample at Coulters Bridge comprised 32 families representing 45 identified genera (Table 5). The most abundant group in our collection was the mayflies comprising 31.4% of the total sample. Overall, a total of 50 taxa were identified from the sample of which 22 were EPT. Based on the EPT taxa richness and overall biotic index of all species collected, the relative health of the benthic community was classified as "Good" (4.2).

Table 5. Taxa list and associated biotic statistics for benthic macroinvertebrates collected from Little River at Coulters Bridge 2014.

ORDER	FAMILY	SPECIES	NUMBER
ANELLIDA			
	Oligochaeta		1
COLEOPTERA			
	Dryopidae	*Helichus* adults	1
	Elmidae	*Macronychus glabratus* adults	6
		Optioservus larva	1
		Optioservus trivittatus adult	1
		Promoresis elegans larva and adults	8
		Stenelmis larva	1
	Gyrinidae	*Dineutus discolor* adults	4
	Haliplidae	*Peltodytes lengi*	1
	Psephenidae	*Psephenus herricki* larvae and adults	5
DIPTERA			
	Athericidae	*Atherix lantha*	1
	Chironomidae	larvae	31
	Simuliidae		11
	Tipulidae	*Tipula*	2

Table 5. Continued.

ORDER	FAMILY	SPECIES	NUMBER
EPHEMEROPTERA			
	Baetidae	*Acentrella*	1
		Baetis	6
		Barbaetis benfieldi	1
	Ephemerellidae	*Serratella*	9
	Heptageniidae	*Leucrocuta*	1
		Maccaffertium mediopunctatum	41
		Maccaffertium modestum	5
		Rhithrogena	1
		Stenonema interpunctatum	2
	Isonychiidae	*Isonychia*	24
	Leptohyphidae	*Tricorythodes*	1
GASTROPODA			
	Pleuroceridae	*Leptoxis*	13
		Pleurocera sp. with stripes	2
HEMIPTERA			
	Veliidae	*Rhagovelia obesa* nymph & adult	2
HYDRACARINA			1
MEGALOPTERA			
	Corydalidae	*Corydalus cornutus*	4
ODONATA			
	Aeshnidae	*Boyeria vinosa*	2
	Calopterygidae	*Hetaerina americana*	5
	Coenagrionidae	*Argia*	1
	Corduliidae	*Helocordulia uhleri*	1
	Gomphidae	*Dromogomphus spinosus*	1
		Hylogomphus adelphus	1
		Stylogomphus albistylus	1
		Stylurus early instar	1
	Macromiidae	*Macromia*	4
PELECYPODA			
	Corbiculidae	*Corbicula fluminea*	6
PLECOPTERA			
	Perlidae	*Perlesta*	9
	Pteronarcyidae	*Pteronarcys dorsata*	3
TRICHOPTERA			
	Brachycentridae	*Brachycentrus lateralis*	20
		Micrasema wataga	9
	Hydropsychidae	*Ceratopsyche morosa*	4
		Cheumatopsyche larave & pupa	5
		Hydropsyche venularis	25
		Undetermined pupa	1
	Lepidostomatidae	*Lepidostoma*	1
	Leptoceridae	*Mystacides sepulchralis*	1
		Triaenodes ignitus	3
	Philopotamidae	*Chimarra*	1
		Total	293

TAXA RICHNESS = 50 EPT TAXA RICHNESS = 22 BIOCLASSIFICATION = (4.2) GOOD

Discussion

Little River provides anglers with the opportunity to catch all species of black bass along with rock bass. The river represents an outstanding resource in the quality of the water and the species that inhabit it. With the growing development in the watershed it will be imperative to monitor activities such that mitigation measures can be taken to ensure that the river maintains its outstanding water quality and aesthetic value.

Trout stocking during suitable months is very popular for residents and non-residents visiting the area. This program should continue at the current level unless use dictates the need for program expansion.

Management Recommendations

1. Continue cooperative IBI surveys.

2. Cooperate with the local watershed organization to protect and enhance the river and its tributaries.

Powell River

Introduction

The remoteness of the Powell River makes it one of the premier warmwater rivers in east Tennessee. It offers the opportunity to take float trips without seeing another individual during the course of a day. The surroundings are appealing which makes a trip to the Powell well worth the drive. It is an important recreational resource for the state both in consumptive and non-consumptive uses. It provides critical habitat for threatened and endangered species and species of special concern. The river supports a diverse fish community and has been documented to host some 37 species of mussels (Ahlstedt 1986). It is one of only two rivers in the region having reaches designated as mussel sanctuaries. Additionally, it supports one of east Tennessee's better warmwater sport fisheries. The Powell River has been the focus of numerous surveys and investigations conducted by other state and federal agencies with the major purpose of assessing and monitoring the fish and benthic communities. Our survey of the Powell River focused on re-evaluating the sport fish population originally sampled in 1999. Our 2014 assessment was derived from six sample sites located between river mile 115 and river mile 75. We were unable to sample our four most downstream sites to due to equipment malfunction and delayed repair. The Powell River is in a 3-year rotational schedule with eight other rivers in the region. In March 2008, smallmouth bass regulations were changed to a protected slot limit (PLR) which prohibits the take of bass between 13 and 17 inches. The regulation allows anglers to keep one bass in excess of 17 inches as part of the five fish daily creel limit.

Study Area and Methods

The Powell River originates in Virginia and flows in a southwesterly direction before emptying into Norris Reservoir near river mile 54. The river has a drainage area of approximately 1,774 kilometers^2. In Tennessee, all of the Powell River flows through the Ridge and Valley province of east Tennessee coursing by the town of Harrogate before emptying into Norris Reservoir near the community of Arthur. Public access along the river is primarily limited to bridge crossings and small "pull-outs" along roads paralleling the river. There are several primitive launching areas for canoes or small boats and one developed launching area managed by the Tennessee Wildlife Resources Agency (Mulberry Creek).

Between May 1 and 7, 2014, we conducted six fish surveys between the Virginia state line and Norris Reservoir (Figure 8). Due to boat failure, we were not able to complete samples for the lower four sites (20,21,28,29). In our

survey sites, the riparian habitat consisted primarily of wooded shorelines with interspersed agricultural fields. Submerged woody debri and water willow were fairly common in most of our sample areas. The river substrate was predominately boulder/cobble in riffle areas and bedrock with interspersed boulder/cobble in the pool habitat. Measured mean channel widths ranged from 29.5 meters to 52.0 meters, while site lengths fell between 290 meters and 649 meters (Table 6). Water temperatures ranged from 17 C to 21.7 C and conductivity varied from 347 to 407 µs/cm (Table 6).

Figure 8. Site locations for samples conducted in the Powell River during 2014 (Sites 20-29 not sampled).

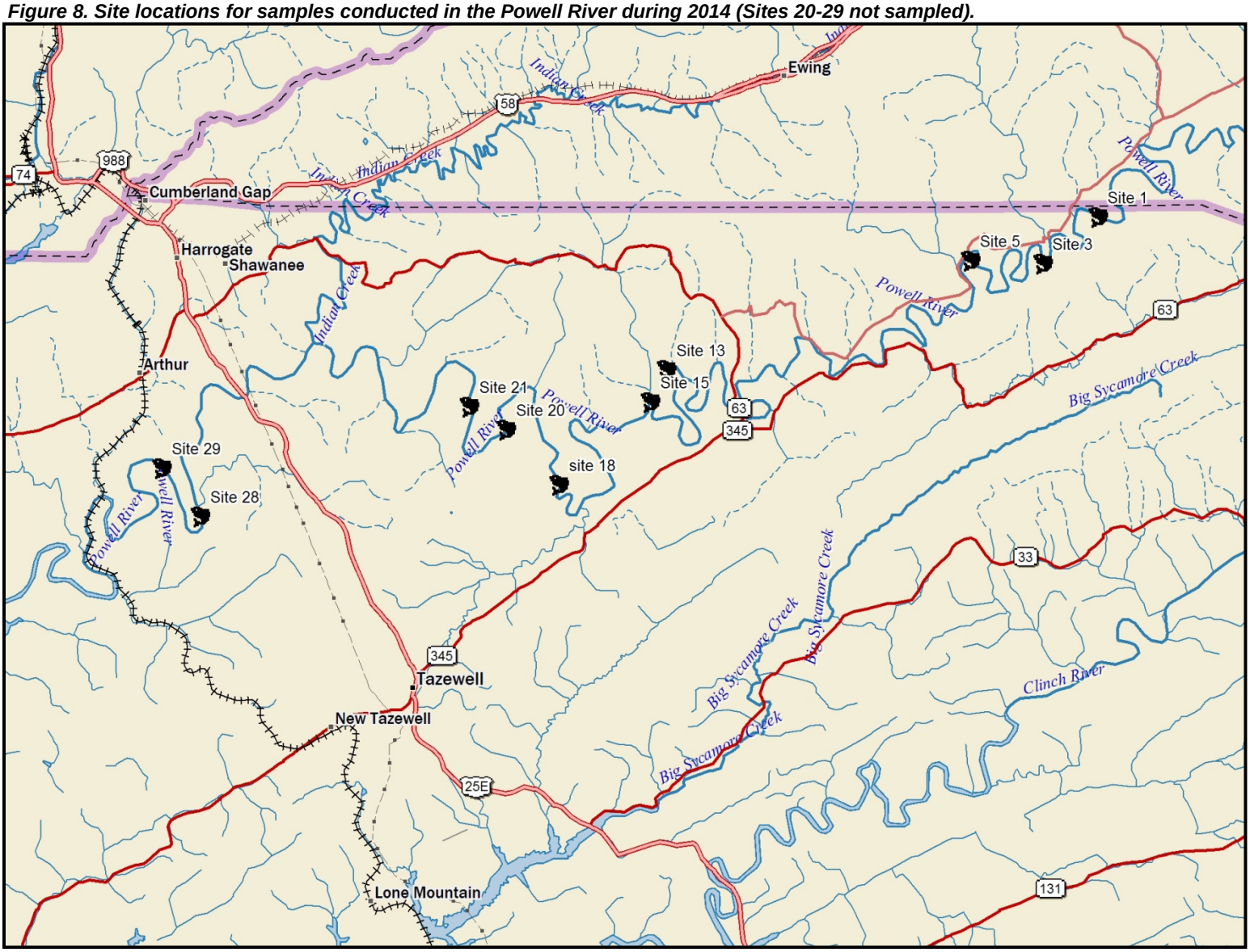


Table 6. Physiochemical and site location data for samples conducted in the Powell River during 2014.

Site Code	Site	Quad	River Mile	Latitude	Longitude	Mean Width (m)	Length (m)	Temp. C	Cond. µs/cm	Secchi (m)
420140701	1	Back Valley	115	36.59472	-83.31444	29.5	290	17	407	-
420140703	3	Back Valley	112.1	36.58111	-83.33472	30	577	17.3	406	-
420140705	5	Back Valley	107.6	36.58194	-83.36194	33.5	480	17.9	408	-
420140713	13	Coleman Gap	91	36.54917	-83.47417	38.5	537	20.1	347	-
420140715	15	Coleman Gap	87.1	36.53972	-83.48028	39	649	21.0	356	-
420140718	18	Wheeler	81	36.51500	-83.51444	40	383	21.7	356	-

Fish were collected by boat electrofishing in accordance with the standard large river sampling protocols (TWRA 1998). Fixed-boom electrodes were used to transfer 4-5 amps DC at all sites. This current setting was determined effective in narcotizing all target species (black bass and rock bass). All sites were sampled during daylight hours and had survey durations ranging from 900 to 911 seconds. Catch-per-unit-effort (CPUE) values were calculated for each target species at each site. Length categorization indices were calculated for target species following Gabelhouse (1984).

Results

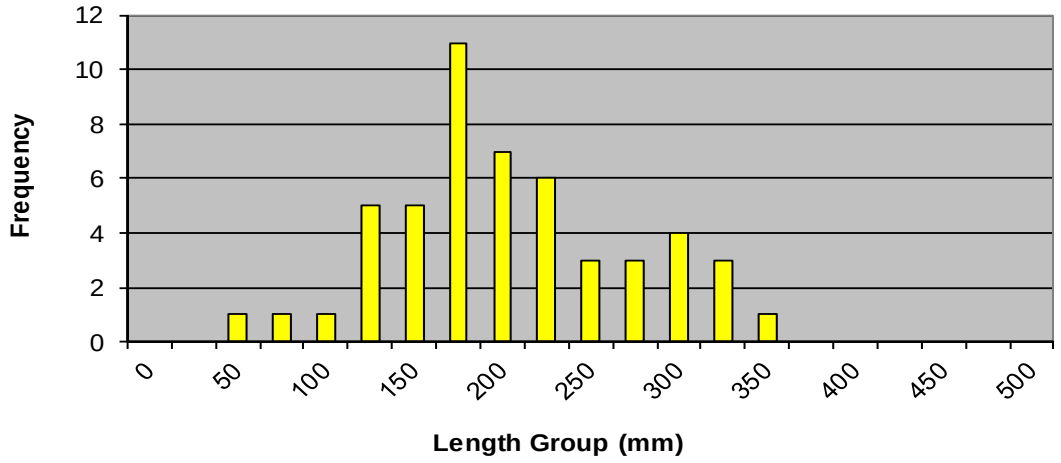
CPUE estimates for smallmouth bass averaged 34/hour (SD 14.9), while the mean rock bass estimate was 70/hour (SD 32.5) (Table 7). Due to the disparity in survey site with previous samples we chose only to report the values for the 2014 sample. There were no spotted bass and or largemouth bass collected in the 2014 sample. Overall, the contribution of largemouth bass and spotted bass to the overall fishery has been insignificant in this and past surveys.

Table 7. Catch per unit effort and length categorization indices of target species collected in the Powell River during 2014.

Site Code	Smallmouth Bass CPUE	Spotted Bass CPUE	Largemouth Bass CPUE	Rock Bass CPUE
420140701	20	-	-	20
420140703	20	-	-	76
420140705	48	-	-	116
420140713	56	-	-	88
420140715	32	-	-	52
420140718	28	-	-	68
MEAN	34	-	-	70
STD. DEV.	14.9	-	-	32.5
	Length-Categorization Analysis	**Length-Categorization Analysis**	**Length-Categorization Analysis**	**Length-Categorization Analysis**
	PSD = 27.0	PSD = 0	PSD = 0	PSD = 28.6
	RSD-PREFERRED = 2.7	RSD-PREFERRED = 0	RSD-PREFERRED = 0	RSD-PREFERRED = 0
	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0	RSD-MEMORABLE = 0
	RSD- TROPHY = 0	RSD- TROPHY = 0	RSD- TROPHY = 0	RSD- TROPHY = 0

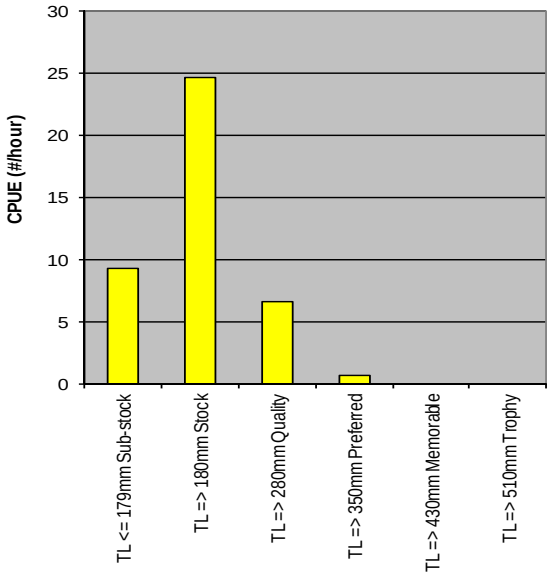
The size distribution of smallmouth bass for the 2014 sample was most abundantly represented by fish in the 175 mm to 250 mm length range. These fish comprised 47% of the total number of fish collected (Figure 9). The frequency of larger fish (> 400 mm) in this sample was substantially lower than observed in our previous survey in 2011.

Figure 9. Length frequency distributions for smallmouth bass collected in the Powell River during 2014.



Length categorization analysis indicated the relative stock density (RSD) of preferred smallmouth bass (TL $\geq$ 350 mm) was 2.7. RSD for memorable (TL $\geq$ 430 mm) and trophy (TL $\geq$ 510 mm) size bass was 0. The PSD of smallmouth bass (ratio of quality size bass to stock size bass) was 27 which was a decrease from both the 2008 (36.2) and 2011 (40.2) samples. There were no spotted bass or largemouth bass collected in the 2008 surveys. Historically, these species contribution to the overall fishery has been insignificant.

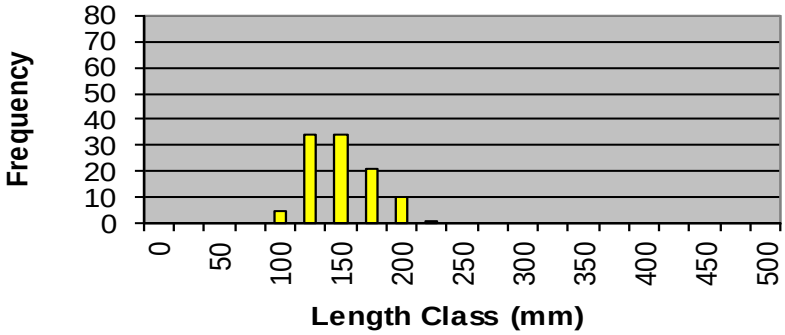
Figure 10. Relative stock density (RSD) catch per unit effort for smallmouth bass collected in the Powell River during 2014.



