2017 Region IV Warmwater Streams and Rivers Fisheries Report

TWRA Fisheries Report No. 19-03

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TENNESSEE WILDLIFE RESOURCES AGENCY

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Cover Photo: Cumberland Arrow Darter *Etheostoma sagitta* in Jennings Creek, TN.

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 methods required are outlined in TWRA Fisheries Operational Plan. Five rivers and 11 streams were sampled and are included in this report. Surveys were conducted from April to December 2017.

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 them 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 GPS.

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

Fish were collected in three different survey types: IBI, standard backpack electrofishing (catch per unit effort [CPUE]), and boat electrofishing (CPUE). During the IBI sampling, 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) used standard backpack electrofishing samples (CPUE) 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 using one backpack electrofishing unit.

Catch-per-unit-effort samples were conducted in three rivers during 2017. 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 CPUE 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 2017 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 ProductsTM 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).

Catch per unit effort analysis was performed for four large rivers sampled during 2017. 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 and those surveyed for Tennessee Dace.

Benthic data collected for the 2017 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 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.

Index of Biotic Integrity Surveys

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 2017 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 13 and 12, 2017, we conducted IBI fish surveys at Tannery Island (PRM 8.2) and Denton (PRM 16.6), respectively (Figure 1).

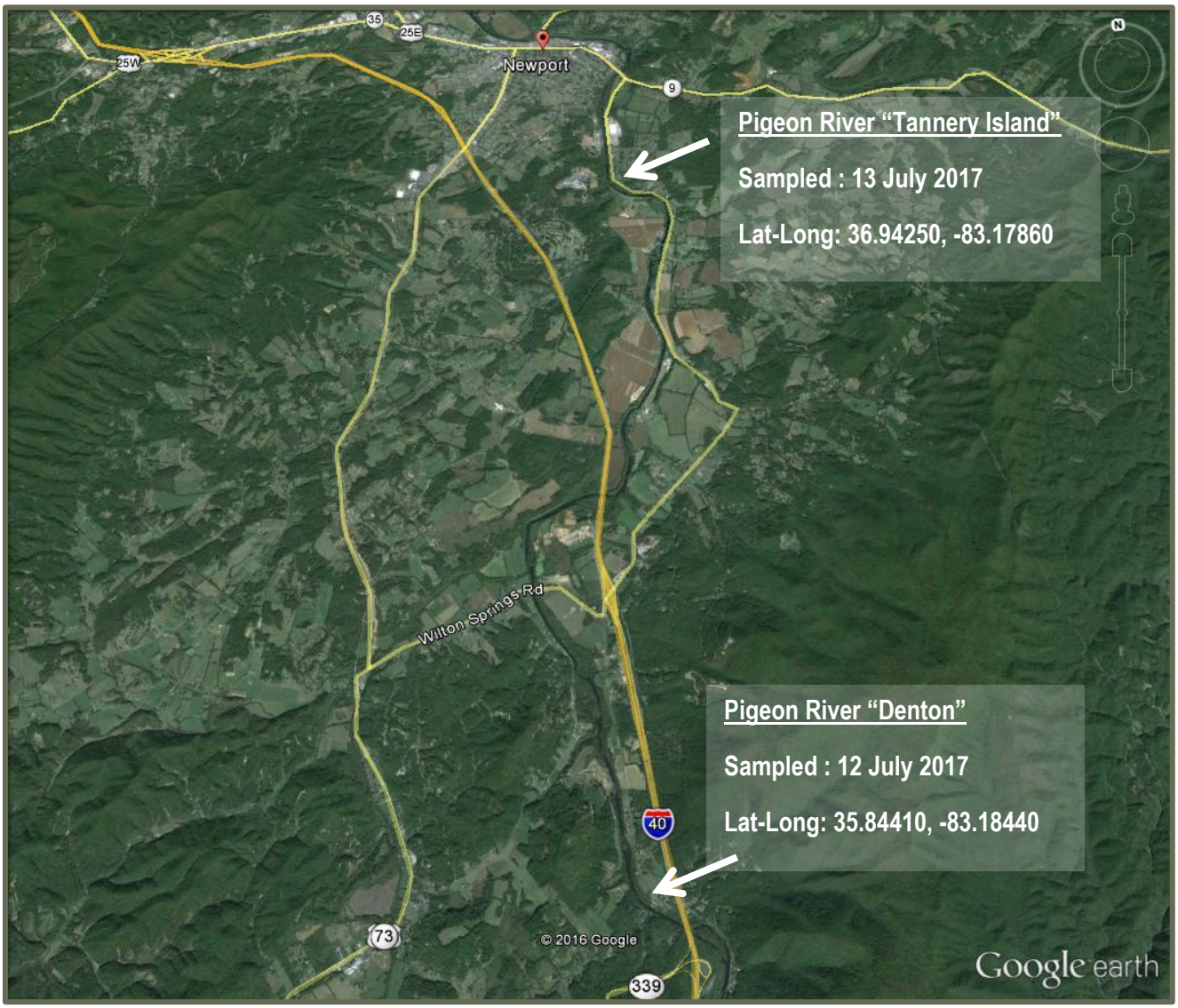

Figure 1. Site locations for the IBI samples conducted in the Pigeon River during 2017.

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 35 fish species were collected at the Tannery Island site and a total of 29 at the Denton site (Table 1). Overall, the IBI analysis indicated the fish community was in "fair/good" condition at Tannery Island (IBI score 46; Figure 2). This is a decrease from previous years and lower than the 10 year average of 48. The condition of the fish community assessed "good" at the Denton site in 2015 (IBI score 48), however, is below the 10 year average of 52, and is the second lowest score over these past 10 years (Figure 2).

Table 1. Fish species collected from the Pigeon River at Tannery Island and Denton 2017.

		Number of fish	
Common name	Scientific name	Tannery Island	Denton
Banded Darter	*Etheostoma zonale*	4	0
Banded Sculpin	*Cottus carolinae*	477	45
Bigeye Chub	*Hybopsis amblops*	26	4
Black Buffalo	*Ictiobus niger*	7	3
Black Redhorse	*Moxostoma duquesnei*	28	36
Bluegill	*Lepomis macrochirus*	32	4
Channel Catfish	*Ictalurus punctatus*	3	2
Flathead Catfish	*Pylodictis olivaris*	1	0
Freshwater Drum	*Aplodinotus grunniens*	1	1
Gilt Darter	*Percina evides*	3	0
Gizzard Shad	*Dorosoma cepedianum*	66	201
Golden Redhorse	*Moxostoma erythrurum*	7	7
Green Sunfish	*Lepomis cyanellus*	4	2
Greenside Darter	*Etheostoma blennioides*	87	11
Highland Shiner	*Notropis micropteryx*	7	5
Largescale Stoneroller	*Campostoma oligolepis*	39	18
Logperch	*Percina caprodes*	8	1
Mountain Brook Lamprey	*Ichthyomyzon greeleyi*	0	5
Northern Hog Sucker	*Hypentelium nigricans*	21	24
Northern Studfish	*Fundulus catenatus*	0	1
Ohio Lamprey	*Ichthyomyzon bdellium*	1	2
Redbreast Sunfish	*Lepomis auritus*	52	53
Redline Darter	*Etheostoma rufilineatum*	431	187
River Redhorse	*Moxostoma carinatum*	4	0
Rock Bass	*Ambloplites rupestris*	9	44