Age and growth characteristics for the smallmouth bass population in the Powell River were characterized in 1999. For the most part, the Powell River has had growth rates somewhat slower than other large river populations with the same age structure. In general, it takes a smallmouth bass in the Powell River about 5.2 years to reach 305 mm (12 inches), and about 9.5 years to attain a length of 406 mm (16 inches).

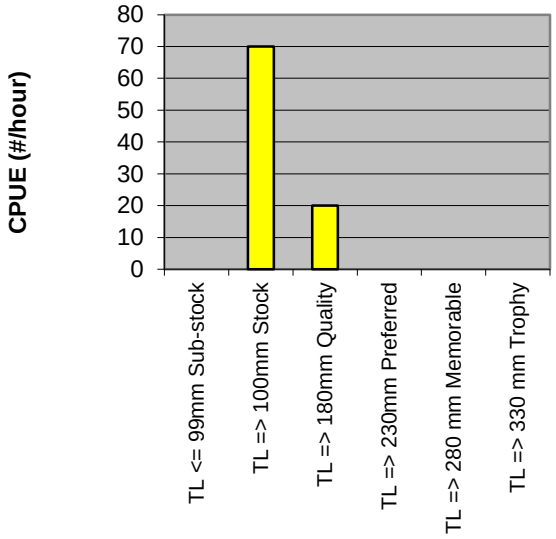
Individuals in the 125 to 175 mm length range represented 68% of the total number of rock bass collected in our 2014 sample (Figure 11). There were a few larger fish collected in the samples that ranged up to 225 mm (8.8 inches).

Figure 11. Length frequency distributions for rock bass collected in the Powell River during 2014.



Length categorization analysis indicated the RSD for preferred rock bass (TL $\geq$ 230 mm), memorable (TL $\geq$ 280 mm) and trophy (TL $\geq$ 330 mm) size rock bass was 0. The PSD of rock bass was 28.6. Stock size fish rpresented the majority of the catch in our samples (Figure 12).

Figure 12. Relative stock density (RSD) catch per unit effort for rock bass collected in the Powell River during 2014.



Discussion

The Powell River provides anglers with the opportunity to catch all species of black bass along with rock bass. Because of the low numbers of spotted and largemouth bass in the Powell River, it should not be considered a sport fishery for these species.

The popularity of this riverine fishery is continuing to grow as more anglers shift from reservoir habitats to rivers. This trend will undoubtedly continue as the use on reservoirs increases. This type of potential for exploitation of riverine fisheries requires angler use/harvest data collection in order to effectively manage the resource. It is imperative that we obtain this data in order to answer fish management questions, public inquiries, and aid in the development of regulations.

Overall the Powell River represents one of east Tennessee's premier warmwater river resources. It provides anglers with the opportunity to catch good numbers of smallmouth bass and rock bass and has the potential of producing memorable catches (both in number and size). The river provides an excellent escape for recreationists (consumptive and non-consumptive) who are looking for a river that offers relatively undisturbed surroundings and a diverse community of wildlife.

Surveys on the Powell River will be conducted on a three-year rotation in order to assess any changes in the fishery. Our return trip in 2017 will focus on the same areas sampled in 2014.

Management Recommendations

1. Initiate an angler use and harvest survey.

Pigeon River

Introduction

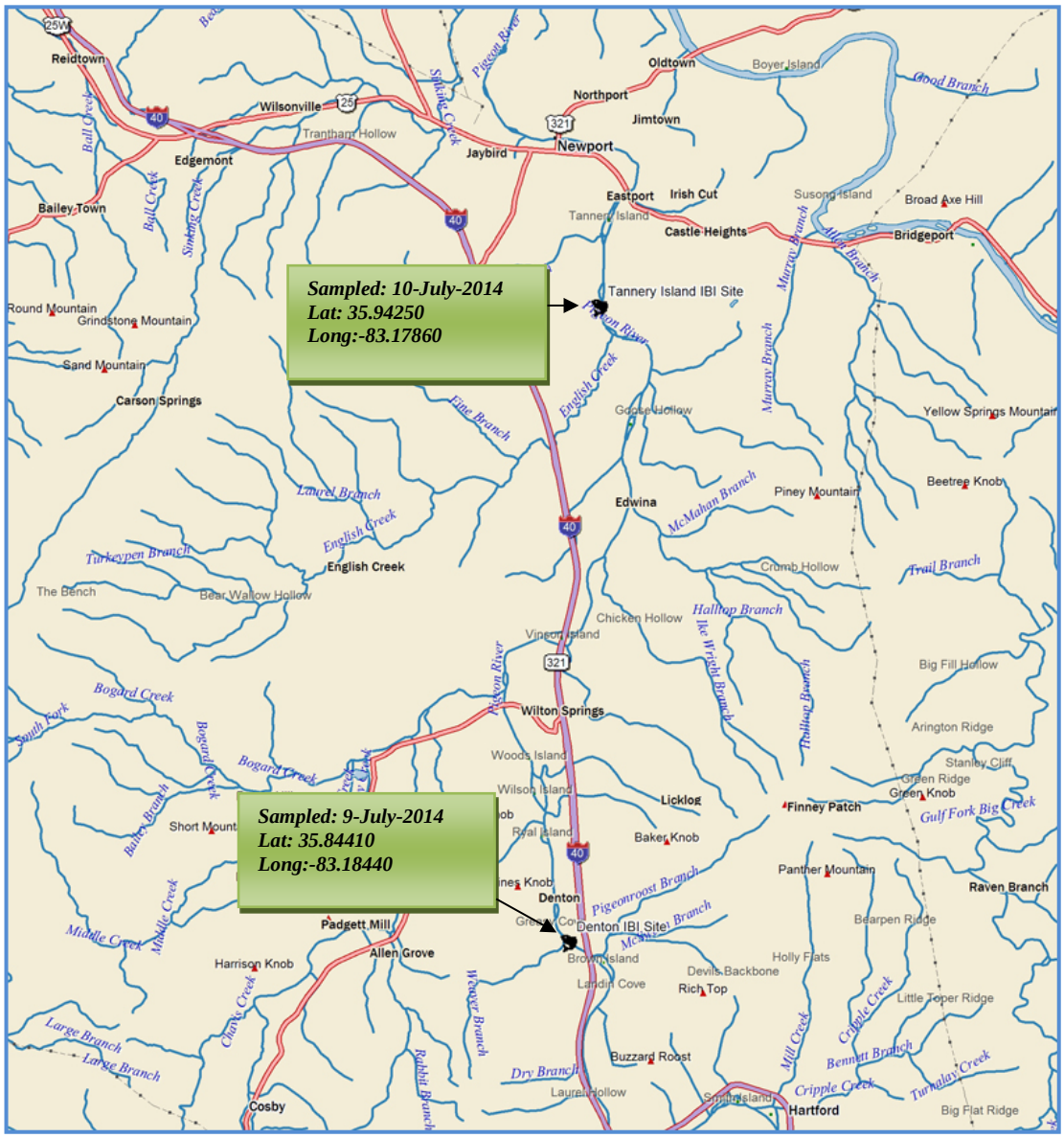
The Pigeon River has had a long history of pollution problems, stemming primarily from the discharge of wastewater from the Blue Ridge Paper Products Mill (formerly Champion Paper Mill) in Canton, North Carolina. This discharge has undoubtedly had a profound effect on the recreational use of the river and after the discovery of elevated dioxin levels in the 1980's raised concerns about public health (TDEC 1996). Although the river has received increased attention in recent years, the recreational use of the river has not developed its full potential. In terms of the fishery, consumption of all fish was prohibited up until 1996 when the ordinance was downgraded, limiting consumption of carp, catfish, and redbreast sunfish (TDEC 1996). In 2003, all consumption advisories were removed from the river. Since 1988, inter-agency Index of Biotic Integrity samples have been conducted at two localities, one near river mile 8.2 (Tannery Island) and one at river mile 16.6 (Denton).

Our 2014 surveys focused on continuing the evaluation of the fish community at two long-term IBI stations. Catch effort data for rock bass and black bass have been collected routinely since 1997 at five sites between river mile 4.0 and 20.5. During 1998, a 508 mm minimum (20-inch) length limit on smallmouth bass with a one fish possession limit was passed by the Tennessee Wildlife Resources Commission (TWRC). This regulation was implemented in March,1999.

Study Area and Methods

The Pigeon River originates in North Carolina and flows in a northwesterly direction before emptying into the French Broad River near river mile 73.8. The river has a drainage area of approximately 1,784 km^2 at its confluence with the French Broad River. In Tennessee, approximately 35 kilometers of the Pigeon River flows through mountainous terrain with interspersed communities and small farms before joining the French Broad River near Newport. Public access along the river is primarily limited to bridge crossings and small "pull-outs" along roads paralleling the river. There are a few primitive launching areas for canoes or small boats and one moderately developed launch at Denton. On July 9 and 10, 2014, we conducted IBI fish surveys at Tannery Island (PRM 8.2) and Denton (PRM 16.6) (Figure 13).

Figure 13. Site locations for the IBI samples conducted in the Pigeon River during 2014.



Fish were collected according to the IBI criteria described in the methods section of this report. Both backpack and boat electrofishing were used to collect samples from both stations. Qualitative benthic macroinvertebrates were collected at both stations and analyzed to produce a biotic index score similar to those derived for the fish IBI.

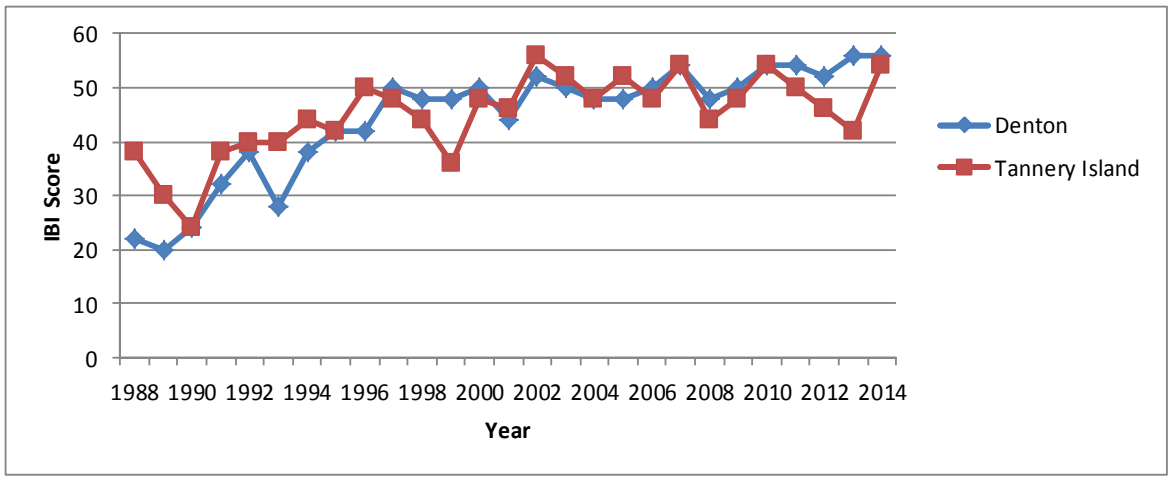
Results

Collaborative community assessments of the Pigeon River have been ongoing since the late 1980's. These surveys have primarily focused on evaluating relative health changes in the fish community. A total of 41 fish species were collected at the Tannery Island site and a total of 32 at the Denton site (Table 8). Overall, the IBI analysis indicated the fish community was in "good/excellent" condition at Tannery Island (IBI score 54). This was a 12 point increase from the 2013 score and was the first increase in three years. The condition of the fish community assessed "good/excellent" at the Denton site in 2014 (56) (Figure 14). The score remained unchanged from 2013.

Table 8. Fish species collected at the two Pigeon River IBI stations during 2014.

Pigeon River Mile	8.2 (Tannery Island)	Number Collected	16.6 (Denton)	Number Collected
	420142501		420142503	
	Ambloplites rupestris	8	*Ambloplites rupestris*	46
	Ameiurus natalis	4	*Ameiurus natalis*	1
	Aplodinotus grunniens	1	*Campostoma oligolepis*	38
	Campostoma oligolepis	44	*Cottus carolinae*	146
	Carpiodes cyprinus	2	*Cyprinella galactura*	152
	Cottus carolinae	122	*Cyprinella spiloptera*	2
	Cyprinella galactura	59	*Cyprinus carpio*	1
	Cyprinella spiloptera	16	*Dorosoma cepedianum*	18
	Cyprinus carpio	1	*Etheostoma blennioides*	17
	Dorosoma cepedianum	23	*Etheostoma rufilineatum*	260
	Etheostoma blennioides	92	*Etheostoma tennesseense*	70
	Etheostoma kennicotti	9	*Hybopsis amblops*	3
	Etheostoma rufilineatum	307	*Hypentelium nigricans*	16
	Etheostoma tennesseense	25	*Ichthyomyzon bdellium*	7
	Etheostoma zonale	1	*Ichthyomyzon greeleyi*	2
	Fundulus catenatus	2	*Ictalurus punctatus*	5
	Hybopsis amblops	4	*Ictiobus bubalus*	2
	Hypentelium nigricans	38	*Lepomis auritus*	18
	Ichthyomyzon bdellium	6	*Lepomis cyanellus*	2
	Ictiobus bubalus	8	*Lepomis macrochirus*	2
	Ictiobus niger	5	*Micropterus dolomieu*	38
	Labidesthes sicculus	4	*Moxostoma anisurum*	1
	Lepomis auritus	23	*Moxostoma breviceps*	3
	Lepomis cyanellus	2	*Moxostoma carinatum*	6
	Lepomis macrochirus	4	*Moxostoma duquesnei*	41
	Micropterus dolomieu	7	*Moxostoma erythrurum*	1
	Micropterus punctulatus	2	*Notropis micropteryx*	1
	Micropterus salmoides	6	*Notropis telescopus*	236
	Moxostoma breviceps	7	*Oncorhynchus mykiss*	5
	Moxostoma carinatum	1	*Percina caprodes*	9
	Moxostoma duquesnei	36	*Pomoxis annularis*	3
	Moxostoma erythrurum	4	*Sander vitreum*	9
	Notropis micropteryx	51		
	Notropis photogenis	3		
	Notropis telescopus	41		
	Noturus eleutherus	3		
	Percina caprodes	19		
	Percina evides	2		
	Pimephales notatus	1		
	Pomoxis annularis	1		
	Sander vitreum	3		

Figure 14. Trends in Index of Biotic Integrity (IBI) at two stations on the Pigeon River (1988-2014).



Benthic macroinvertebrates collected at the Tannery Island site comprised 28 families representing 30 identified genera (Table 9). The most abundant

group in our collection was the caddisflies comprising 39.1% of the total sample. Overall, a total of 40 taxa were identified from the sample of which 9 were EPT. Based on the EPT taxa richness and overall biotic index of all species collected, the relative health of the benthic community was classified as “Fair-Fair/Good” (2.8).

Table 9. Taxa list and associated biotic statistics for benthic macroinvertebrates collected from the Pigeon River at Tannery Island (river mile 8.2) 2014.

ORDER	FAMILY	SPECIES	NUMBER
AMPHIPODA			
	Crangonyctidae	*Synurella*	2
ANELLIDA			
	Hirudinea		3
	Oligochaeta		3
COLEOPTERA			
	Dytiscidae	*Laccophilus maculosus* female	1
	Elmidae	*Ancyronyx variegatus* larva	1
		Macronychus glabratus adult	1
		Micocylloepus pusillus adult	1
		Promoresia elegans adult	2
DIPTERA			
	Chironomidae	larvae	16
	Empididae		1
	Simulidae	larvae	4
EPHEMEROPTERA			
	Baetidae	*Acentrella*	2
		Baetis	2
	Heptageniidae	*Maccaffertium* early instar	3
		Maccaffertium mediopunctatum	3
	Isonychiidae	*Isonychia*	3
GASTROPODA			
	Ancylidae	*Ferrissia*	1
	Physidae		1
	Pleuroceridae	*Leptoxis*	1
		Pleurocera (yellow form)	1
		Pleurocera (striped form)	1
HEMIPTERA			
	Belostomatidae	*Belostoma lutarium* female ovigerous	1
HYDRACARINA			3
ISOPODA			
	Asellidae	*Caecidotea*	10
MEGALOPTERA			
	Corydalidae	*Corydalus cornutus*	2
ODONATA			
	Aeshnidae	*Boyeria early* instar	1
	Calopterygidae	*Hetaerina americana*	18
	Coenagrionidae	*Argia sedula*	2
		Enallagma	2
		Ischnura	3
	Corduliidae	*Neurocordulia obsoleta*	1
		Neurocordulia yamaskanensis	1
	Macromiidae	*Macromia*	2
PELECYPODA			
	Corbiculidae	*Corbicula fluminea*	1
	Sphaeriidae	*Pisidium*	1
TRICHOPTERA			
	Brachycentridae	*Brachycentrus lateralis*	6
	Hydropsychidae	*Ceratopsyche morosa*	20
		Cheumatopsyche (1 is pupa)	34
	Hydroptilidae	*Hydroptila*	7
	Lepidostomatidae	*Lepidostoma*	1
TURBELLARIA			5
		Total	**174**

TAXA RICHNESS = 40 EPT TAXA RICHNESS = 9 BIOCLASSIFICATION = (2.8 FAIR- FAIR/GOOD)

Benthic macroinvertebrates collected at the Denton site comprised 27 families representing 33 identified genera (Table 10). The most abundant groups in our collection were the mayflies comprising about 31.7% of the total sample. Overall, a total of 37 taxa were identified from the sample of which 19 were EPT. Based on the EPT taxa richness and overall biotic index of all species collected, the relative health of the benthic community was classified as "Good" (4.0).