Table 1 continued

Common name	Scientific name	Number of fish	
		Tannery Island	Denton
Silver Redhorse	*Moxostoma anisurum*	1	0
Silver Shiner	*Notropis photogenis*	8	0
Smallmouth Bass	*Micropterus dolomieu*	9	43
Smallmouth Buffalo	*Ictiobus bubalus*	2	6
Smallmouth Redhorse	*Moxostoma breviceps*	7	3
Spotfin Shiner	*Cyprinella spiloptera*	18	0
Stripetail Darter	*Etheostoma kennicotti*	8	0
Telescope Shiner	*Notropis telescopus*	20	30
Tennessee Darter	*Etheostoma tennesseense*	32	23
Walleye	*Sander vitreum*	0	3
Western Mosquitofish	*Gambusia affinis*	1	0
Whitetail Shiner	*Cyprinella galactura*	9	66
Yellow Bullhead	*Ameiurus natalis*	4	1

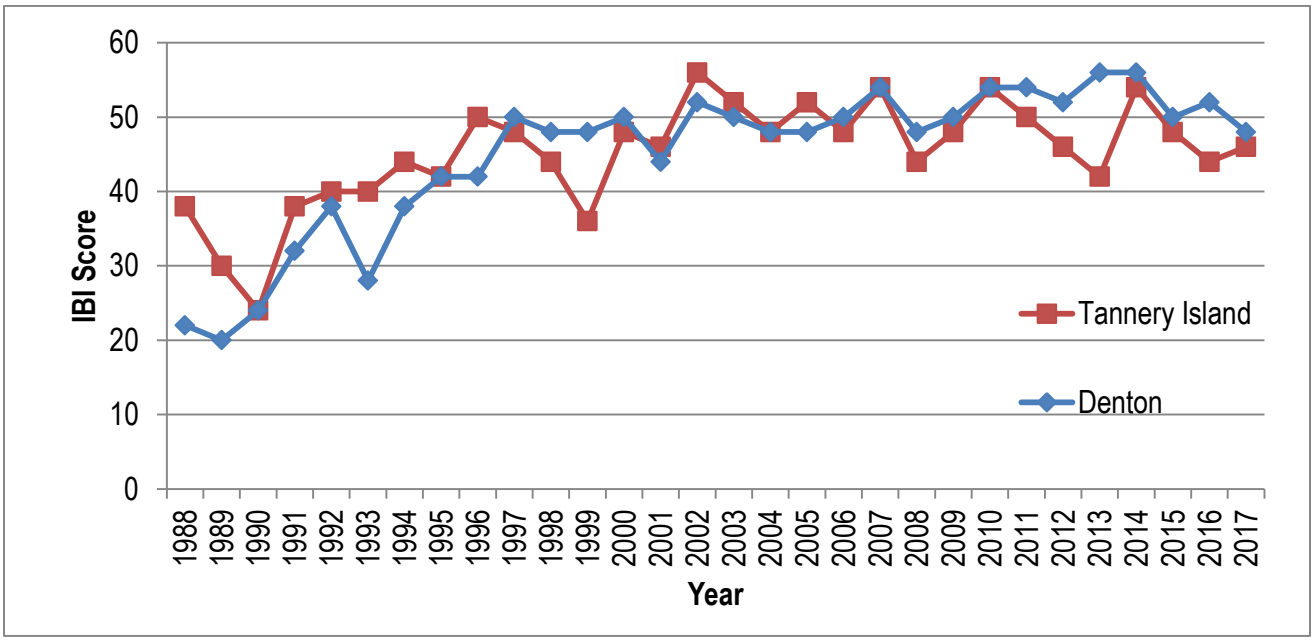

Figure 2. Trends in Index of Biotic Integrity (IBI) at two stations on the Pigeon River (1988-2017).

Benthic macroinvertebrates collected at the Tannery Island site comprised 35 families representing 44 identified genera (Table 2). The most abundant group in our collection was the true flies (Diptera) comprising 24.9% of the total sample. Overall, a total of 44 taxa were identified from the sample of which 13 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/Good" (3.5).

Table 2. Taxa list and associated biotic statistics for benthic macroinvertebrates collected from the Pigeon River at Tannery Island 2017.

		Genus species	Number	Percentage
ANNELIDA				1.9
	Oligochaeta		6	
COLEOPTERA				3.1
	Dytiscidae	*Neoporus clypialis* adult	1	
	Elmidae	*Ancyronyx variegatus* adult	1	
	Elmidae	larva early instar	1	
	Elmidae	*Macronychus glabratus* adults	6	
	Haliplidae	*Peltodytes lengi* adult	1	
DIPTERA				24.9
	Chironomidae	mostly larvae, a few pupae	61	
	Simuliidae		19	
EPHEMEROPTERA				15.3
	Baetidae	undetermined	6	
		Acentrella	1	
		Heterocloeon	6	
		Labiobaetis	1	
	Ephemerellidae	*Teloganopsis deficiens*	1	
	Heptageniidae	*Maccaffertium* early instars	14	
		Maccaffertium mediopunctatum	10	
		Maccaffertium modestum	1	
	Isonychiidae	*Isonychia*	9	
GASTROPODA				8.1
	Ancylidae	*Ferrissia*	4	
	Lymnaeidae		1	
	Physidae		2	
	Planorbidae		4	
	Pleuroceridae	*Leptoxis*	5	
		Pleurocera spiraled striped form	6	
		Pleurocera yellow concolorous form	4	
HETEROPTERA				2.2
	Corixidae nymph		1	
	Gerridae	*Metrobates hesperius* nymph	1	
	Veliidae	*Rhagovelia obesa* nymphs	5	
HOPELONEMERTEA				0.6
	Tetrastemmatidae	*Prostoma*	2	
HYDRACARINA			7	2.2
ISOPODA				2.2
	Asellidae	*Caecidotea*	7	
MEGALOPTERA				3.4
	Corydalidae	*Corydalus cornutus*	9	
		Nigronia serricornis	2	
ODONATA				13.1

Table 2 continued

		Genus species	Number	Percentage
	Aeshnidae	*Boyeria vinosa*	6	
	Calopterygidae	*Hetaerina americana*	19	
	Coenagrionidae	*Argia*	6	
		Enallagma	2	
	Corduliidae	*Neurocordulia yamaskanensis*	1	
	Gomphidae	*Dromogomphus spinosus*	1	
		Hagenius brevistylus	4	
	Macomiidae	*Macromia*	3	
PELECYPODA				1.9
	Corbiculidae	*Corbicula fluminea*	6	
PLECOPTERA				0.3
	Pteronarcyidae	*Pteronarcys dorsata*	1	
TRICHOPTERA				15.9
	Brachycentridae	*Brachycentrus lateralis*	4	
	Hydropsychidae pupae		2	
	Hydropsychidae	*Ceratopsyche morosa*	12	
		Cheumatopsyche	28	
	Lepidostomatidae	*Lepidostoma*	2	
	Leptoceridae	*Oecetis avara*	3	
TURBELLARIA			16	5.0
		TOTAL	321	

Benthic macroinvertebrates collected at the Denton site comprised 30 families representing 42 identified genera (Table 3). The most abundant groups in our collection were the mayflies (Ephemeroptera) comprising about 27.9% of the total sample. Overall, a total of 42 taxa were identified from the sample of which 15 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" (3.5).

Table 3. Taxa list and associated biotic statistics for benthic macroinvertebrates collected from the Pigeon River at Denton 2017.

		Genus species	Number	Percentage
AMPHIPODA			3	1.1
ANNILIDA				0.7
	Oligochaeta		2	
COLEOPTERA				17.1
	Dryopidae	*Helichus* adults	7	
	Elmidae	*Ancyronyx varigatus* adult	1	
		Macronychus glabratus larvae & adults	16	
		Promoresia elegans adult	1	
	Gyrinidae	*Dineutus disclor* females	3	
		Dineutus larvae	3	
		Gyrinus analis adults	15	
DIPTERA				10.8
	Chironomidae		21	
	Simuliidae		7	
	Tipulidae	*Tipula*	1	
EPHEMEROPTERA				27.9
	Baetidae early instars		6	
		Acentrella	4	
		Baetis	2	
		Heterocloeon	5	
		Iswaeon	1	
	Ephemerellidae	*Teloganopsis deficiens*	4	
	Heptageniidae	*Maccaffertium* early instars	27	
		Maccaffertium ithaca	4	
		Maccaffertium mediopunctatum	7	
	Isonychiidae	*Isonychia*	15	
GASTROPODA				3.0
	Ancylidae	*Ferrissia*	4	
	Pleuroceridae	*Leptoxis*	2	
		Pleurocera	2	
HETEROPTERA				1.1
	Gerridae	*Metrobates hesperimanus*	3	
HYDRACARINA			4	1.5
ISOPODA				
	Asellidae	*Caecidotea*	19	7.1
LEPIDOPTERA				0.4
	Pyralidae		1	
MEGALOPTERA				4.1
	Corydalidae	*Corydalus cornutus*	9	
		Nigronia serricornis	2	
ODONATA				6.3
	Aeshnidae	*Boyeria vinosa*	9	
	Calopterygidae	*Hetaerina americana*	2	

Table 3. Continued

		Genus species	Number	Percentage
	Coenagrionidae	*Argia sp* undetermined	3	
		Argia moesta	1	
		Argia translata	2	
PELECYPODA				2.6
	Corbiculidae	*Corbicula fluminea*	6	
	Sphaeriidae	*Psidium*	1	
PLECOPTERA				0.4
	Perlidae	*Acroneuria abnormis*	1	
TRICHOPTERA				15.6
	Hydropsychidae	*Ceratopsyche morosa*	14	
		Ceratopsyche sparna	2	
		Cheumatopsyche	21	
	Hydroptilidae	*Hydroptila* larvae and pupa	3	
	Lepidostomatidae	*Lepidostoma*	1	
	Polycentropodidae	*Polycentropus*	1	
TURBELLARIA			1	0.4
		TOTAL	269	

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. Reintroduction of select fish species occurs annually through efforts by the University of Tennessee, Tennessee Department of Environment and Conservation, and North Carolina Wildlife Resources Commission. Over the past several years, we have had drought like conditions, which could be attributing to the recent downward trend in IBI scores. TWRA is also partnering with University of Tennessee (UT) as part of the Pigeon River Recovery Program to help restore native species within the Pigeon River. UT has asked us to consider stocking muskellunge within the Pigeon as part of this program. Muskellunge were not physically documented here, but it is thought they were within the Pigeon due to their documentation in adjacent watersheds.

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—particularly muskellunge.
4. Continue stocking between the powerhouse and Bluffton with Rainbow Trout when available.
5. Monitor temperature to determine if the water temperature is within acceptable ranges for native species, particularly at low flow.

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 km2 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 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


Little River

(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.


Stoneroller

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 2017 survey of Little River consisted of two IBI sites (Coulters Bridge and Townsend). We cooperated with several agencies in conducting the two IBI samples between July 11 and 14, respectively. The Coulters Bridge site is located in the Ridge and Valley Province of Blount County while the Townsend site lies in the transitional zone between the Blue Ridge and the Ridge and Valley Provinces (Figure 3).

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).

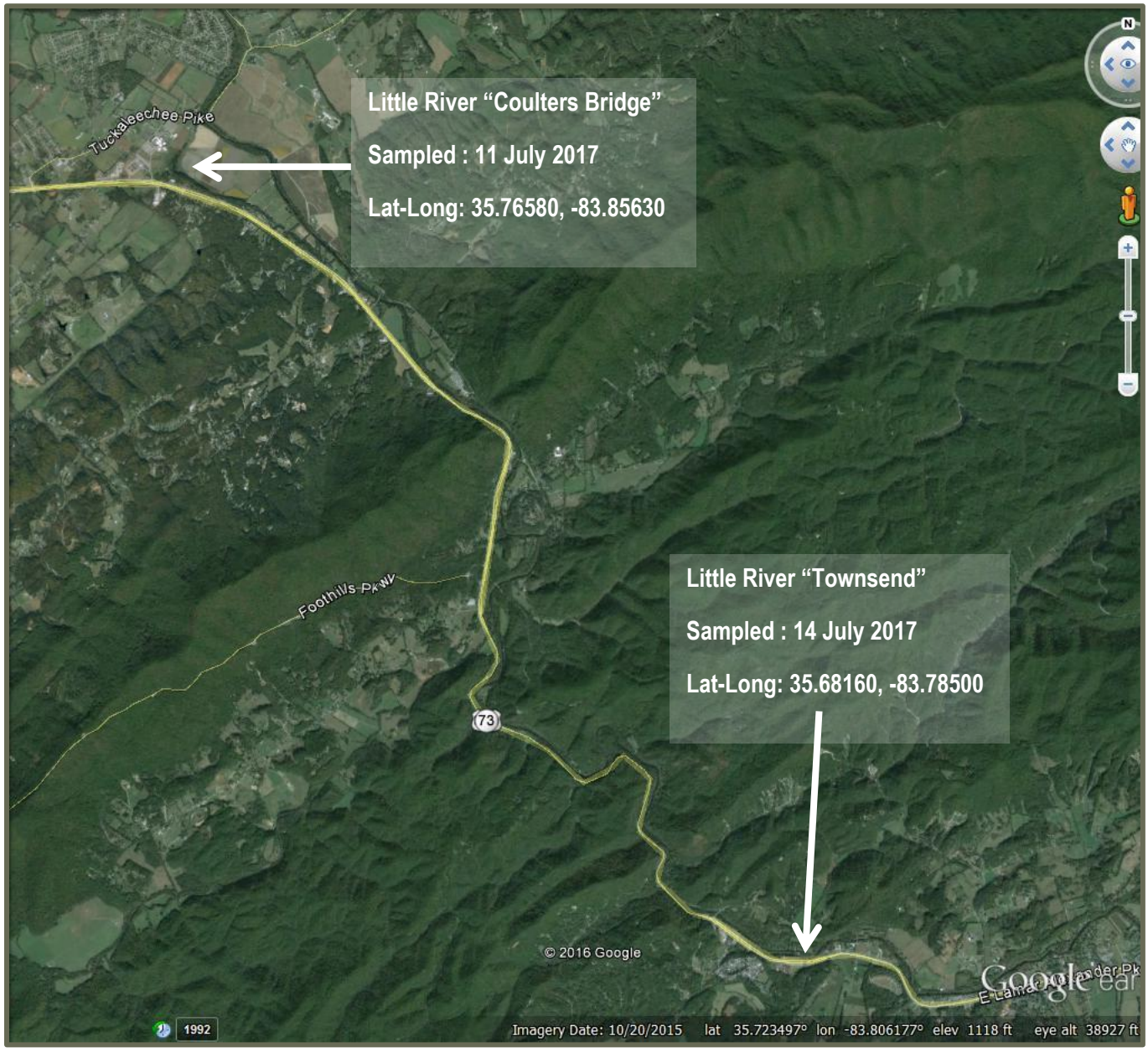

Figure 3. Site locations for samples conducted in Little River during 2017.