Table 10. Taxa list and associated biotic statistics for benthic macroinvertebrates collected from the Pigeon River at Denton (river mile 17.1) 2014.

ORDER	FAMILY	SPECIES	NUMBER
ANELLIDA			
	Oligochaeta		2
COLEOPTERA			
	Gyrinidae	*Dineutus discolor* adult males	3
		Dineutus larvae	2
	Elmidae	*Macronychus glabratus* adults	6
	Psephenidae	*Psephenus herricki* larvae	2
DIPTERA			
	Athericidae	*Atherix lantha*	1
	Chironomidae	larvae	29
	Simuliidae	larvae and pupae	13
	Tipulidae	*Tipula*	1
EPHEMEROPTERA			
	Baetidae	*Acentrella*	1
		Baetis	7
		Heterocloeon	2
	Ephemerellidae	*Eurylophella*	1
	Ephemerellidae	*Serratella* sp. 1	1
		Serratella sp. 2	1
	Heptageniidae	*Epeorus rubidus/subpalidus*	1
		Maccaffertium mediopunctatum	13
		Maccaffertium early instars	5
		Stenacron interpunctatum	9
	Isonychiidae	*Isonychia*	18
GASTROPODA			
	Pleuroceridae	*Leptoxis*	2
		Pleurocera	1
ISOPODA			
	Asellidae	*Caecidotea*	5
MEGALOPTERA			
	Corydalidae	*Corydalus cornutus*	7
		Nigronia serricornis	5
ODONATA			
	Aeshnidae	*Boyeria vinosa*	3
	Coenagrionidae	*Argia moesta*	1
	Gomphidae	*Gomphus rogersi*	1
		Hylogomphus viridifrons	1
PELECYPODA			
	Corbiculidae	*Corbicula fluminea*	4
TRICHOPTERA			
	Brachycentridae	*Brachycentrus lateralis*	8
	Hydropsychidae	*Ceratopsyche morosa*	10
		Cheumatopsyche	5
		Hydropsyche franclemonti	6
	Hydroptilidae	*Hydroptila*	1
	Lepidostomatidae	*Lepidostoma*	2
	Polycentropodidae	*Polycentropus*	4
	Psychomyiidae	*Psychomyia flavida*	1
	Ueonidae	*Neophylax* pupa	1
		Total	**186**

TAXA RICHNESS = 37 EPT TAXA RICHNESS = 19 BIOCLASSIFICATION = 4.0 (GOOD)

Discussion

Water quality improvement over the last 20 years has primarily been the result of more advanced wastewater treatment at the Blue Ridge Paper Mill in Canton, North Carolina. The improved water quality has undoubtedly had an effect on the amount of recreation that is currently taking place, particularly whitewater rafting. It has also resulted in the return of a few species (e.g. silver shiner, telescope shiner) previously not encountered in the annual surveys and the implementation of a fish and mollusk recovery effort. During 2006, there were at least two instances of pesticides entering the river. During these events, both benthic invertebrates and fish were killed. Investigations by TWRA and TDEC resulted in identifying the areas of agricultural runoff into the river.

Management Recommendations

1. Continue monitoring the sport fish population every three years.

2. Continue the cooperative IBI surveys at the two established stations (Denton and Tannery Island).

3. Continue cooperative efforts to reintroduce common species.

4. Continue stocking that section of the river between the powerhouse and Bluffton with rainbow trout when available.

Straight Fork

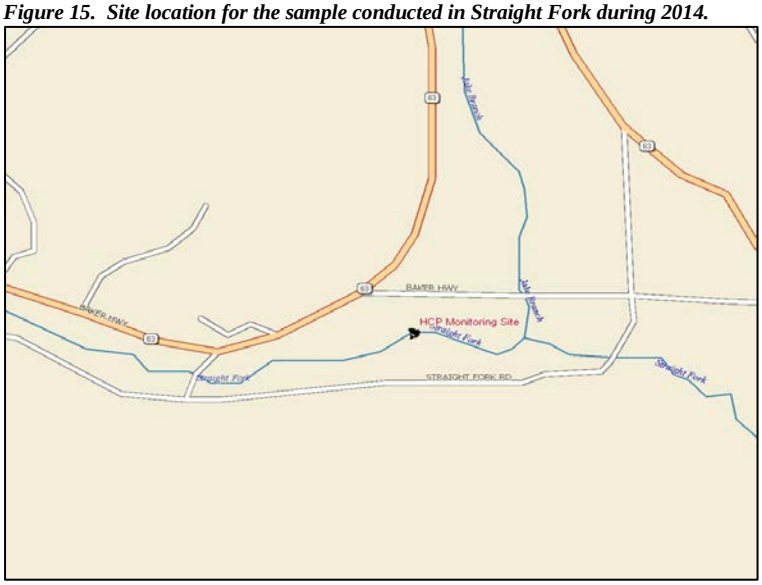
Introduction

Straight Fork was chosen for monitoring due to TWRA's planned forestry activity within the watershed and the occurrence of blackside dace in the stream. The blackside dace (federally listed) is the species of concern in this system and was identified as one of the key species for monitoring under the Habitat Conservation Plan (HCP).

Study Area and Methods

The area we surveyed was located near the confluence with Jake Branch (Figure 15). We conducted the survey on August 8, 2014. Our survey was actually on private land but was at the upper extent of the blackside dace distribution. There is a substantial reach of the stream above our survey site that flows through private land that depending on use, could have impacts on the population we are monitoring. We surveyed approximately 208 meters of stream, recording our total electrofishing time so that subsequent samples could be repeated with same amount of effort. We used one backpack electrofishing unit operating at 150 volts DC to stun fish which were collected by the backpack operator or the netter assisting with the survey. Catch per unit effort (CPUE) estimates for blackside dace were calculated based on the total catch from a single electrofishing pass and amount of effort expended at the site. Basic water quality collected at the site indicated a conductivity of 394 µs/cm, a pH of 6.0, and water temperature of 20 C. Overall, the physical habitat and condition of the stream scored 120 (sub-optimal). The most influential metrics on the overall score were the amount of sediment deposition, instability of the stream banks and substrate embeddedness.

Figure 15. Site location for the sample conducted in Straight Fork during 2014.



Results

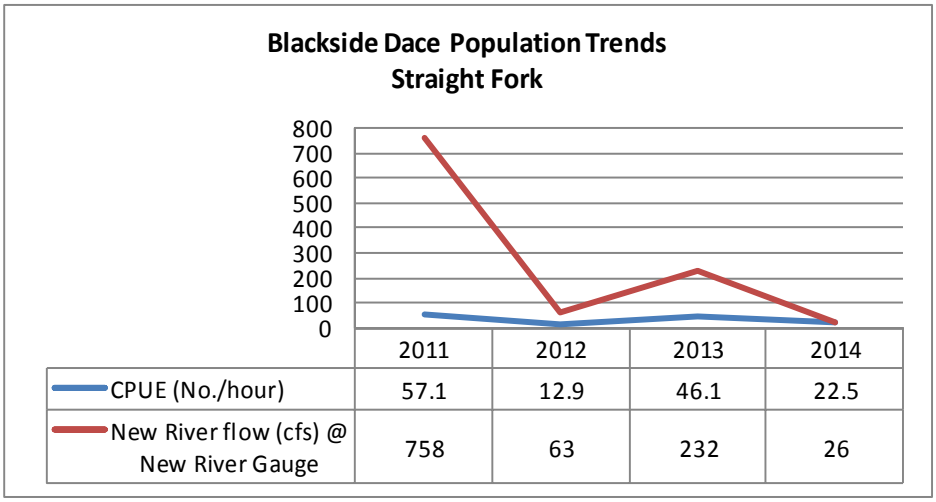
We collected six fish species during our 2014 survey of Straight Fork. The most abundant species were creek chub and green sunfish. Nine (18 in 2013) blackside dace were collected within our sample area (Table 11). Based on the

one pass electrofishing catch, our CPUE estimate within our sample area was 22.5 (Figure 16). This was down from 46.1 recorded in the 2013 survey. Blackside dace abundance is highly variable from year to year depending on flow conditions. Straight Fork flow was somewhat lower during 2013 as indicated by the recorded flow at the New River gauging station (lowest since sampling began in 2011). Other factors potentially affecting the dace population in the stream could be the fluctuation in abundance of predators such as green sunfish. These values will be used to develop trends prior to TWRA land management activities and serve as a benchmark for comparison should forestry practices take place within the watershed.

Table 11. Fish species collected from Straight Fork 2014.

Species	Abundance
Chrosomus cumberlandensis	9 (CPUE = 22.5)
Catostomus commersonii	Scarce
Lepomis cyanellus	Common
Lepomis macrochirus	Scarce
Rhinichthys atratulus	Scarce
Semotilus atromaculatus	Abundant

Figure 16. Blackside dace population trends in Straight Fork 2011-14.



Discussion

Straight Fork is still under the influence of acid mine drainage and if not for the buffering effect of Jake Branch, recovery of stream would not be realized for some distance downstream of our sample location. In previous surveys of the stream, we have documented pH as low as 2.3 in tributaries to Straight Fork. We will return to repeat the sample in 2015 to add to the HCP database.

Management Recommendations

1. Continue to monitor blackside dace, basic water quality, and habitat characteristics annually.

Jake Branch

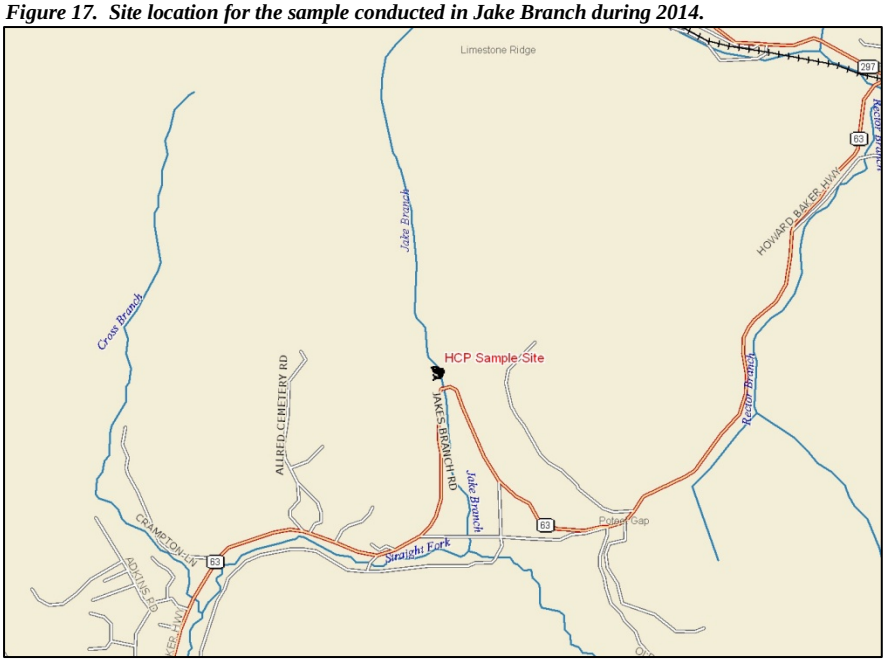
Introduction

Jake Branch was chosen for monitoring due to TWRA's planned forestry activity within the Straight Fork watershed and the occurrence of blackside dace in the stream. The blackside dace (federally listed) is the species of concern in this system and was identified as one of the key species for monitoring under the HCP.

Study Area and Methods

The area we surveyed was located approximately 0.6 miles upstream from the confluence with Straight Fork on the Bridge's property (Figure 17). We conducted the survey on August 8, 2014. We were confined to the reach of stream located at the downstream boundary of the private property and the first farm road crossing upstream from the landowner residence. We surveyed approximately 178 meters of stream, recording our total electrofishing time so that subsequent samples could be repeated with similar effort. We used one backpack electrofishing unit operating at 150 volts DC to stun fish which were collected by the backpack operator or the netter assisting with the survey. Catch per unit effort estimates for blackside dace were calculated based on the total catch from a single electrofishing pass and amount of effort expended at the site. Basic water quality collected at the site indicated a conductivity of 324 µs/cm, a pH of 6.0, and water temperature of 20.2 C. Overall, the physical habitat and condition of the stream scored 132 (sub-optimal). The most influential metrics on the overall score were the bank vegetative protection and the width of the riparian zone.

Figure 17. Site location for the sample conducted in Jake Branch during 2014.



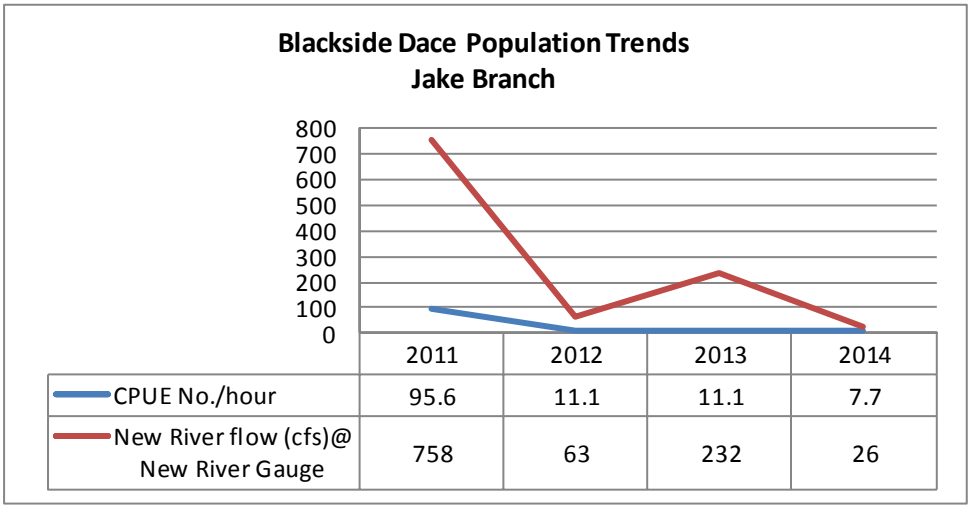
Results

We collected four fish species during our survey of Jake Branch. Both the green sunfish and creek chub were abundant in our sample area. Two blackside dace (4 in 2013) were collected within our sample area (Table 12). Based on the one pass electrofishing catch, our CPUE within our sample area was 7.7 (Figure 18). This represented a decrease from 11.1 recorded in our 2013 and was significantly lower than our value for the 2011 survey (95.6). Blackside dace abundance is highly variable from year to year depending on flow conditions. There were high water events during 2013 according to the land owner and our observations over the last two sampling events have indicated an increase in the green sunfish abundance in this section of the stream. These values will be used to develop trends for comparison to streams that will be subject to land management activities.

Table 12. Fish species collected from Jake Branch 2014.

Species	Abundance
Chrosomus cumberlandensis	2 (CPUE = 7.7)
Lepomis cyanellus	Common
Rhinichthys atratulus	Common
Semotilus atromaculatus	Abundant

Figure 18. Blackside dace population trends in Jake Branch 2011-14.



Discussion

The portion of the Jake Branch watershed that is within the WMA boundary has been designated as a forest reserve and will be used to characterize blackside dace population trends where TWRA forest management will not occur. We will return to repeat the sample in 2015 to add to the HCP database.

Management Recommendations

1. Continue to monitor blackside dace, basic water quality, and habitat characteristics annually.

Hudson Branch

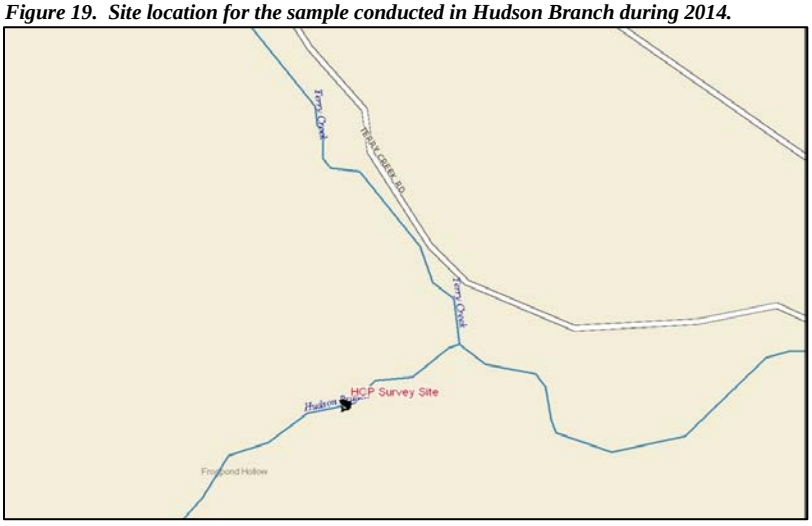
Introduction

Hudson Branch was chosen for monitoring due to the occurrence of blackside dace and Cumberland arrow darter in the stream. The blackside dace (federally listed) and Cumberland arrow darter (state listed) are species of concern in this system and were identified as key species for monitoring under the HCP.