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 debris 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.

Results

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 2017, one at Coulters Bridge (river mile 20) and one at Townsend (river mile 29.8). A total of 47 fish species were collected at the Coulters Bridge site and 29 at Townsend. Overall, the IBI analysis indicated the fish community was in excellent condition at Coulters Bridge (IBI score 58). This is just above the 10 year average of 57.6 (excellent). At the upper most station, Townsend, the stream rated good receiving a score of 52. This was a slight decrease of from the previous sample (Figure 4), and below the 10 year average of 55.2. Several rare or endangered species of fish inhabit Little River, and thus, the protection of the watershed is a high priority for managing agencies and local conservation groups. Table 4 lists fish species collected at the Coulters Bridge and Townsend sites.

Table 4. Fish species collected from Little River at Coulter Bridge and Townsend 2017.

		Number of fish	
Common name	Scientific name	Coulters	Townsend
American Brook Lamprey	*Lethenteron appendix*	2	20
Banded Darter	*Etheostoma zonale*	4	7
Banded Sculpin	*Cottus carolinae*	23	25
Bigeye Chub	*Hybopsis amblops*	11	16
Black Redhorse	*Moxostoma duquesnei*	52	33
Bluebreast Darter	*Etheostoma camurum*	1	0
Bluegill	*Lepomis macrochirus*	7	33
Blueside Darter	*Etheostoma jessiae*	28	0
Channel Catfish	*Ictalurus punctatus*	1	0
Common Carp	*Cyprinus carpio*	3	0
Flathead Catfish	*Pylodictis olivaris*	1	0

Table 4 continued.

Common name	Scientific name	Number of fish	
		Coulters	Townsend
Gilt Darter	*Percina evides*	4	0
Golden Redhorse	*Moxostoma erythrurum*	40	0
Green Sunfish	*Lepomis cyanellus*	1	2
Greenside Darter	*Etheostoma blennioides*	15	6
Highland Shiner	*Notropis micropteryx*	72	28
Largemouth Bass	*Micropterus salmoides*	1	0
Largescale Stoneroller	*Campostoma oligolepis*	27	20
Logperch	*Percina caprodes*	11	0
Longnose Gar	*Lepisosteus osseus*	3	0
Mimic Shiner	*Notropis volucellus*	56	5
Mountain Brook Lamprey	*Ichthyomyzon greeleyi*	1	7
Mountain Shiner	*Lythrurus lirus*	20	12
Northern Hog Sucker	*Hypentelium nigricans*	7	23
Northern Studfish	*Fundulus catenatus*	3	9
Rainbow Trout	*Oncorhynchus mykiss*	0	1
Redbreast Sunfish	*Lepomis auritus*	41	1
Redline Darter	*Etheostoma rufilineatum*	247	30
River Chub	*Nocomis micropogon*	11	25
River Redhorse	*Moxostoma carinatum*	11	0
Rock Bass	*Ambloplites rupestris*	42	57
Sickle Darter	*Percina williamsi*	4	0
Silver Redhorse	*Moxostoma anisurum*	7	0
Silver Shiner	*Notropis photogenis*	5	11
Smallmouth Bass	*Micropterus dolomieu*	3	12
Smallmouth Redhorse	*Moxostoma breviceps*	2	0
Spotfin Shiner	*Cyprinella spiloptera*	10	1
Spotted Bass	*Micropterus punctulatus*	3	0
Stargazing Minnow	*Phenacobius uranops*	1	0
Striped Shiner	*Luxilus chrysocephalus*	13	0
Tangerine Darter	*Percina aurantiaca*	8	0
Telescope Shiner	*Notropis telescopus*	20	126
Tennessee Darter	*Etheostoma tennesseense*	16	15
Tennessee Shiner	*Notropis leuciodus*	43	63
Warpaint Shiner	*Luxilus coccogenis*	6	67
Western Mosquitofish	*Gambusia affinis*	3	0
Whitetail Shiner	*Cyprinella galactura*	63	160
Yellow Bullhead	*Ameiurus natalis*	6	1

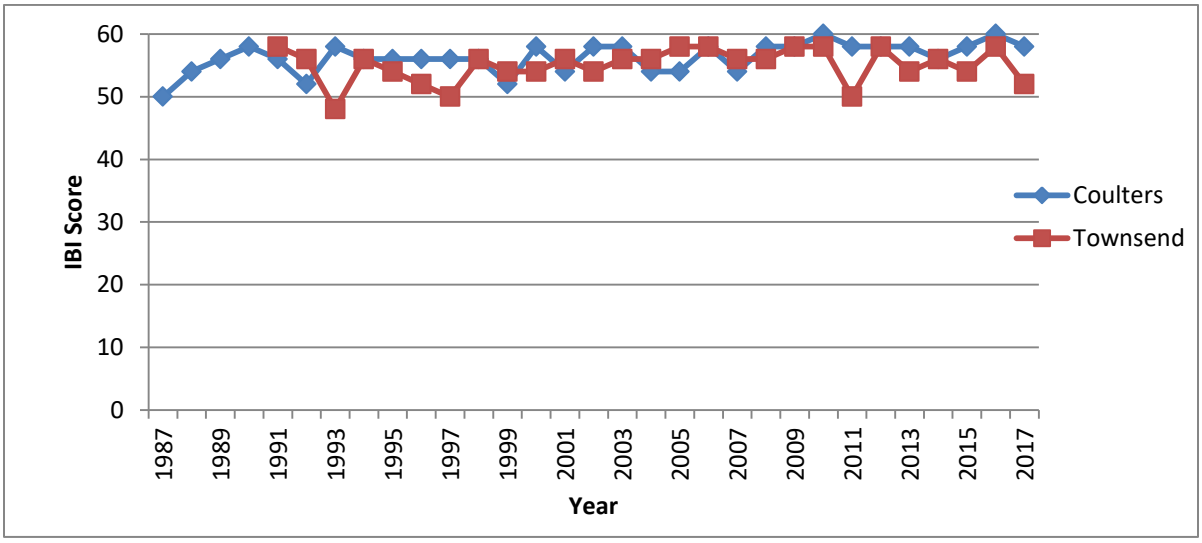

Figure 4. Trends in the Index of Biotic Integrity (IBI) at two stations in Little River (1987-2017).

Benthic macroinvertebrates collected in our sample at Coulters Bridge comprised 34 families representing 53 identified genera (Table 5). The most abundant group in our collection was the mayflies, Ephemeroptera, comprising 37.0% of the total sample. Overall, a total of 53 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 the Little River at Coulters Bridge 2017.