Study Area and Methods

The area we surveyed was located approximately 0.1 miles upstream from the confluence with Terry Creek on private property (Figure 19). We conducted the survey on August 8, 2014. We surveyed approximately 234 meters of stream, recording our total electrofishing time so that subsequent samples could be repeated with same amount of effort. We used one backpack electrofishing unit operating at 200 volts DC to stun fish which were collected by the backpack operator or the netter assisting with the survey. Catch per unit effort estimates for blackside dace and Cumberland arrow darter were calculated based on the total catch from a single electrofishing pass and amount of effort expended at the site. Basic water quality collected at the site indicated a conductivity of 107.7 µs/cm, a pH of 6.0, and water temperature of 20.7 C. Overall, the physical habitat and condition of the stream scored 115 (suboptimal). The most influential metrics on the overall score were sedimentation and the bank instability. Stream flow was low at the time of our survey as evidenced by the nearest Clear Fork Cumberland River gauging station.

Figure 19. Site location for the sample conducted in Hudson Branch during 2014.



Results

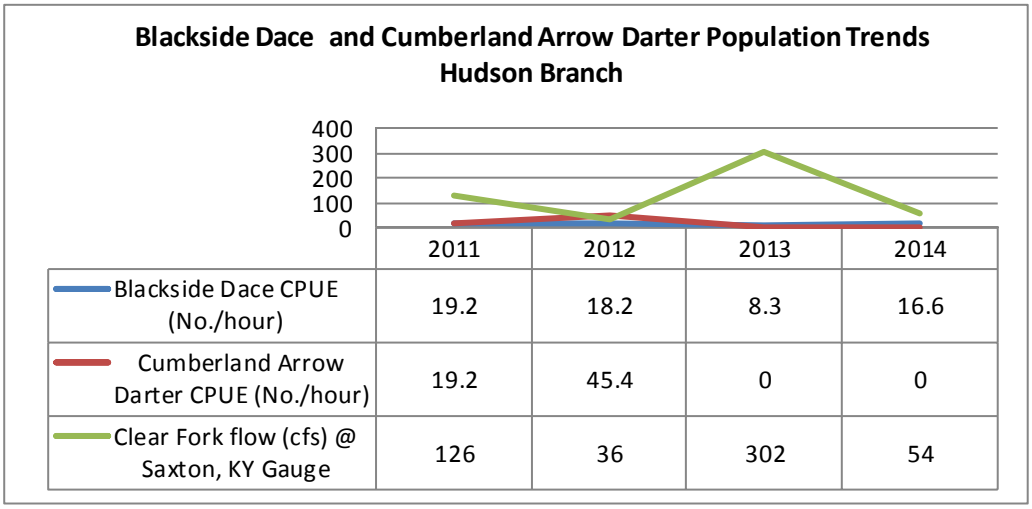
We collected five fish species during our survey of Hudson Branch. The most common species collected in our survey were creek chub, stoneroller and stripetail darter. Five blackside dace (3 in 2013) were collected within our sample area (Table 13). Based on the one pass electrofishing catch, our CPUE estimate of blackside dace within our sample area was 16.6 (Figure 20). This was up from 8.3 recorded in the 2013 survey. There were no Cumberland arrow darters

collected during our survey (5 in 2012, 0 in 2013). These values will be used to develop trends for comparison to streams that will be subject to land management activities.

Table 13. Fish species collected from Hudson Branch 2014.

Species	Abundance
Campostoma anomalum	Common
Chrosomus cumberlandensis	5 (CPUE = 16.6)
Etheostoma kennicotti	Common
Lepomis cyanellus	Rare
Semotilus atromaculatus	Abundant

Figure 20. Blackside dace and Cumberland arrow darter population trends in Hudson Branch 2011-14.



Discussion

There are no plans by TWRA to conduct forestry activities within this watershed. However, given the occurrence of blackside dace and Cumberland arrow darter we wanted to begin building background data for comparative purposes. We will return to repeat the sample in 2015 to add to the HCP database.

Management Recommendations

1. Continue to monitor blackside dace, Cumberland arrow darter, basic water quality, and habitat characteristics annually.

Terry Creek

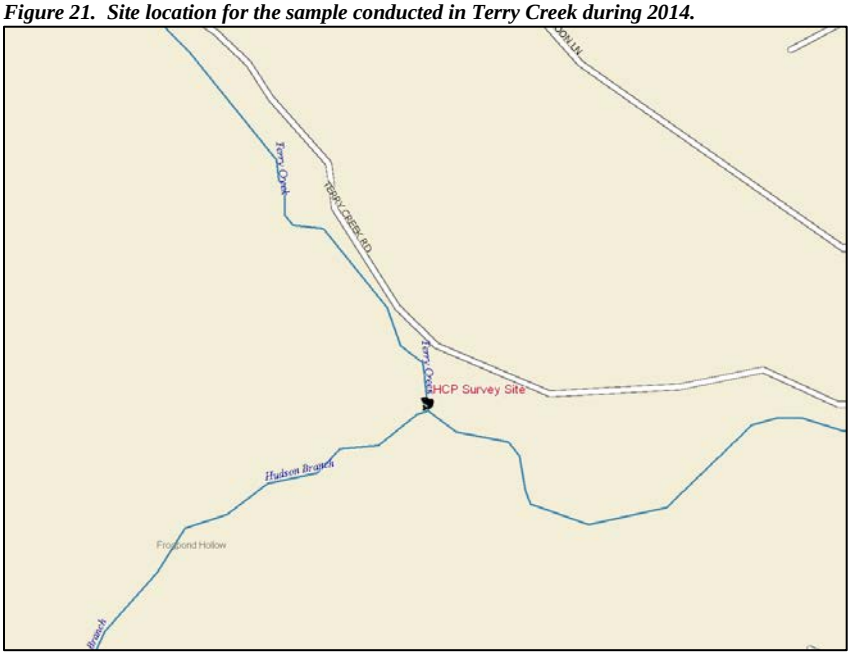
Introduction

Terry Creek was chosen for monitoring due to the occurrence of blackside dace and Cumberland arrow darter in the stream. The blackside dace (federally listed) and Cumberland arrow darter (state listed) are species of concern in this system and were identified as key species for monitoring under the HCP.

Study Area and Methods

The area we surveyed was located just upstream from the confluence with Hudson Branch on private property (Figure 21). We conducted the survey on August 8, 2014. We surveyed approximately 113 meters of stream, recording our total electrofishing time so that subsequent samples could be repeated with same amount of effort. We used one backpack electrofishing unit operating at 200 volts DC to stun fish which were collected by the backpack operator or the netter assisting with the survey. Catch per unit effort estimates for blackside dace and Cumberland arrow darter were calculated based on the total catch from a single electrofishing pass and amount of effort expended at the site. Basic water quality collected at the site indicated a conductivity of 123.3 µs/cm, a pH of 6.0, and water temperature of 20.5 C. Overall, the physical habitat and condition of the stream scored 134 (sub-optimal). The most influential metrics on the overall score were the bank vegetative protection, riparian zone width, and bank instability.

Figure 21. Site location for the sample conducted in Terry Creek during 2014.



Results

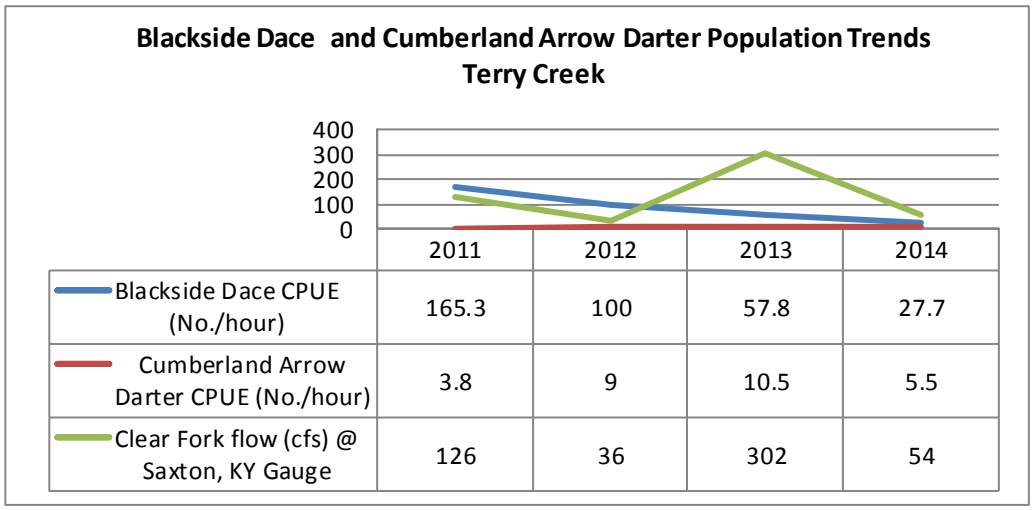
We collected seven fish species during our survey of Terry Creek. The most common species were creek chub and stoneroller. Due to flooding in 2012, the abundance of many species collected in 2014 was still depressed. Five blackside dace (11 in 2013) were collected within our sample area (Table 14). Based on the one pass electrofishing catch, our CPUE estimate of blackside dace within our sample area was 27.7 (Figure 22). This was about half of the

value recorded for the 2013 sample. One Cumberland arrow darter was collected during our survey. Based on our catch and the amount of electrofishing effort expended at the site we calculated a CPUE of 5.5 for this species (10.5 in 2013). These values will be used to develop trends for comparison to streams that will be subject to land management activities.

Table 14. Fish species collected from Terry Creek 2014.

Species	Abundance
Campostoma anomalum	Common
Catostomus commersonii	Rare
Chrosomus cumberlandensis	5 (CPUE= 27.7)
Etheostoma caeruleum	Scarce
Etheostoma kennicotti	Rare
Etheostoma sagitta sagitta	1 (CPUE = 5.5)
Semotilus atromaculatus	Abundant

Figure 22. Blackside dace and Cumberland arrow darter population trends in Terry Creek 2011-14.



Discussion

There are no plans by TWRA forestry to conduct activity within this watershed. However, given the occurrence of blackside dace and Cumberland arrow darter we wanted to begin building background data as a control. We will return to repeat the sample in 2015 to add to the HCP database.

Management Recommendations

1. Continue to monitor blackside dace, Cumberland arrow darter, basic water quality, and habitat characteristics annually.

Stinking Creek

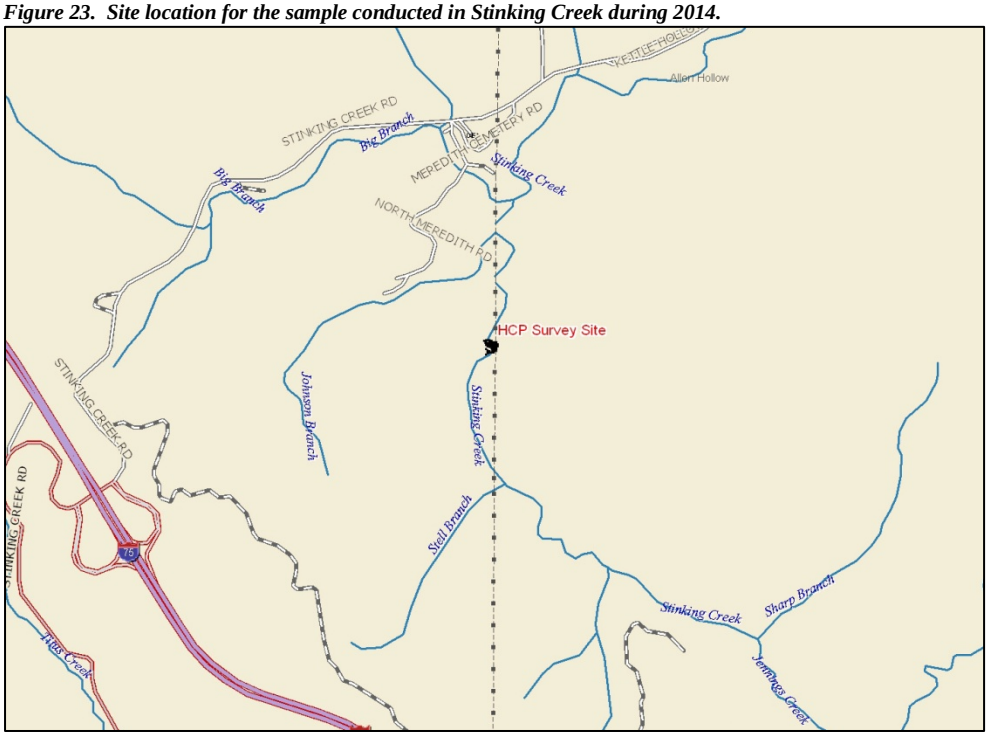
Introduction

Stinking Creek was chosen for monitoring due to TWRA's potential forestry activity within the watershed and the occurrence of Cumberland arrow darter in the stream. The Cumberland arrow darter (state listed) is a species of concern in this system and was identified as key species for monitoring under the HCP.

Study Area and Methods

The area we surveyed was located about 200 m upstream from the first road crossing after entering North Cumberland WMA (Figure 23). We conducted the survey on August 14, 2014. We surveyed approximately 200 meters of stream, recording our total electrofishing time so that subsequent samples could be repeated with same amount of effort. We used one backpack electrofishing unit operating at 200 volts AC to stun fish which were collected by the backpack operator or the netter assisting with the survey. Catch per unit effort (fish/hour) was calculated for Cumberland arrow darter. Basic water quality collected at the site indicated a conductivity of 116.5 µs/cm, a pH of 6.2, and water temperature of 22.0 C. Overall, the physical habitat and condition of the stream scored 118 (sub-optimal). The most influential metrics on the overall score were the amount of embeddedness, sediment deposition, and bank stability.

Figure 23. Site location for the sample conducted in Stinking Creek during 2014.



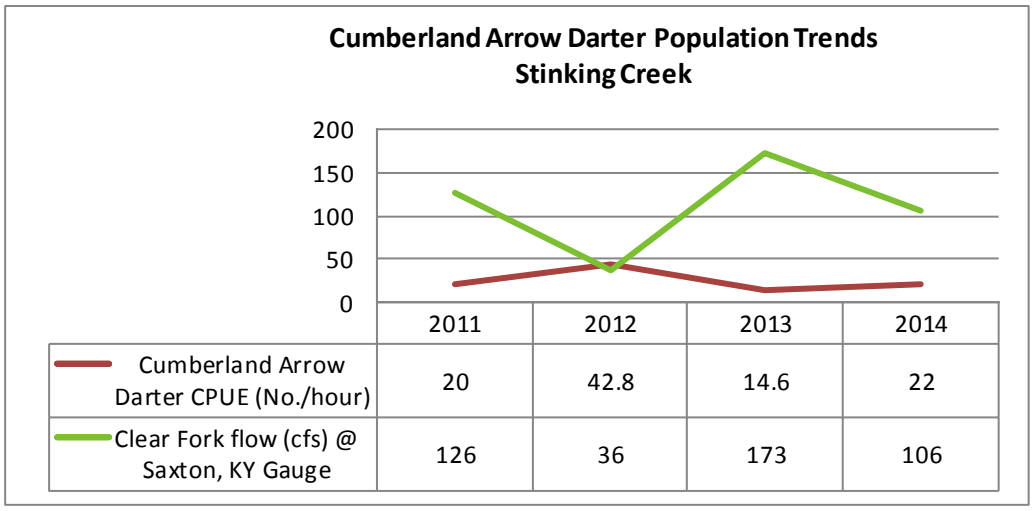
Results

We collected 11 fish species during our survey of Stinking Creek. There were several species in the survey that were common (Table 15). Eleven Cumberland arrow darters were collected during our survey (6 in 2013). This was almost double the number collected in 2013 but still far short of the 21 collected in 2012. Based on our catch and the amount of electrofishing effort expended at the site we calculated a CPUE of 22.0 (14.6 in 2013) for this species (Figure 24). This value will be used to develop trends and serve as a benchmark for comparison should forestry practices take place within the watershed.

Table 15. Fish species collected from Stinking Creek 2014.

Species	Abundance
Campostoma anomalum	Common
Catostomus commersonii	Rare
Etheostoma blenniodes	Rare
Etheostoma caeruleum	Abundant
Etheostoma kennicotti	Common
Etheostoma sagitta sagitta	11 (CPUE = 22)
Hypentelium nigricans	Common
Micropterus dolomieu	Rare
Notropis rubellus	Common
Pimephales notatus	Scarce
Semotilus atromaculatus	Abundant

Figure 24. Cumberland arrow darter population trends in Stinking Creek 2011-14.



Discussion

There are plans by TWRA to conduct forest management activities within this watershed in the future. We are monitoring Cumberland arrow darter to begin building background data for activities that will take place here and evaluate any influence these activities may have on this species. We will return to repeat the sample in 2015 to add to the HCP database.