		Genus species	Number	Percentage
AMPHIPODA			3	0.8
ANNELIDA				1.8
	Oligochaeta		7	
COLEOPTERA				13.3
	Dryopidae	*Helichus adults*	8	
	Elmidae	*Macronychus glabratus* adults	4	
		Microcylloepus larva	1	
		Optioservus trivitatus adults	16	
		Promoresia elegans adults & larvae	12	
		Stenelmis larva	1	
	Gyrinidae	*Dineutus discolor* adults	4	
	Halplidae	*Peltodytes lengi* adult	1	
	Hydrophilidae	*Berosus sayi* adult female	1	
	Psephenidae	*Psephenus herricki* larvae	3	
DIPTERA				15.9
	Chironomidae		36	
	Simuliidae		23	
	Tipulidae	*Tipula*	2	
EPHEMEROPTERA				37.0
	Baetidae	early instars	19	
		Acentrella	3	
		Baetis	5	
		Iswaeon	4	
		Labiobaetis	4	
	Ephemerellidae	*Teloganopsis deficiens*	11	
	Heptageniidae	*Epeorus* early instar	1	
		Leucrocuta	2	
		Maccaffertium early instars	23	
		Maccaffertium mediopunctatum	5	
		Maccaffertium modestum	1	
		Stenacron interpunctatum	6	
		Tricorythodes	7	
	Isonychiidae	*Isonychia*	51	
GASTROPODA				5.2
	Physidae		3	
	Pleuroceridae	*Leptoxis*	10	
		Pleurocera	7	
HETEROPTERA				0.5
	Nepidae	*Ranatra* nymph	1	
	Veliidae	*Rhagovelia obesa* nymph	1	
MEGALOPTERA				2.1
	Corydalidae	*Corydalus cornutus*	8	

Table 5 continued

		Genus species	Number	Percentage
ODONATA				8.3
	Aeshnidae	*Basiaeschna janata*	1	
		Boyeria vinosa	7	
	Calopterygidae	*Hetaerina americana*	10	
	Corduliidae	*Helocordulia selysii*	1	
	Gomphidae	*Dromogomphus spinosus*	4	
		Hagenius brevistylus	5	
		Stylogomphus albistylus	2	
	Macromiidae	*Macromia*	2	
PELECYPODA				1.8
	Corbiculidae	*Corbicula fluminea*	5	
	Sphaeriidae	*Pisidium*	2	
PLECOPTERA				1.8
	Perlidae	*Perlesta shabuta*	5	
		Perlinella early instar	1	
	Pteronarcyidae	*Pteronarcys dorsata*	1	
TRICHOPTERA				11.5
	Brachycentridae	*Brachycentrus lateralis*	3	
	Hydropsychidae	*Ceratopsyche morosa*	3	
		Cheumatopsyche	16	
		Hydropsyche early instars	6	
		Hydropsyche venularis	5	
	Leptoceridae	*Triaenodes injusta*	1	
	Philopotamidae	*Chimara*	8	
	Polycentropodidae	*Polycentropus*	2	
		TOTAL	384	

Benthic macroinvertebrates collected in our sample at Townsend comprised 36 families representing 66 identified genera (Table 6). The most abundant group in our collection was the mayflies, Ephemeroptera comprising 30.4% of the total sample. Overall, a total of 66 taxa were identified from the sample of which 33 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” (4.3).

Table 6. Taxa list and associated biotic statistics for benthic macroinvertebrates collected from the Little River at Townsend 2017.

		Genus species	Number	Percentage
AMPHIPODA			3	1.0
ANNELIDA				1.0
	Oligochaeta		3	
COLEOPTERA				16.2
	Dryopidae	*Helichus* adults	6	
	Elmidae	*Dubiraphia* adults	2	
		Macronychus glabratus adults	6	
		Optioservus larva	1	
		Optioservus trivittatus adults	2	
		Promoresia elegans larvae & adults	21	
		Stenelmis larva	1	
	Hydrophilidae	*Cymbiodyta* adult	1	
	Psephenidae	*Psephenus herricki* larvae	8	
DIPTERA				11.1
	Athericidae	*Atherix lantha*	4	
	Chironomidae		23	
	Empididae		3	
	Simuliidae		2	
	Tabanidae	*Chrysops*	1	
EPHEMEROPTERA				30.4
	Baetidae early instars		17	
		Acentrella	3	
		Baetis	5	
		Iswaeon	1	
		Labiobaetis	2	
		Procloeon	1	
	Caenidae	*Caenis*	2	
	Ephemerellidae	*Eurylophella*	2	
		Serratella	4	
	Ephermidae	*Hexagenia*	1	
	Heptageniidae	*Heptagenia*	2	
		Leucrocuta	3	
		Maccaffertium early instars	13	
		Maccaffertium ithaca	1	
		Maccaffertium mediopunctatum	3	
		Maccaffertium modestum	1	
		Stenacron pallidum	1	
	Isonychiidae	*Isonychia*	24	
	Leptohyphidae	*Tricorythodes*	4	
GASTROPODA				1.7
	Pleuroceridae	*Leptoxis*	2	
		Pleurocera	3	

Table 6 continued

		Genus species	Number	Percentage
HETEROPTERA				1.0
	Veliidae	*Rhagovelia obesa* nymphs	3	
HYDRACARINA			4	1.4
MEGALOPTERA				2.4
	Corydalidae	*Corydalus cornutus*	6	
		Nigronia serricornis	1	
ODONATA				6.1
	Aeshnidae	*Boyeria vinosa*	6	
	Calopterygidae	*Hetaerina americana*	2	
	Coenagrionidae	*Argia moesta*	1	
	Gomphidae early instar		1	
		Hagenius brevistylus	1	
		Lanthus early instar	1	
		Phanogomphus lividus	2	
		Phanogomphus quadricolor	1	
		Stenogomphus rogersi	1	
		Stylogomphus albistylus	1	
	Macromiidae	*Macromia*	1	
PELECYPODA				1.7
	Corbiculidae	*Corbicula fluminea*	5	
PLECOPTERA				1.4
	Leuctridae	*Leuctra*	1	
	Peltoperlidae	*Peltoperla*	1	
	Perlidae	*Perlesta*	2	
TRICHOPTERA				24.3
	Brachycentridae	*Brachycentrus lateralis*	6	
		Micrasema rickeri	2	
		Micrasema wataga	6	
	Hydropsychidae	*Ceratopsyche morosa*	13	
		Ceratopsyche sparna	1	
		Cheumatopsyche	19	
		Hydropsyche venularis	10	
	Leptoceridae	*Nectopsyche exquisita*	1	
		Oecetis	2	
		Triaenodes ignita	5	
		Triaenodes perna	2	
	Philopotamidae	*Chimara*	2	
	Polycentropodidae	*Polycentropus*	3	
TURBELLARIA			1	0.3
		TOTAL	296	

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 anglers 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.
3. Conduct an angler survey periodically.