Management Recommendations

1. Continue to monitor Cumberland arrow darter, basic water quality, and habitat characteristics annually.

Jennings Creek

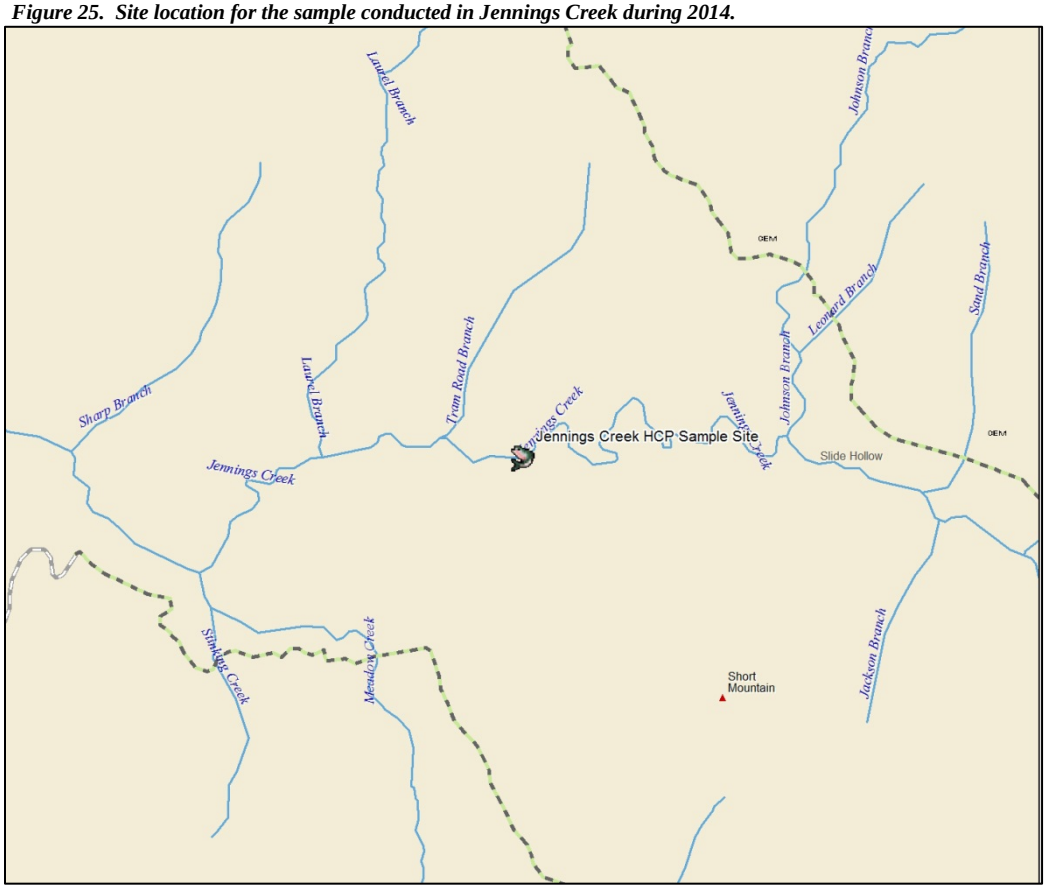
Introduction

Jennings Creek was chosen for monitoring due to TWRA's potential forestry activity within the watershed and the occurrence of Cumberland arrow darter in the stream. This stream was added to the sampling scheme in 2014. The Cumberland arrow darter (state listed) is a species of concern in this system and was identified as key species for monitoring under the HCP.

Study Area and Methods

The area we surveyed was located about 100 m downstream from the OHV road crossing (Figure 25). We conducted the survey on August 14, 2014. We surveyed approximately 193 meters of stream, recording our total electrofishing time so that subsequent samples could be repeated with same amount of effort. We used one backpack electrofishing unit operating at 150 volts AC to stun fish which were collected by the backpack operator or the netter assisting with the survey. Catch per unit effort (fish/hour) was calculated for Cumberland arrow darter. Basic water quality collected at the site indicated a conductivity of 152.8 µs/cm, a pH of 6.1, and water temperature of 18.3 C. Overall, the physical habitat and condition of the stream scored 119 (sub-optimal). The most influential metrics on the overall score were the amount of embeddedness, sediment deposition, and instream cover.

Figure 25. Site location for the sample conducted in Jennings Creek during 2014.



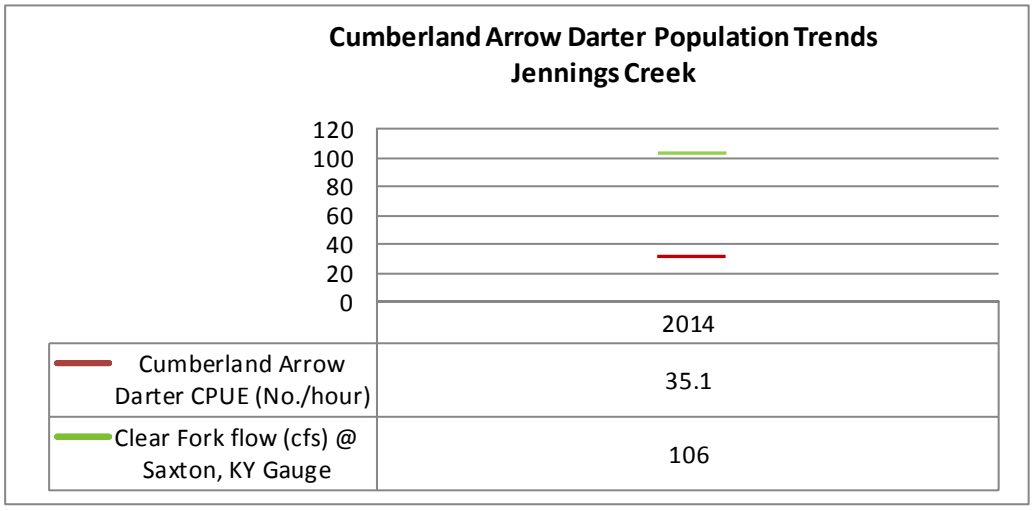
Results

We collected five fish species during our survey of Jennings Creek (Table 16). Thirteen Cumberland arrow darters were collected during our survey. Based on our catch and the amount of electrofishing effort expended at the site we calculated a CPUE of 35.1 (Figure 26). This value will be used to develop trends and serve as a benchmark for comparison should forestry practices take place within the watershed.

Table 16. Fish species collected from Jennings Creek 2014.

Species	Abundance
Ambloplites rupestris	Common
Etheostoma kennicotti	Abundant
Etheostoma sagitta sagitta	13 (CPUE = 35.1)
Lepomis macrochirus	Common
Semotilus atromaculatus	Abundant

Figure 26. Cumberland arrow darter population trends in Jennings Creek 2014.



Discussion

There are plans by TWRA to conduct forest management activities within this watershed in the future. We are monitoring Cumberland arrow darter to begin building background data for activities that will take place here and evaluate any influence these activities may have on this species. We will return to repeat the sample in 2015 to add to the HCP database.

Management Recommendations

1. Continue to monitor Cumberland arrow darter, basic water quality, and habitat characteristics annually.

Louse Creek

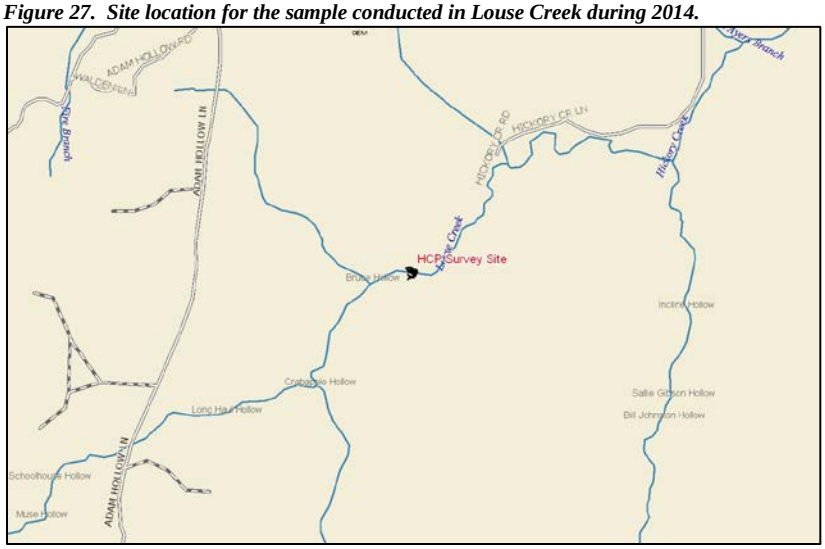
Introduction

Louse Creek was chosen for monitoring due to TWRA's potential forestry activity within the Stinking Creek watershed and the occurrence of blackside dace and Cumberland arrow darter in the stream. The blackside dace (federally listed) and Cumberland arrow darter (state listed) are species of concern in this system and were identified as key species for monitoring under the HCP.

Study Area and Methods

The area we surveyed was located just upstream from the logging access road (Figure 27). We conducted the survey on August 14, 2014. We surveyed approximately 190 meters of stream, recording our total electrofishing time so that subsequent samples could be repeated with same amount of effort. We used one backpack electrofishing unit operating at 200 volts DC to stun fish which were collected by the backpack operator or the netter assisting with the survey. Catch per unit effort (fish/hour) was calculated for Cumberland arrow darter and blackside dace. Basic water quality collected at the site indicated a conductivity of 143.8 µs/cm, a pH of 6.2, and water temperature of 19.0 C. Overall, the physical habitat and condition of the stream scored 139 (sub-optimal) which was slightly higher than the previous year score (127). The most influential metrics on the overall score was bank instability and sedimentation.

Figure 27. Site location for the sample conducted in Louse Creek during 2014.



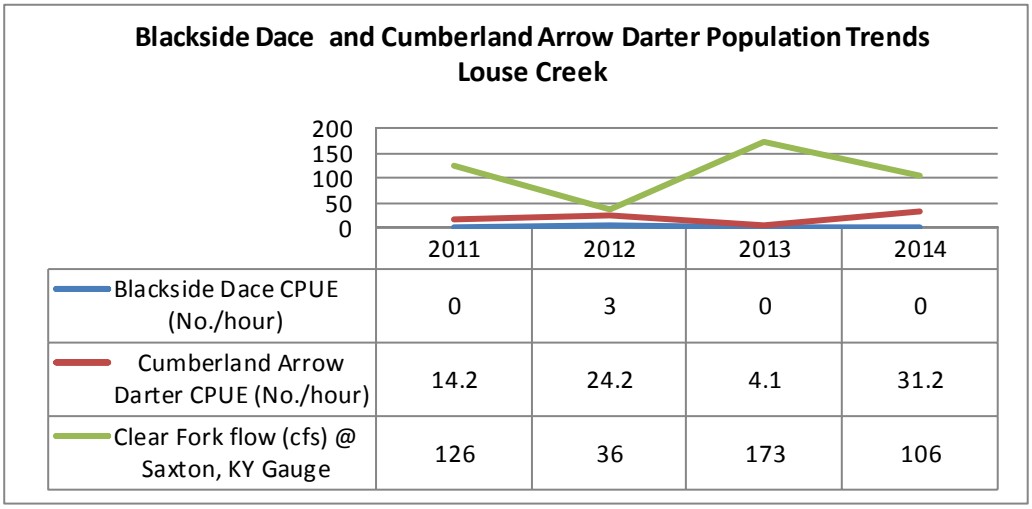
Results

We collected eight fish species during our survey of Louse Creek. The most abundant species were creek chub and rainbow darter (Table 17). We did not collect any blackside dace in 2014 or 2013 (1 in 2012). Fifteen Cumberland arrow darters were collected during our survey. Based on our catch and the amount of electrofishing effort expended at the site we calculated a CPUE of 31.2 which was a significant increase from 2013 (Figure 28). These values will be used to develop trends and serve as a benchmark for comparison should forestry practices take place within the watershed.

Table 17. Fish species collected from Louse Creek 2014.

Species	Abundance
Campostoma anamolum	Common
Catostomus commersonii	Scarce
Etheostoma caeruleum	Abundant
Etheostoma kennicotti	Common
Etheostoma sagitta sagitta	15 (CPUE = 31.2)
Hypentelium nigricans	Scarce
Rhinichthys atratulus	Common
Semotilus atromaculatus	Abundant

Figure 28. Blackside dace and Cumberland arrow darter population trends in Louse Creek 2011-14.



Discussion

There are no plans by TWRA to conduct forest management activity within this watershed. However, given the occurrence of blackside dace and Cumberland arrow darter we wanted to begin building background data for activities that may take place in the future. We will return to repeat the sample in 2015 to add to the HCP database.

Management Recommendations

1. Continue to monitor Cumberland arrow darter, blackside dace, basic water quality, and habitat characteristics annually.

Collection Efforts to Locate Tennessee Dace

Greene, Sevier, Sullivan, and Washington counties Tennessee

2014

Tennessee Wildlife Resources Agency

Rick D. Bivens and Carl E. Williams

Introduction

As part of the 2014 warmwater stream sampling agenda, the Tennessee Wildlife Resources Agency (TWRA) Region 4 Stream Unit conducted additional fish surveys to determine the occurrence of Tennessee Dace (*Chrosomus tennesseensis*). The Tennessee Dace is a state listed species deemed "in need of management". It occurs primarily in first and second order streams in the upper Tennessee River watershed from Polk County north to Sullivan County in Tennessee (and also in SW VA). These streams typically have fairly low gradient, shallow, silt and gravel pools, or undercut banks in shady areas created by surrounding woody vegetation. Nine target streams were identified from historical documentation, primarily from the University of Tennessee Etnier Ichthyological Collection (UTEIC) records, and also from areas where habitat was considered similar to those historical locations. The surveys were conducted in July and August of 2014.

Sample Methods

Fish were qualitatively collected with standard backpack electrofishing techniques (TWRA 1998). Collection from each stream was with a single backpack electrofishing unit operating at 125 to 200 volts AC (VAC) and a person assisting with a dipnet. Sample lengths were approximated in most cases and averaged around 200 m, but varied from about 100 to 470 m (Cherokee Creek trib.). Collections were made in all habitat types within the selected survey reach. They were made repeatedly for each habitat type and especially in pool areas until it was considered likely that no Tennessee Dace would occur with repeated efforts. All fish collected from each sample were enumerated by actual number or in terms of relative abundance (i.e. few, several, common, abundant, or very abundant). In general, most fish were identified in the field and released. However, selected voucher specimens from some streams were retained and were preserved in 10% formalin. Voucher specimens of all Tennessee Dace were retained. All voucher specimens were later identified in the lab and catalogued into the Agency reference collection. Specimens of Tennessee Dace representing new collection records were also sent to UT to be catalogued into the UTEIC as well. Common and scientific names of fishes used in this report are after Etnier and Starnes (1993), Page et al. (2013), and Powers and Mayden (2007).

Results and Discussion

Tennessee Dace were collected from four of the nine streams sampled. Two were from historic locations and two represented new records. Three of the historic localities and two other sample sites produced no Tennessee Dace.

Tennessee Dace were first collected from Back Creek in Greene County in 2008 during a survey primarily looking for wild trout near the lower Cherokee National Forest boundary (Habera et al. 2009). Another specimen was collected in 2009 by USFS personnel at the same location. At that time, all those voucher specimens were catalogued into the TWRA Collection (TWRA Cat. # 11.803, 4 specimens; TWRA Cat. # 11.814, 1 specimen). The 2014 collection was located about 1.3 mi. downstream of the Forest Service boundary on private land, and just upstream of the Kelly Gap Road crossing. This represents a significant addition to the known distribution of Tennessee Dace in this stream. Four specimens from the 2014 collection were catalogued into the TWRA Collection (TWRA Cat. # 11.1310) and five were sent to the UTEIC. Mize Branch, a Dunn Creek tributary in Sevier County, represents another previously unknown population of Tennessee Dace. Seven specimens were collected and all were retained as voucher specimens. Four specimens were catalogued in the TWRA Collection (TWRA Cat. # 11.1320) and the other three were sent to the UTEIC.

Tennessee Dace were also collected from two historical locations, both in the Dunn Creek watershed in Sevier County. Fourteen were collected from Dockery Branch along with one Creek Chub x Tennessee Dace hybrid. Seven specimens and the one hybrid were catalogued into the TWRA Collection (TWRA Cat. # 11.1325; TWRA Cat. # 11.1326). A Creek Chub x Tennessee Dace hybrid was also collected from this same site in 2000 (UTEIC Cat. # 44.8626). Two Tennessee Dace were also collected from an unnamed tributary to Dockery Branch along Henry Town Road. Tennessee Dace were very abundant in Chucky Creek, where about 70 were collected within a 200 m section of stream downstream of the Henry Town Road crossing. Twenty-two were catalogued into the TWRA Collection (TWRA Cat. # 11.1327).

Three other historical locations were surveyed but no Tennessee Dace were found. These included upper Dunn Creek in Sevier County, an unnamed tributary to Cherokee Creek in Washington County, and Little Creek in Bristol, Sullivan County. The Dunn Creek site was along Rocky Flats Road and the stream is fairly large and the previous dace collection probably represents fish that may have entered Dunn Creek from a tributary stream. This was probably also the case of a TWRA collection of Tennessee Dace from a location farther downstream in 1996. All five specimens from that collection were found in a side pool to the main stream (TWRA Cat. # 11.480 - 2 specimens and UTEIC Cat. # 44.7291 - 3 specimens). The Dunn Creek segment we sampled in 2014 was too large to be adequately sampled with one backpack unit. The tributary to Cherokee Creek (Washington County) had only one specimen collected in 1972 (UTEIC Cat. # 44.653). Hammed and Alsop (2005) did not find any Tennessee Dace when it was re-surveyed in 2001. After an exhaustive effort of over 470 m in the area best determined as the 1972 location, we failed to turn up any Tennessee Dace either. We sampled Little Creek in Bristol in 2014, from its mouth upstream to the state line (approx. 370 m), but no Tennessee Dace were found. Hammed (personal communication in a 2005 e-mail) reported the collection of Tennessee Dace from this location by his class from Virginia Highlands Community College, Abingdon, VA. He also reported that Little Creek

had a good population of Tennessee Dace in VA, upstream of Bristol. On another note, we found the Rusty Crayfish (*Orconectes rusticus*) in Little Creek which represents a new population, and only the second record for the state for this invasive species. They were very abundant and no other crayfish species were encountered within the reach surveyed. Although no direct effort to collect all crayfish habitat was made during our survey, it certainly appears the Rusty Crayfish has displaced at least some native species.