North Cumberland Habitat Conservation Plan Monitoring

Introduction

The development of a comprehensive forest resource Habitat Conservation Plan (HCP) has been an ongoing effort for the Tennessee Wildlife Resources Agency. This collaboration between TWRA, USFWS and several other governmental and academic groups has focused on developing a plan to determine "take" of species listed in the plan in relation TWRA's forestry practices and formulate mitigation strategies should this occur. The goal of this plan is to allow the Agency to qualify for USFWS grant funding to purchase land within the project area.

Our involvement with the development of the plan was to address aquatic issues and strategies regarding TWRA's forest resource management and the means by which the Agency could evaluate "take" for listed fish species. The following stream accounts encompass monitoring efforts undertaken to evaluate TWRA's forestry activities in watersheds that have harvest compartments identified. This data will be used to establish benchmarks for these populations and serve as the standard by which influences from land use practices can be determined.

The surveys conducted in 2017 marked the seventh year of baseline monitoring for the streams identified in the plan. Figure 5 illustrates the location of the monitoring streams in relation to the managed compartments and HCP reserves (no action).

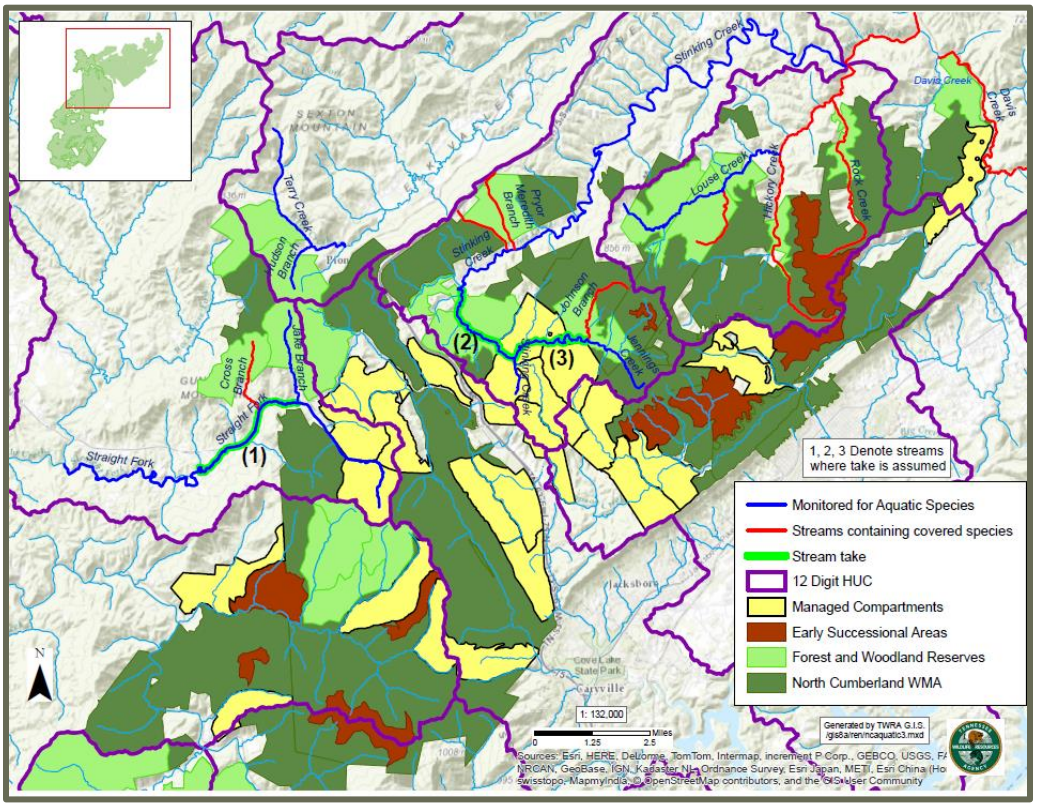

Figure 4. North Cumberland Habitat Conservation Plan monitoring streams.

Study Area and Methods

Seven streams were selected as part of the aquatic monitoring program for the HCP. These include Straight Fork and Jake Branch in the New River drainage and Terry Creek, Hudson Branch, Stinking Creek, Jennings Creek, and Louse Creek in the Clear Fork Cumberland drainage. Figure 6 depicts these survey sites and their geographical relationship to each other.

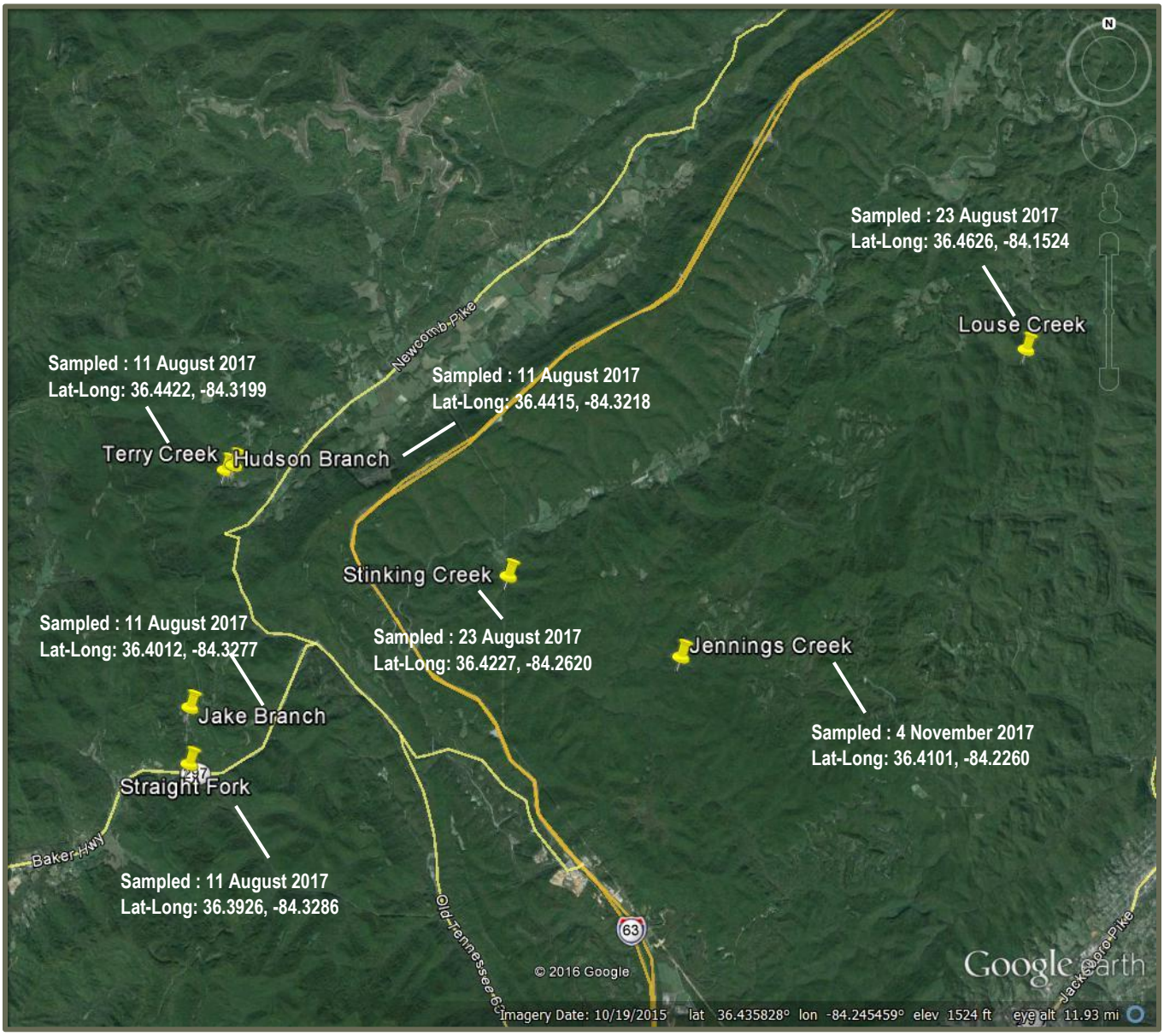

Figure 6. North Cumberland Habitat Conservation Plan monitoring site distribution.

We conducted surveys for Straight Fork, Jake Branch, Hudson Branch and Terry Creek on 11 August 2017; Stinking Creek and Louse Creek on 23 August 2017; and Jennings Creek on 4 November 2017. Our survey reaches

ranged from 100 to 200 meters in length. We surveyed each site with one backpack electrofishing unit, recording our total electrofishing time. Standard backpack electrofishing units operating at or between 150 and 300 volts were used to stun fish during 2017. Where Blackside Dace were present, DC current was used to capture fish. 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 each site included conductivity, pH and temperature. Physical habitat features were visually evaluated at each site.

Results

Blackside Dace and Cumberland Arrow Darter populations continue to ebb and flow as see in below figures (Figures 7-13). Data is consistent with previous six years and TWRA is committed to continuing these monitoring efforts until the plan is finalized. The monitoring efforts conducted thus far will provide useful data to support the HCP plan as well as provide benchmark data for activities in the region (e.g. coal mining) where these species may be impacted. Collected data has already been utilized by the USFWS to address permitting request for coal mining activities within the region. Temperature (C), Conductivity (µs/cm), pH, habitat score and effort (s) can be found in Table 7 for 2017.

Table 7. Water quality, habitat score, and electrofishing effort for seven streams monitored as part of the North Cumberland Habitat Conservation Plan 2017. Jennings Creek sampling was in November while all others sampled in August.

Stream	Temperature (C)	Conductivity (µs/cm)	pH	Habitat Score	Electrofishing Effort (Seconds)
Straight Fork	19.6	141.8	7.0	99	1365
Jake Branch	19.7	186.1	7.0	117	1287
Hudson Branch	20.7	68.0	7.0	122	1332
Terry Creek	20.4	88.9	7.0	117	760
Stinking Creek	24.2	66.5	7.0	131	1900
Louse Creek	22.0	108.3	7.2	137	1409
Jennings Creek	7.6	66.3	6.8	133	2280

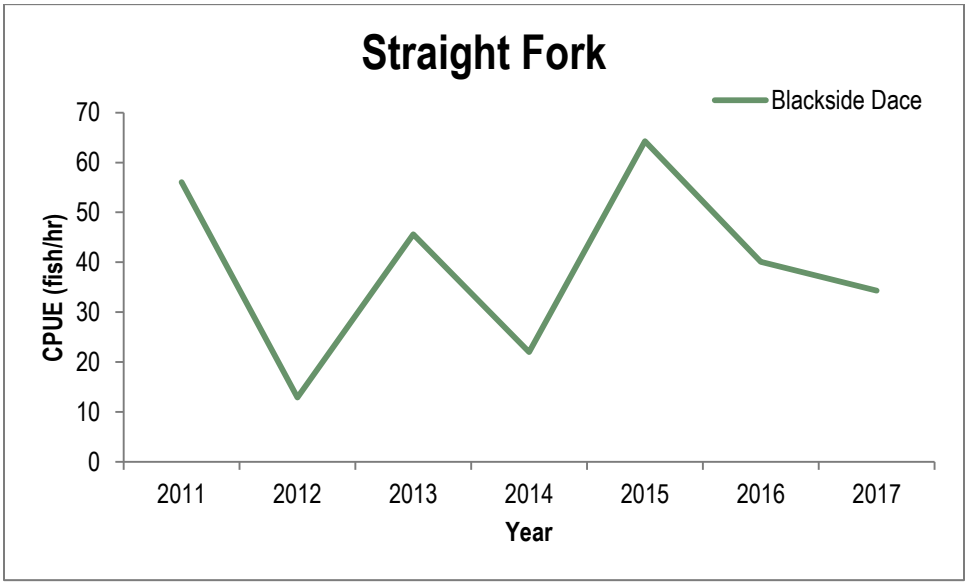

Figure 7. Catch per unit effort (fish/hour) for Blackside Dace from 2011-2017 in Straight Fork.

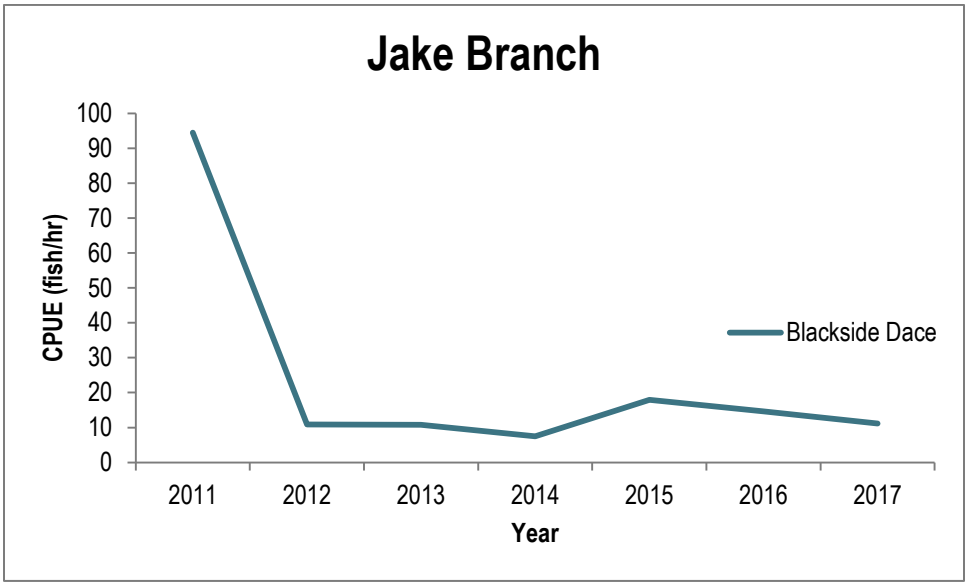

Figure 8. Catch per unit effort (fish/hour) for Blackside Dace from 2011-2017 in Jake Branch.