Two other locations in Sullivan County, Nicely Branch and a tributary to Rock Springs Branch, were also sampled but no Tennessee Dace were found. No other federal or state listed fish species were found in any of the streams sampled. The fish species encountered were all typical inhabitants of east Tennessee Ridge and Valley Ecoregion streams. Some streams were degraded by moderate to heavy siltation. No stream habitat or water quality data were collected during these surveys but heavy siltation and embeddedness was observed at some locations (i.e. the tributary to Cherokee Creek in Washington County had silt deposits up to a foot deep in places).

Stream: Dunn Creek **Date:** 31 July 2014

Field Number: RDB-2014-15 **Quadrangle:** Jones Cove

Coordinates: 35.81515N – 83.29805W **Elevation:** 1,300 ft.

Locality: Figure 29. The site was along Rocky Flats Road, approx. 1.2 mi. (by road) upstream of the Henry Town Road intersection (where the stream first comes along the Rocky Flats Road). Area started along Rocky Flats Road and went upstream for about 160 m to the bridge crossing of a private road. Sevier Co., TN.

Comments: Observed clean rubble, boulder substrate and fairly cool temperature. Occurrence of a wild rainbow trout in July indicates the colder water.

Effort: One backpack unit at 125-200 VAC. Approx. 160 m sample length.

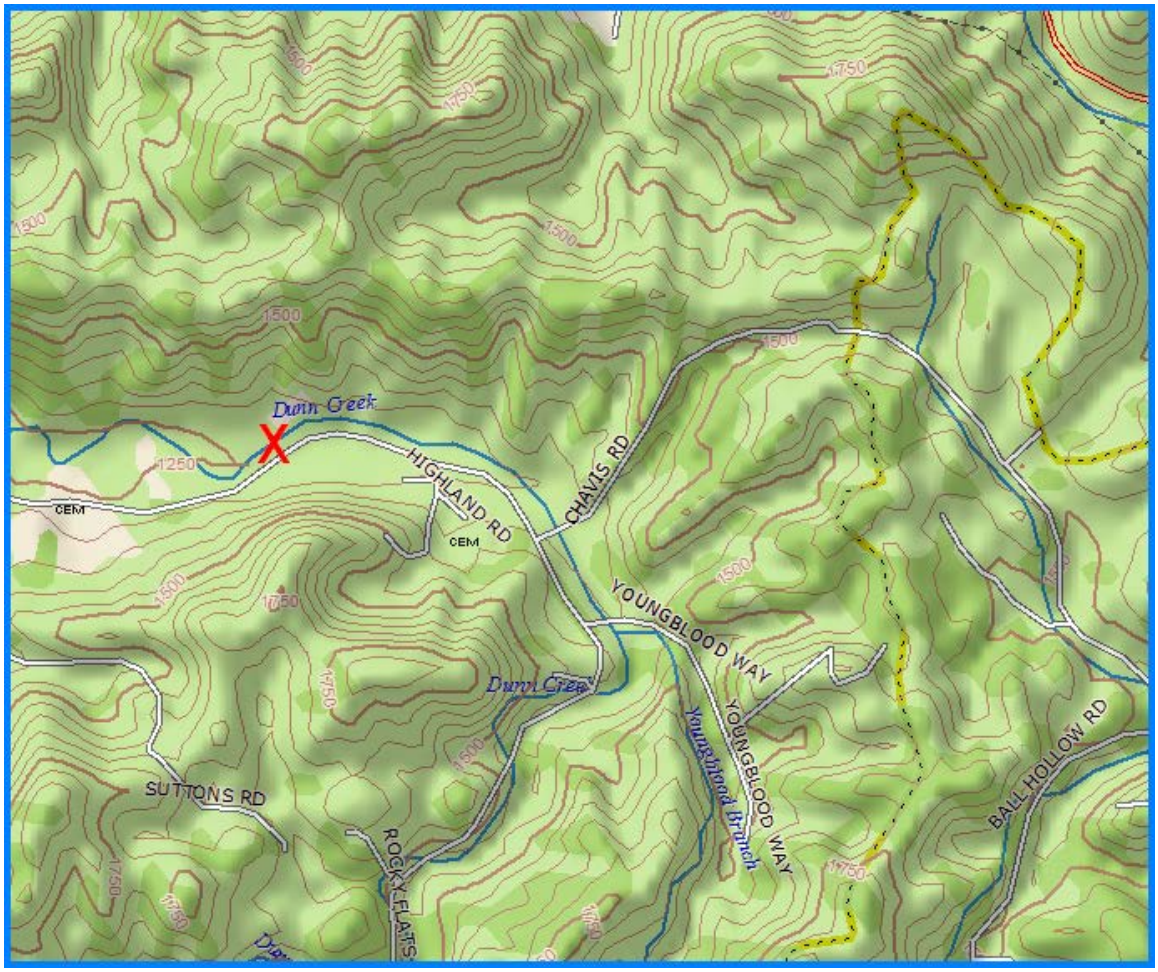
Species Collected:

		No. Collected
Ambloplites rupestris	Rock Bass	1
Oncorhynchus mykiss	Rainbow Trout (wild fish)	1
Hypentelium nigricans	Northern Hog Sucker	several
Campostoma anomalum	Central Stoneroller	common
Luxilus chrysocephalus	Striped Shiner	(1) 240 mm TL*
Luxilus coccogenis	Warpaint Shiner	common
Nocomis micropogon	River Chub	3
Notropis leuciodus	Tennessee Shiner	4
Notropis rubricroceus	Saffron Shiner	common
Rhinichthys atratulus	Blacknose Dace	common
Rhinichthys cataractae	Longnose Dace	2
Semotilus atromaculatus	Creek Chub	1
Etheostoma kennicotti	Stripetail Darter	4
Etheostoma swannanoa	Swannanoa Darter	2
Etheostoma tennesseense	Tennessee Darter	1
Cottus carolinae	Banded Sculpin	common
Ichthyomyzon ammocoetes	Lamprey larvae	7

* reported maximum TL of 240 mm (9.5 in) in Etnier and Starnes 1993

Figure 29. Dunn Creek sample area (X)

Coordinates: 35.81515N – 83.29805W



Stream: Mize Branch **Date:** 31 July 2014

Field Number: RDB-2014-14 **Quadrangle:** Richardson Cove

Coordinates: 35.81257N – 83.39449W **Elevation:** 1,120 ft.

Locality: Figure 30. The site was along Henry Town Road, starting where Henry Town Road crosses the stream for the first time, and continuing upstream for about 300 m. Sevier Co., TN.

Comments: Observed fairly clean rubble, cobble substrate and lots of bedrock areas, but with many pool areas interspersed within the bedrock outcrops.

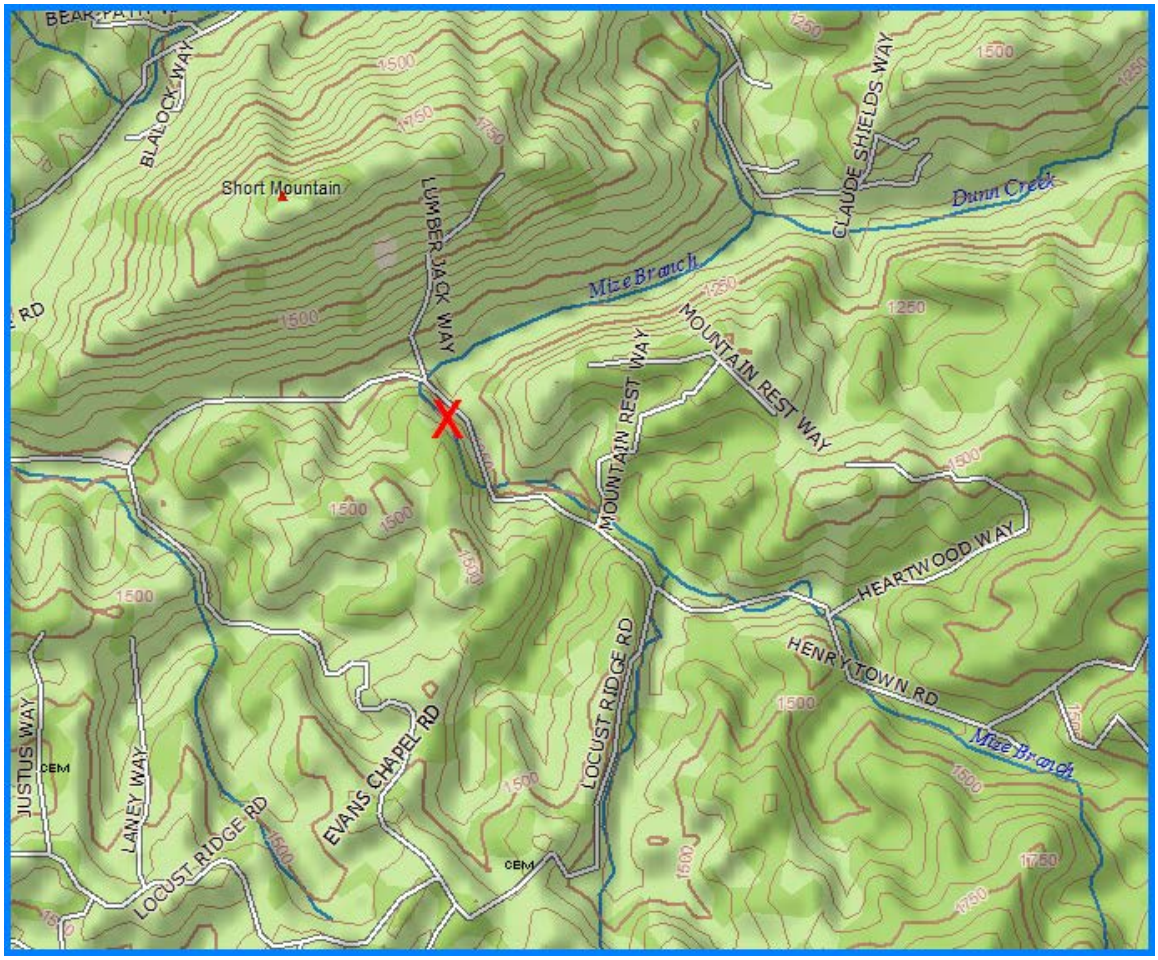
Effort: One backpack unit at 125 VAC. Approx. 300 m sample length.

Species Collected:

		No. Collected
Lepomis cyanellus	Green Sunfish	10 - 15
Campostoma anomalum	Central Stoneroller	common
Chrosomus tennesseensis	Tennessee Dace	7
Cyprinella spiloptera	Spotfin Shiner	1
Luxilus coccogenis	Warpaint Shiner	common
Nocomis micropogon	River Chub	3
Notropis rubricroceus	Saffron Shiner	common
Rhinichthys atratulus	Blacknose Dace	abundant
Semotilus atromaculatus	Creek Chub	abundant
Etheostoma kennicotti	Stripetail Darter	2

Figure 30. Mize Branch sample area (X)

Coordinates: 35.81257N – 83.39449W



Stream: Dockery Branch **Date:** 31 July 2014

Field Number: RDB-2014-12 **Quadrangle:** Jones Cove

Coordinates: 35.80770N – 83.36349W **Elevation:** 1,380 ft.

Locality: Figure 31. The site was downstream of the Henry Town Road crossing, at the intersection of Dockery Branch Road and Henry Town Road. Area started about 100 m downstream of Henry Town Road. Sevier Co., TN.

Comments: Observed moderate to fairly heavy siltation and rubble, cobble substrate with lots of bedrock areas. Several pool areas interspersed within the bedrock outcrops.

Effort: One backpack unit at 125 VAC. Approx. 100 m sample length.

Species Collected:

		No. Collected
Chrosomus tennesseensis	Tennessee Dace	14
Rhinichthys atratulus	Blacknose Dace	abundant
Semotilus atromaculatus	Creek Chub	common
Semotilus atromaculatus x *Chrosomus tennesseensis*	Hybrid	1

Figure 31. Dockery Branch sample area (X)

Coordinates: 35.80770N – 83.36349W

Stream: Chucky Creek **Date:** 31 July 2014

Field Number: RDB-2014-13 **Quadrangle:** Jones Cove

Coordinates: 35.80842N – 83.32824W **Elevation:** 1,338 ft.

Locality: Figure 32. The site was along Henry Town Road, downstream of where Henry Town Road crosses the stream (culvert) at View Seeker Way. Sevier Co., TN.

Comments: Observed moderately clean rubble, cobble substrate with moderate siltation.

Effort: One backpack unit at 125 VAC. Approx. 200 m sample length.

Species Collected:

		No. Collected
Campostoma anomalum	Central Stoneroller	common
Chrosomus tennesseensis	Tennessee Dace	69
Luxilus coccogenis	Warpaint Shiner	3
Notropis rubricroceus	Saffron Shiner	common
Rhinichthys atratulus	Blacknose Dace	common
Semotilus atromaculatus	Creek Chub	abundant
Etheostoma flabellare	Fantail Darter	several
Hypentelium nigricans	Northern Hog Sucker	1

Figure 32. Chucky Creek sample area (X)

Coordinates: 35.80842N – 83.32824W

Stream: Back Creek **Date:** 1 July 2014

Field Number: RDB-2014-01 **Quadrangle:** Davy Crockett Lake

Coordinates: 36.02532N – 82.82619W **Elevation:** 1,355 ft.

Locality: Figure 33. The site was upstream of the Kelly Gap Road crossing, upstream to the mouth of Kelly Branch. Greene Co., TN.

Comments: Observed moderately clean rubble, cobble substrate with moderate siltation.

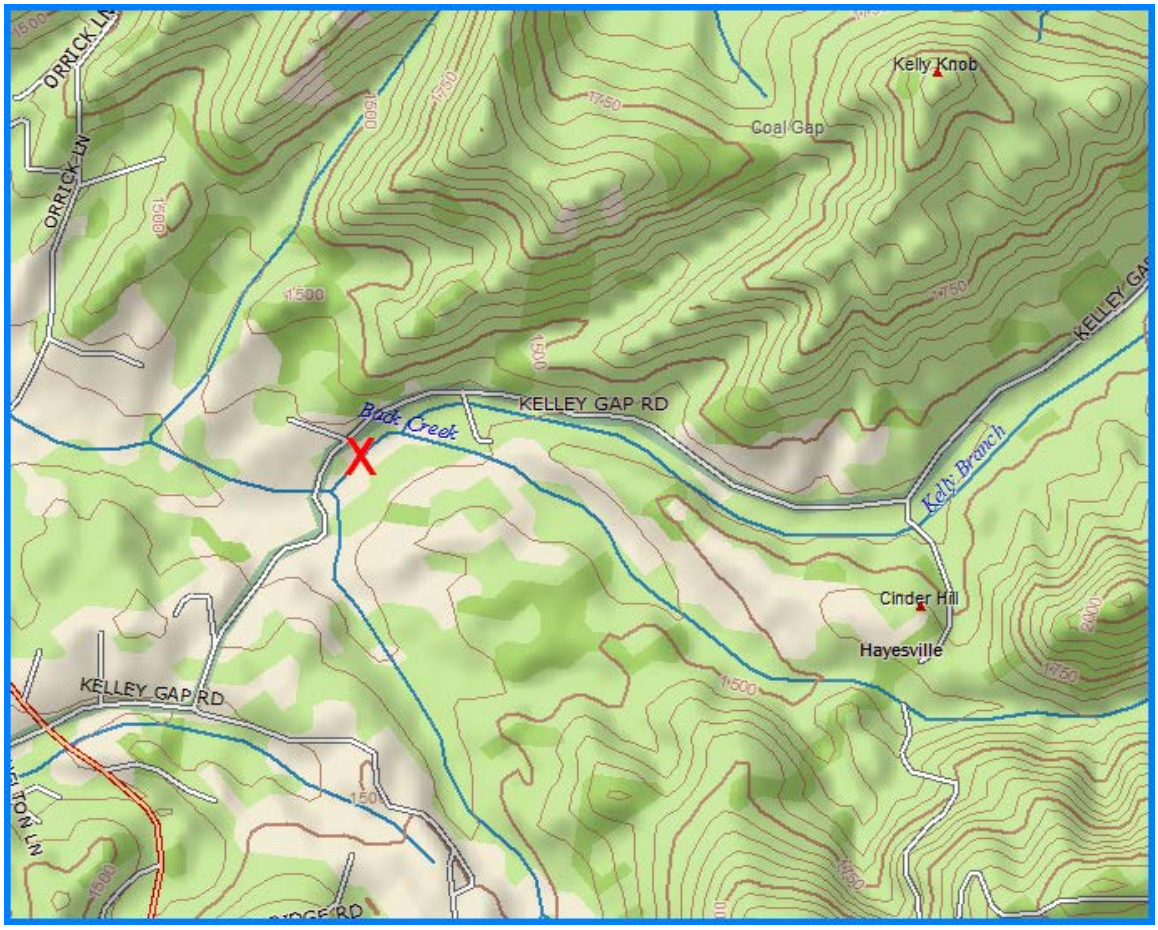
Effort: One backpack unit at 125-150 VAC. Approx. 350 m sample length.

Species Collected:

		No. Collected
Ambloplites rupestris	Rock Bass	~10
Campostoma oligolepis	Largescale Stoneroller	common
Chrosomus tennesseensis	Tennessee Dace	9
Luxilus chrysocephalus	Striped shiner	several
Rhinichthys atratulus	Blacknose Dace	abundant
Semotilus atromaculatus	Creek Chub	abundant
Etheostoma rufilineatum	Redline Darter	several
Etheostoma tennesseense	Tennessee Darter	common
Catostomus commersonii	White Sucker	2 or 3
Hypentelium nigricans	Northern Hog Sucker	several
Cottus carolinae	Banded Sculpin	common

Figure 33. Back Creek sample area (X)

Coordinates: 36.02532N – 82.82619W



Stream: Trib. to Cherokee Creek **Date:** 17 July 2014

Field Number: RDB-2014-10 **Quadrangle:** Jonesborough

Coordinates: 36.02532N – 82.82619W **Elevation:** 1,700 ft.

Locality: Figure 34. The site was upstream of the Mill Springs Road crossing, upstream to the culvert on Dulaney Road. Washington Co., TN.

Comments: Observed very heavy siltation, deep in places.

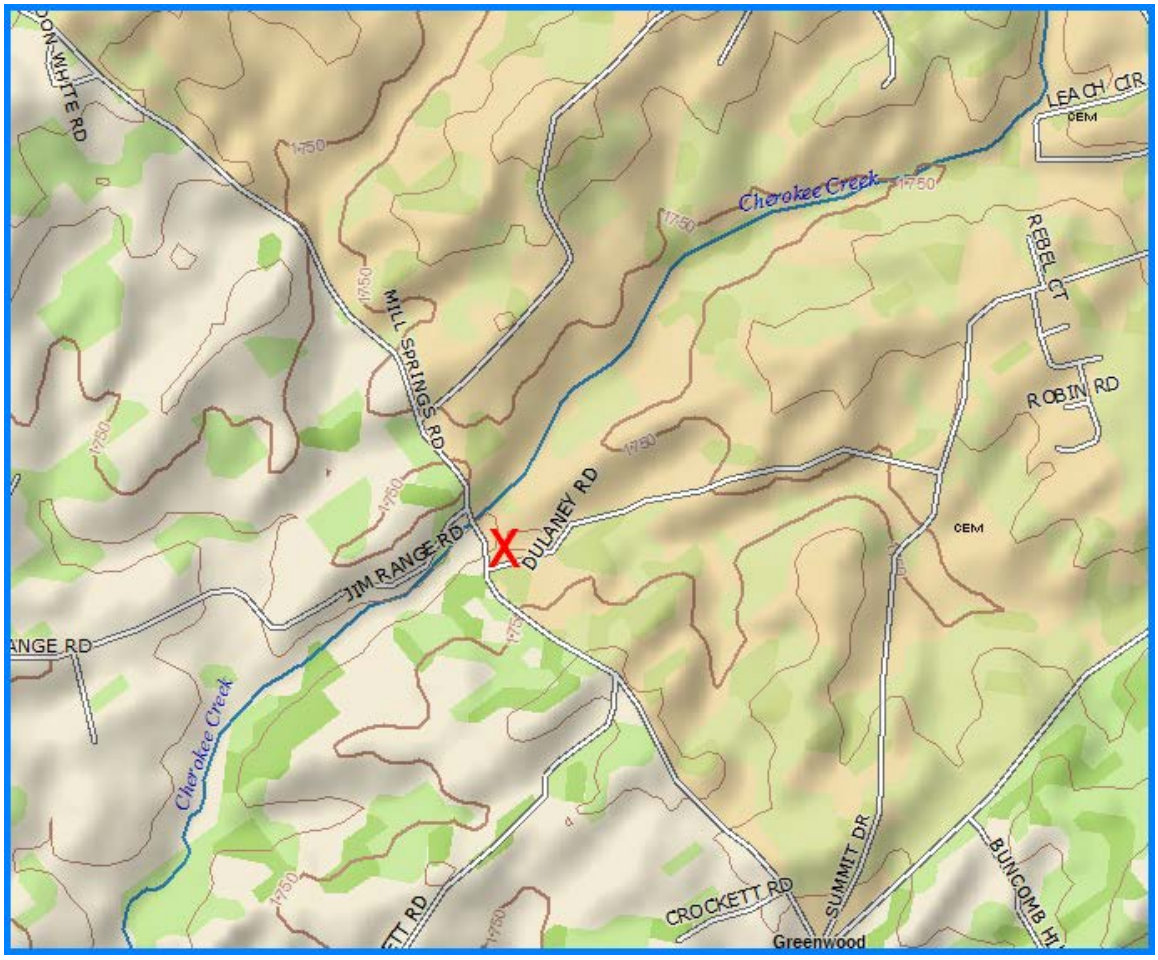
Effort: One backpack unit at 125-150 VAC. Approx. 470 m sample length.

Species Collected:

		No. Collected
Rhinichthys atratulus	Blacknose Dace	very abundant
Semotilus atromaculatus	Creek Chub	common
Etheostoma tennesseense	Tennessee Darter	common
Catostomus commersonii	White Sucker	several
Cottus carolinae	Banded Sculpin	several

Figure 34. Trib. to Cherokee Creek sample area (X)

Coordinates: 36.27147N – 82.43431W



Stream: Trib. to Rock Springs Branch **Date:** 1 August 2014

Field Number: RDB-2014-16 **Quadrangle:** Sullivan Gardens

Coordinates: 36.47103N – 82.54832W **Elevation:** 1,442 ft.

Locality: Figure 35. The site was upstream of driveway off Fiddlers Way in Kingsport. Sullivan Co., TN.

Comments: Observed fairly clean gravel substrate, moderate siltation.

Effort: One backpack unit at 125 VAC. Approx. 100 m sample length.

Species Collected:

		No. Collected
Rhinichthys atratulus	Blacknose Dace	abundant
Semotilus atromaculatus	Creek Chub	abundant

Figure 35. Trib. to Rock Spring Branch sample area (X)

Coordinates: 36.27147N – 82.43431W

Stream: Little Creek **Date:** 17 July 2014

Field Number: RDB-2014-11 **Quadrangle:** Bristol

Coordinates: 36.59315N – 82.18838W **Elevation:** 1,678 ft.

Locality: Figure 36. The site was in Bristol, near the Bristol Justice Center, starting upstream of the Anderson Street (Hwy. 34) bridge crossing and going upstream to the State Street (Hwy. 421) bridge. Sullivan Co., TN.

Comments: Observed rubble, cobble substrate with moderate to heavy siltation and urban debris along stream course.

Effort: One backpack unit at 100-125 VAC. Approx. 350 m sample length.

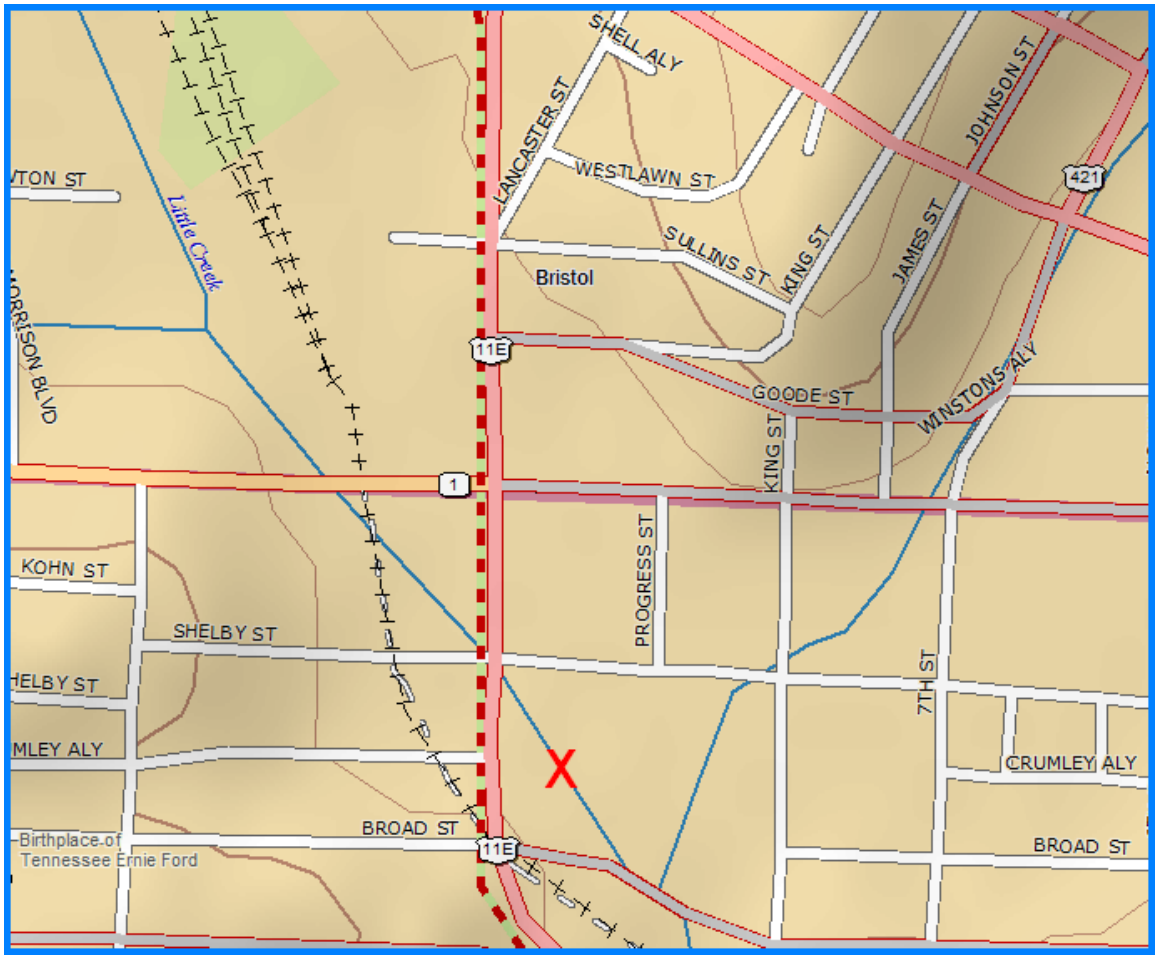
Species Collected:

		No. Collected
Ambloplites rupestris	Rock Bass	~10
Lepomis cyanellus	Green Sunfish	~5
Cyprinella galactura	Whitetail Shiner	several
Notropis rubricroceus	Saffron Shiner	1
Rhinichthys atratulus	Blacknose Dace	abundant
Semotilus atromaculatus	Creek Chub	abundant
Etheostoma blennioides	Greenside Darter	1
Etheostoma simoterum	Snubnose Darter	common
Catostomus commersonii	White Sucker	common
Hypentelium nigricans	Northern Hog Sucker	several
Cottus carolinae	Banded Sculpin	several
Orconectes rusticus *	Rusty Crayfish	very abundant

* new locality record

Figure 36. Little Creek sample area (X)

Coordinates: 36.59315N – 82.18838W



Stream: Nicely Branch **Date:** 1 August 2014

Field Number: RDB-2014-17 **Quadrangle:** Bristol

Coordinates: 36.56149N – 82.12995W **Elevation:** 1,595 ft.

Locality: Figure 37. The site was upstream of the Paperville Road crossing, going upstream for about 200 m. Sullivan Co., TN.

Comments: Observed rubble, cobble substrate with moderate to heavy siltation.

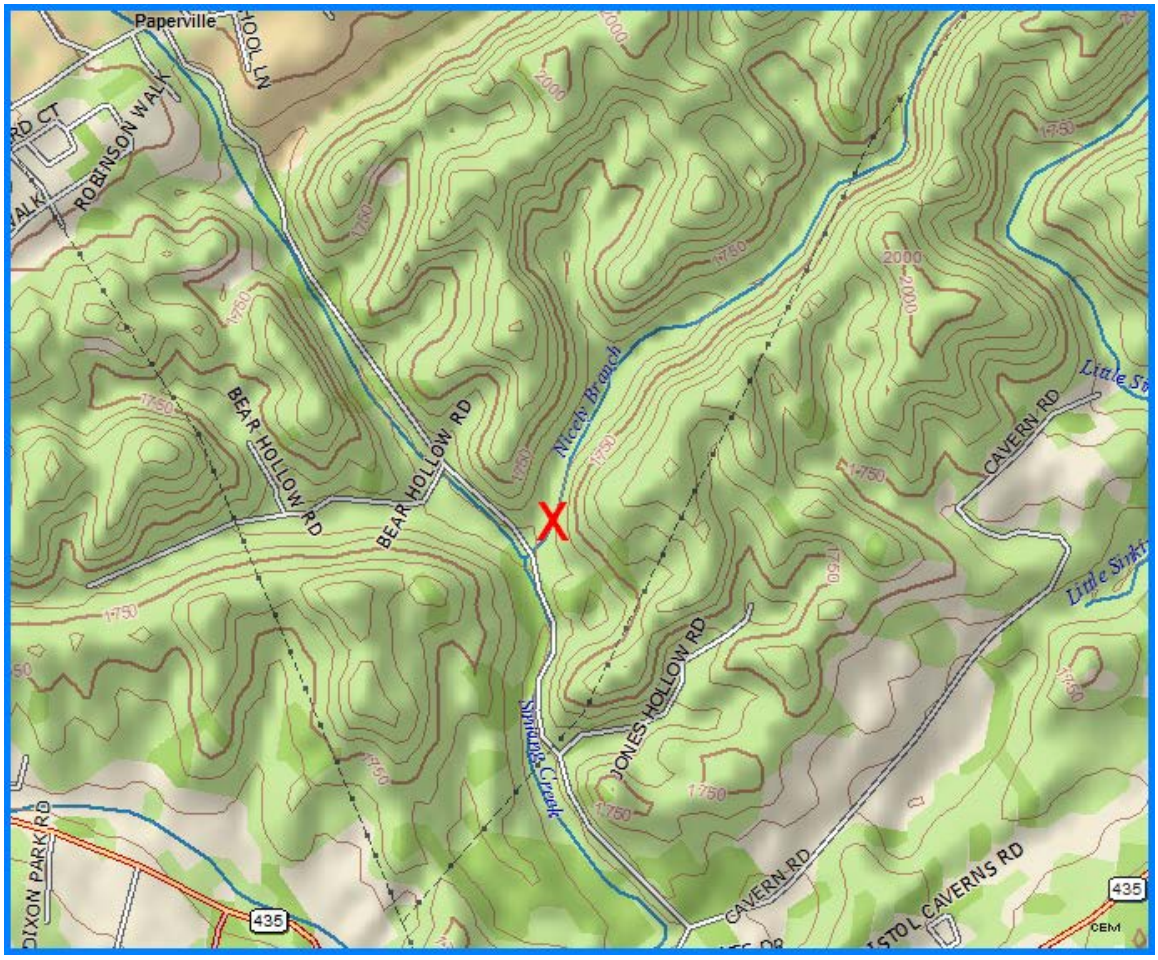
Effort: One backpack unit at 125 VAC. Approx. 200 m sample length.

Species Collected:

		No. Collected
Lepomis macrochirus	Bluegill	few
Campostoma oligolepis	Largescale Stoneroller	common
Luxilus chrysocephalus	Striped Shiner	few
Luxilus coccogenis	Warpaint Shiner	very abundant
Notropis rubricroceus	Saffron Shiner	common
Semotilus atromaculatus	Creek Chub	common
Etheostoma rufilineatum	Redline Darter	5
Etheostoma simoterum	Snubnose Darter	common
Hypentelium nigricans	Northern Hog Sucker	several
Cottus carolinae	Banded Sculpin	1

Figure 37. Nicely Branch sample area (X)

Coordinates: 36.56149N – 82.12995W



Summary

During 2014, we collected 35 fish and four benthic macroinvertebrate samples. These included samples from Little River, Powell River, and Pigeon River. Additionally, seven streams were surveyed for North Cumberland HCP monitoring program and nine to determine current distribution of Tennessee Dace.

Overall, CPUE estimates for black bass and rock bass were down in the Little River during 2014. We only collected a partial sample on the Powell River so comaprisons with previous samples was not attempted.

The IBI surveys for Little River and the Pigeon River changed slightly in most cases when compared to 2013. Most sites retained there IBI designation assigned in the 2013 samples. The most significant increase was observed at the Tannery Island site in the Pigeon River where the score increased 12 points in 2014.

Streams monitored for the HCP were completed and the fourth year of monitoring data for species covered under the plan was generated. We will continue to monitor these select streams over the next three years to establish benchmarks to relate to TWRA's forestry activities in these watersheds.

Efforts to re-assess Tennessee dace distribution in east Tennessee resulted in the collection of the species from four of the nine streams sampled. Two were from historic locations and two represented new records. Three of the historic localities and two other sample sites produced no Tennessee Dace. These efforts also identified new records of the invasive rusty crayfish (*Orconectes rusticus*) .

Over the past several years the stream survey unit has been conducting Index of Biotic Integrity surveys in various watersheds within the region. These have been done in response to requests made by TWRA personnel, cooperative effort requests, and general interest in determining the state of certain streams. Our compilation of these surveys has given us a reference database for many streams in the region that can be used for comparison purposes should we return for a routine survey or responding to a water quality issue. Table 18 lists our results for various streams surveyed during this time period.

Table 18. Index of Biotic Integrity and Benthic Biotic Index scores for samples conducted between 1994 and 2014.

Water	Watershed	Year Surveyed	County	IBI Score	Benthic BI Score
Capuchin Creek	Cumberland River	1994	Campbell	44 (Fair)	3 (Fair/Good)
Trammel Branch	Cumberland River	1994	Campbell	36 (Poor/Fair)	3 (Fair/Good)
Hatfield Creek	Cumberland River	1994	Campbell	42 (Fair)	3 (Fair/Good)
Baird Creek	Cumberland River	1994	Campbell	38 (Poor/Fair)	3 (Fair/Good)
Clear Fork (Site 1)	Cumberland River	1994	Campbell	52 (Good)	3 (Fair/Good)
Clear Fork (Site 2)	Cumberland River	1994	Claiborne	40 (Fair)	N/A
Clear Fork (Site 3)	Cumberland River	1994	Claiborne	24 (Very Poor/Poor)	1 (Poor)
Elk Fork Creek	Clear Fork	1994	Campbell	40 (Fair)	2 (Fair)
Fall Branch	Clear Fork	1994	Campbell	28 (Poor)	1 (Poor)
Crooked Creek	Clear Fork Cumberland River	1994	Campbell	38 (Poor/Fair)	2 (Fair)
Burnt Pone Creek	Clear Fork Cumberland River	1994	Campbell	38 (Poor/Fair)	2 (Fair)
Whistle Creek	Clear Fork Cumberland River	1994	Campbell	38 (Poor/Fair)	2 (Fair)
Little Elk Creek	Clear Fork Cumberland River	1994	Campbell	40 (Fair)	2 (Fair)
Lick Fork	Clear Fork Cumberland River	1994	Campbell	38 (Poor/Fair)	2 (Fair)
Terry Creek	Clear Fork Cumberland River	1994	Campbell	48 (Good)	2 (Fair)
Crouches Creek	Clear Fork Cumberland River	1994	Campbell	28 (Poor)	1 (Poor)
Hickory Creek (Site 1)	Clear Fork Cumberland River	1994	Campbell	46 (Fair/Good)	3 (Fair/Good)
Hickory Creek (Site 2)	Clear Fork Cumberland River	1994	Campbell	48 (Good)	2 (Fair)
White Oak Creek	Clear Fork Cumberland River	1994	Campbell	30 (Poor)	2 (Fair)
No Business Branch	Clear Fork Cumberland River	1994	Campbell	30 (Poor)	3 (Fair/Good)

Table 18. Continued.

Water	Watershed	Year Surveyed	County	IBI Score	Benthic BI Score
Laurel Fork	Clear Fork Cumberland River	1994	Campbell	52 (Good)	3 (Fair/Good)
Lick Creek	Clear Fork Cumberland River	1994	Campbell	44 (Fair)	3 (Fair/Good)
Davis Creek	Clear Fork Cumberland River	1994	Campbell	38 (Poor/Fair)	2 (Fair)
Rock Creek	Clear Fork Cumberland River	1994	Campbell	54 (Good/Excellent)	3 (Fair/Good)
Little Tackett Creek	Clear Fork Cumberland River	1994	Claiborne	28 (Poor)	3 (Fair/Good)
Unnamed tributary to Little Tackett Creek	Clear Fork Cumberland River	1994	Claiborne	0 (No Fish)	3 (Fair/Good)
Rose Creek	Clear Fork Cumberland River	1994	Campbell	36 (Poor/Fair)	2 (Fair)
Rock Creek	Clear Fork Cumberland River	1994	Claiborne	28 (Poor)	2 (Fair)
Tracy Branch	Clear Fork Cumberland River	1994	Claiborne	34 (Poor)	2 (Fair)
Little Yellow Creek (Site 1)	Cumberland River	1994	Claiborne	38 (Poor/Fair)	N/A
Little Yellow Creek (Site 2)	Cumberland River	1994	Claiborne	38 (Poor/Fair)	N/A
Little Yellow Creek (Site 3)	Cumberland River	1994	Claiborne	36 (Poor/Fair)	N/A
Hickory Creek	Clinch River	1995	Knox	46 (Fair/Good)	3 (Fair/Good)
White Creek	Clinch River	1995	Union	34 (Poor) (SC)	4 (Good)
Little Sycamore Creek	Clinch River	1995	Claiborne	40 (Fair)	4.5 (Good/Excel).
Big War Creek	Clinch River	1995	Hancock	50 (Good)	4 (Good)
North Fork Clinch River	Clinch River	1995	Hancock	46 (Fair/Good)	4 (Good)
Old Town Creek (Site 1)	Powell River	1995	Claiborne	40 (Fair)	4 (Good)
Old Town Creek (Site 2)	Powell River	1995	Claiborne	42 (Fair)	4 (Good)
Indian Creek	Powell River	1995	Claiborne	N/A	4 (Good)
Sweetwater Creek	Tennessee River	1995	Loudon	30 (Poor)	3 (Fair/Good)
Burnett Creek	French Broad River	1995	Knox	46 (Fair/Good)	3 (Fair/Good)
Jockey Creek	Nolichucky River	1995	Greene	34 (Poor)	3 (Fair/Good)
South Indian Creek (Sandy Bottoms)	Nolichucky River	1995	Unicoi	38 (Poor/Fair)	4 (Good)
South Indian Creek (Ernestville)	Nolichucky River	1995	Unicoi	44 (Fair)	4 (Good)
Spivey Creek	Nolichucky River	1995	Unicoi	54 (Good/Excellent)	4 (Good)
Little Flat Creek	Holston River	1995	Knox	42 (Fair)	3 (Fair/Good)
Beech Creek	Holston River	1995	Hawkins	48 (Good)	4 (Good)
Big Creek	Holston River	1995	Hawkins	46 (Fair/Good)	4 (Good)
Alexander Creek	Holston River	1995	Hawkins	34 (Poor)	4 (Good)
Thomas Creek	South Fork Holston River	1995	Sullivan	54 (Good/Excellent)	4 (Good)
Hinds Creek	Clinch River	1996	Anderson	36 (Poor/Fair)	3 (Fair/Good)
Cove Creek	Clinch River	1996	Campbell	28 (Poor)	3 (Fair/Good)
Titus Creek	Clinch River	1996	Campbell	42 (Fair)	3 (Fair/Good)
Cloyd Creek	Tennessee River	1996	Loudon	36 (Poor/Fair)	4 (Good)
Sinking Creek	Little Tennessee River	1996	Loudon	34 (Poor)	4 (Good)
Baker Creek	Little Tennessee River	1996	Loudon	26 (Very Poor/Poor)	3 (Fair/Good)
Little Baker Creek	Little Tennessee River	1996	Blount	38 (Poor/Fair)	4 (Good)
Ninemile Creek	Little Tennessee River	1996	Blount	24 (Very Poor/Poor)	4 (Good)
East Fork Little Pigeon River	French Broad River	1996	Sevier	36 (Poor/Fair)	3 (Fair/Good)
Dunn Creek	French Broad River	1996	Sevier	32 (Poor)	4 (Good)
Wilhite Creek	French Broad River	1996	Sevier	44 (Fair)	4 (Good)
Watauga River (above Watauga Res.)	Holston River	1996	Johnson	42 (Fair)	4 (Good)
Stony Fork	Big South Fork	1996	Campbell	38 (Poor/Fair)	4 (Good)
Bullett Creek	Hiwassee River	1997	Monroe	50 (Good)	4.5 (Good/Excel.)
Canoe Branch	Powell River	1997	Claiborne	26 (V Poor/Poor) (SC)	4.7 (Excellent)
Town Creek	Tennessee River	1997	Loudon	34 (Poor)	2 (Fair)
Bat Creek	Little Tennessee River	1997	Monroe	30 (Poor)	1.5 (Poor/Fair)
Island Creek	Little Tennessee River	1997	Monroe	40 (Fair)	4 (Good)
Little Pigeon River	French Broad River	1997	Sevier	40 (Fair)	2 (Fair)
West Prong Little Pigeon River	French Broad River	1997	Sevier	46 (Fair/Good)	2 (Fair)
Flat Creek	French Broad River	1997	Sevier	30 (Poor)	3.8 (Good)
Clear Creek	French Broad River	1997	Jefferson	34 (Poor)	2.2 (Fair)
Richland Creek	Nolichucky River	1997	Greene	30 (Poor)	2.3 (Fair)
Middle Creek	Nolichucky River	1997	Greene	34 (Poor)	4 (Good)
Sinking Creek	Pigeon River	1997	Cocke	30 (Poor)	3.8 (Good)
Chestuee Creek	Hiwassee River	1998	Monroe	28 (Poor)	2.5 (Fair/Fair -Good)
Fourmile Creek	Powell River	1998	Hancock	36 (Poor/Fair)	4.5 (Good/Excel.)
Martin Creek	Powell River	1998	Hancock	50 (Good)	4 (Good)
Big Creek	Tellico River	1998	Monroe	46 (Fair/Good)	4 (Good)
Oven Creek	Nolichucky River	1998	Cocke	40 (Fair)	2.9 (Fair/Good)
Cherokee Creek	Nolichucky River	1998	Washington	36 (Poor/Fair)	2.8 (Fair/Good)
Bennetts Fork	Cumblerland River	2000	Claiborne	30 (Poor)	3.5 (Fair/Good)
Gulf Fork Big Creek	French Broad River	2001	Cocke	42 (Fair)	4.0 (Good)
Nolichucky River	French Broad River	2001	Unicoi	56 (Good/Excellent)	4.0 (Good)
North Fork Holston River	Holston River	2001	Hawkins	50 (Good)	4.5 (Good)
Stinking Creek	Cumberland River	2002	Campbell	42 (Fair)	4.5 (Good)
Straight Fork	Cumberland River	2002	Campbell	18 (Very Poor)	3.0 (Fair/Good)
Montgomery Fork	Cumberland River	2002	Campbell	48 (Good)	3.5 (Fair/Good)
Turkey Creek	Holston River	2003	Hamblen	34 (Poor)	1.5 (Poor)
Spring Creek	Holston River	2003	Hamblen	34 (Poor)	2.2 (Fair)
Cedar Creek	Holston River	2003	Hamblen	30 (Poor)	3.5 (Fair/Good)
Fall Creek	Holston River	2003	Hamblen	32 (Poor)	2.3 (Fair)
Holley Creek	Nolichucky River	2003	Greene	30 (Poor)	2.4 (Fair)

Table 18. Continued.

Water	Watershed	Year Surveyed	County	IBI Score	Benthic BI Score
College Creek	Nolichucky River	2003	Greene	36 (Poor/Fair)	2.2 (Fair)
Kendrick Creek	South Fork Holston River	2004	Sullivan	34 (Poor)	3.8 (Fair/Good-Good)
Sinking Creek	South Fork Holston River	2004	Sullivan	32 (Poor)	3.8 (Fair/Good-Good)
Mud Creek	Nolichucky River	2004	Greene	46 (Fair/Good)	4.0 (Good)
New River (Site 1)	Big South Fork Cumberland River	2004	Anderson	30 (Poor)	4.2 (Good)
New River (Site 2)	Big South Fork Cumberland River	2004	Campbell	42 (Fair)	3.5 (Fair/Good)
Indian Fork	Big South Fork Cumberland River	2004	Anderson	41 (Fair)	3.8 (Fair/Good-Good)
Unnamed Tributary to Taylor Branch	Hiwassee River	2005	Bradley	48 (Good)	4.0 (Good)
Little River (Coulters Bridge)	Tennessee River	2005	Blount	54 (Good/Excellent)	-
Little River (Townsend)	Tennessee River	2005	Blount	48 (Good)	-
Williams Creek	Clinch River	2005	Grainger	42 (Fair)	4.3 (Good)
Beaver Creek (Site 1)	Holston River	2005	Jefferson	38 (Poor/Fair)	2.8 (Fair/Fair-Good)
Beaver Creek (Site 2)	Holston River	2005	Jefferson	30 (Poor)	3.2 (Fair/Good)
Doe Creek	Holston River	2005	Johnson	46 (Fair/Good)	4.0 (Good)
Gap Creek	Nolichucky River	2005	Greene	36 (Poor/Fair)	3.5 (Fair/Good)
Pigeon River (Tannery Island)	French Broad River	2005	Cocke	52 (Good)	2.8 (Fair/Fair-Good)
Pigeon River (Denton)	French Broad River	2005	Cocke	48 (Good)	3.8 (Fair-Good/Good)
Little River (Coulters Bridge)	Tennessee River	2006	Blount	58 (Excellent)	4.2 (Good)
Little River (Townsend)	Tennessee River	2006	Blount	58 (Excellent)	4.7 (Good-Excellent)
Pigeon River (Tannery Island)	French Broad River	2006	Cocke	48 (Good)	3.5 (Fair-Good)
Pigeon River (Denton)	French Broad River	2006	Cocke	50 (Good)	3.8 (Fair-Good/Good)
Pigeon River (Hwy. 73 Bridge)	French Broad River	2006	Cocke	-	3.8 (Fair-Good/Good)
Little River (Coulters Bridge)	Tennessee River	2007	Blount	54 (Good)	3.8 (Fair-Good/Good)
Little River (Townsend)	Tennessee River	2007	Blount	56 (Good/Excellent)	4.0 (Good)
Pigeon River (Tannery Island)	French Broad River	2007	Cocke	54 (Good)	3.7 (Fair-Good/Good)
Pigeon River (Denton)	French Broad River	2007	Cocke	54 (Good)	3.5 (Fair/Good)
Little River (Coulters Bridge)	Tennessee River	2008	Blount	58 (Excellent)	3.8 (Fair-Good/Good)
Little River (Townsend)	Tennessee River	2008	Blount	56 (Good/Excellent)	3.0 (Fair/Good)
Pigeon River (Tannery Island)	French Broad River	2008	Cocke	44 (Fair)	2.0 (Fair)
Pigeon River (Denton)	French Broad River	2008	Cocke	48 (Good)	3.0 (Fair/Good)
Little River (Coulters Bridge)	Tennessee River	2009	Blount	58 (Excellent)	4.3 (Good)
Little River (Townsend)	Tennessee River	2009	Blount	58 (Excellent)	4.5 (Good)
Pigeon River (Tannery Island)	French Broad River	2009	Cocke	48 (Good)	3.0 (Fair/Good) July
Pigeon River (Denton)	French Broad River	2009	Cocke	50 (Good)	3.0 (Fair/Good) July
Pigeon River (Waterville)	French Broad River	2009	Cocke	-	4.5 (Good) March
Pigeon River (Denton)	French Broad River	2009	Cocke	-	4.3 (Good) March
Pigeon River (Tannery Island)	French Broad River	2009	Cocke	-	4.0 (Good) March
Poplar Creek	Clinch River	2009	Anderson	30 (Poor)	3.7 (Fair/Good-Good)
Titus Creek	Clinch River	2009	Campbell	-	4.5 (Good)
Pigeon River (Tannery Island)	French Broad River	2010	Cocke	54 (Good)	4.0 (Good)
Pigeon River (Denton)	French Broad River	2010	Cocke	54 (Good)	3.3 (Fair/Good)
Little River (Coulters Bridge)	Tennessee River	2010	Blount	60 (Excellent)	4.3 (Good)
Little River (Townsend)	Tennessee River	2010	Blount	58 (Excellent)	4.5 (Good/Excellent)
Smoky Creek	New River	2010	Scott	37 (Fair)	3.5 (Fair/Good)
Beech Fork	New River	2010	Campbell	47 (Good)	-
Pigeon River (Tannery Island)	French Broad River	2011	Cocke	50 (Good	2.5 (Fair)
Pigeon River (Denton)	French Broad River	2011	Cocke	54 (Good)	3.3 (Fair/Good)
Little River (Coulters Bridge)	Tennessee River	2011	Blount	58 (Excellent)	4.3 (Good)
Little River (Townsend)	Tennessee River	2011	Blount	50 (Good)	4.3 (Good)
Little River (Coulters Bridge)	Tennessee River	2012	Blount	58 (Excellent)	4.5 (Good)
Little River (Townsend)	Tennessee River	2012	Blount	58 (Excellent)	4.2 (Good)
Cove Creek	Clinch river	2012	Campbell	32 (Poor)	-
Pigeon River (Tannery Island)	French Broad River	2012	Cocke	46 (Good	3.0 (Fair/Good)
Pigeon River (Denton)	French Broad River	2012	Cocke	52 (Good)	4.0 (Good)
Capuchin Creek	Clear Fork Cumberland River	2012	Campbell	38 (Poor/Fair)	-
Little Elk Creek	Clear Fork Cumberland River	2012	Campbell	42 (Fair)	-
Little River (Coulters Bridge)	Tennessee River	2013	Blount	58 (Excellent)	4.5 (Good)
Little River (Townsend)	Tennessee River	2013	Blount	54 (Good/Excellent)	4.6 (Good/Excellent)
Pigeon River (Tannery Island)	French Broad River	2013	Cocke	42 (Good)	3.0 (Fair/Good)
Pigeon River (Denton)	French Broad River	2013	Cocke	56 (Good/Excellent)	4.0 (Good)
Little River (Coulters Bridge)	Tennessee River	2014	Blount	56 (Good/Excellent)	4.2 (Good)
Little River (Townsend)	Tennessee River	2014	Blount	56 (Good/Excellent)	4.0 (Good)
Pigeon River (Tannery Island)	French Broad River	2014	Cocke	54 (Good/Excellent)	2.8 (Fair/Fair-Good)
Pigeon River (Denton)	French Broad River	2014	Cocke	56 (Good/Excellent)	4.0 (Good)

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