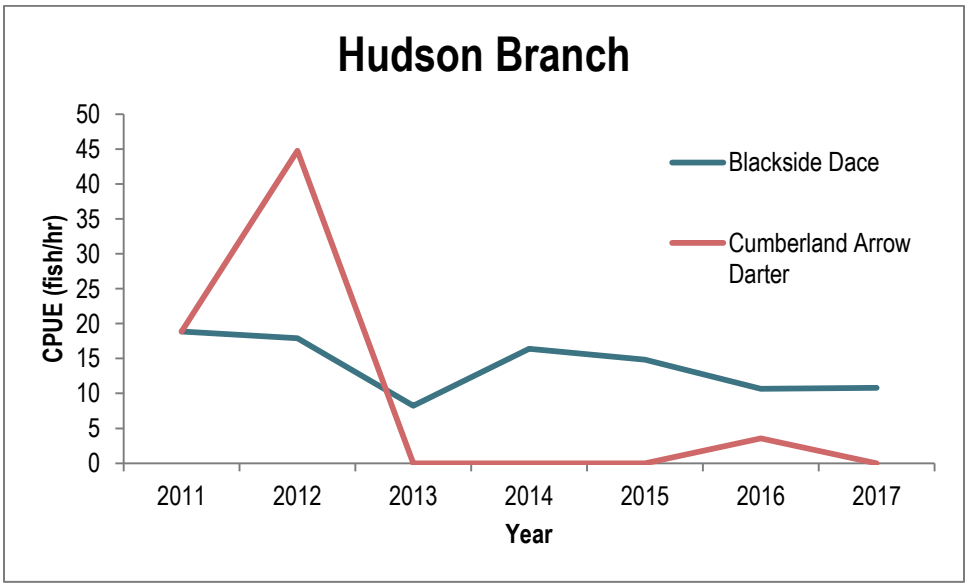

Figure 9. Catch per unit effort (fish/hour) for Blackside Dace and Cumberland Arrow Darter from 2011-2017 in Hudson Branch.

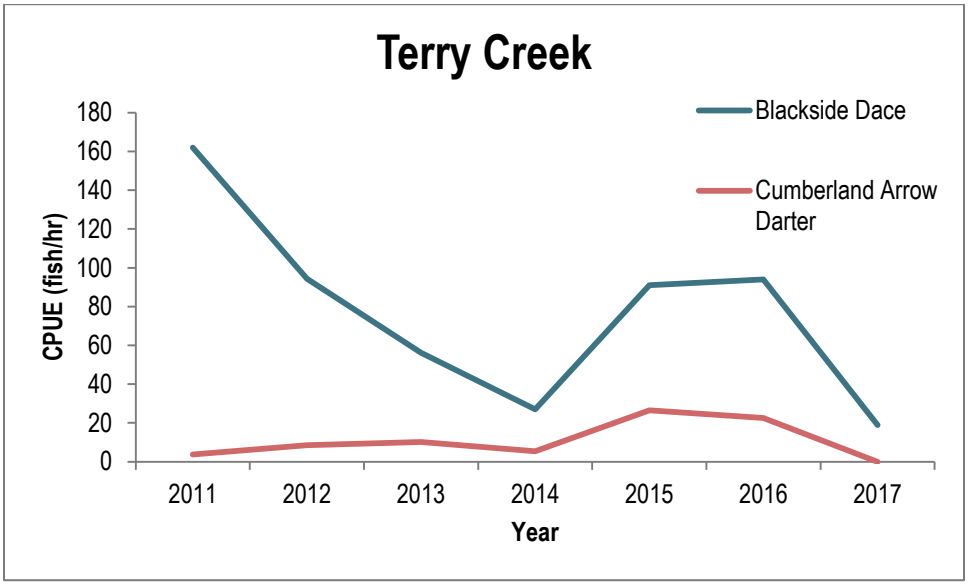

Figure 10. Catch per unit effort (fish/hour) for Blackside Dace and Cumberland Arrow Darter from 2011-2017 in Terry Creek.

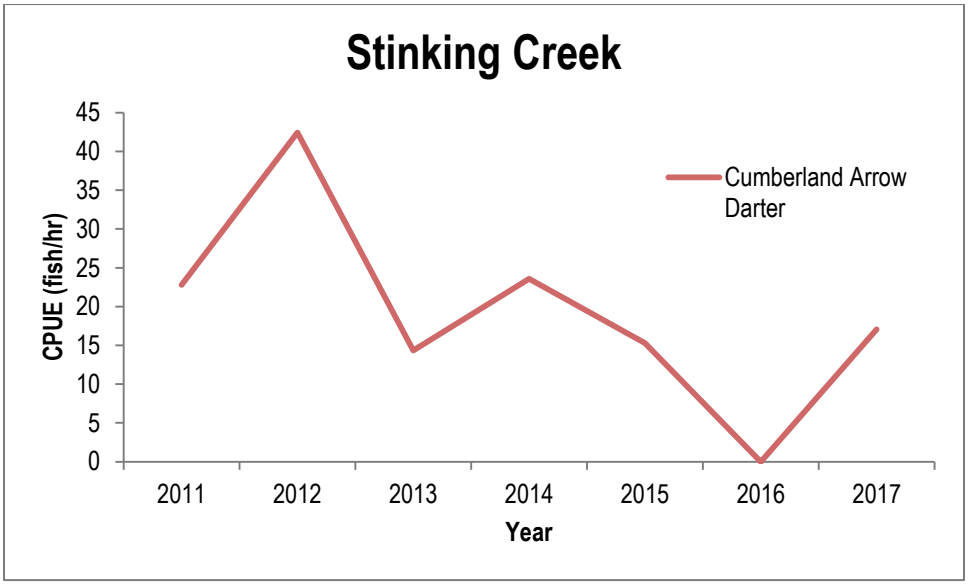

Figure 11. Catch per unit effort (fish/hour) for Cumberland Arrow Darter from 2011-2017 in Stinking Creek.

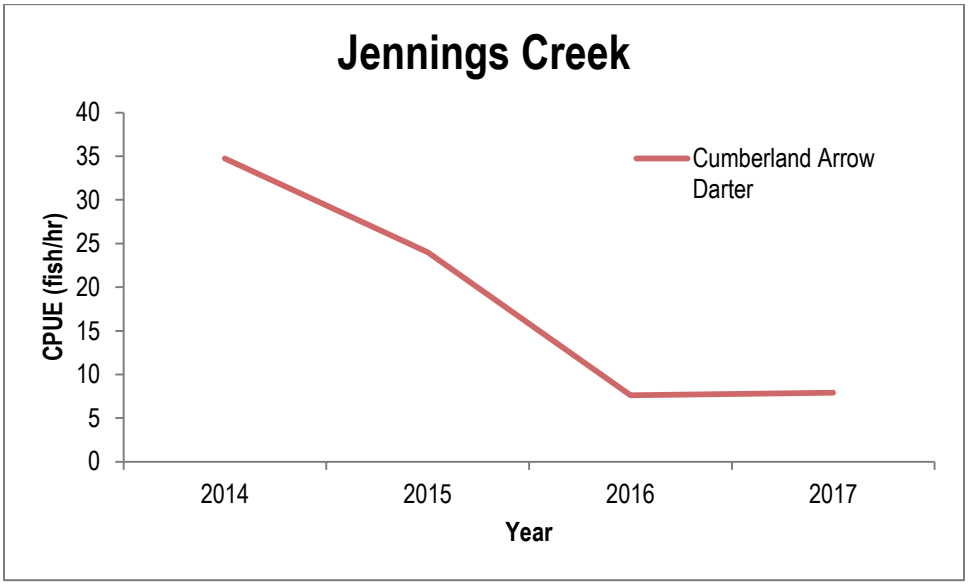

Figure 12. Catch per unit effort (fish/hour) for Cumberland Arrow Darter from 2011-2017 in Jennings Creek.

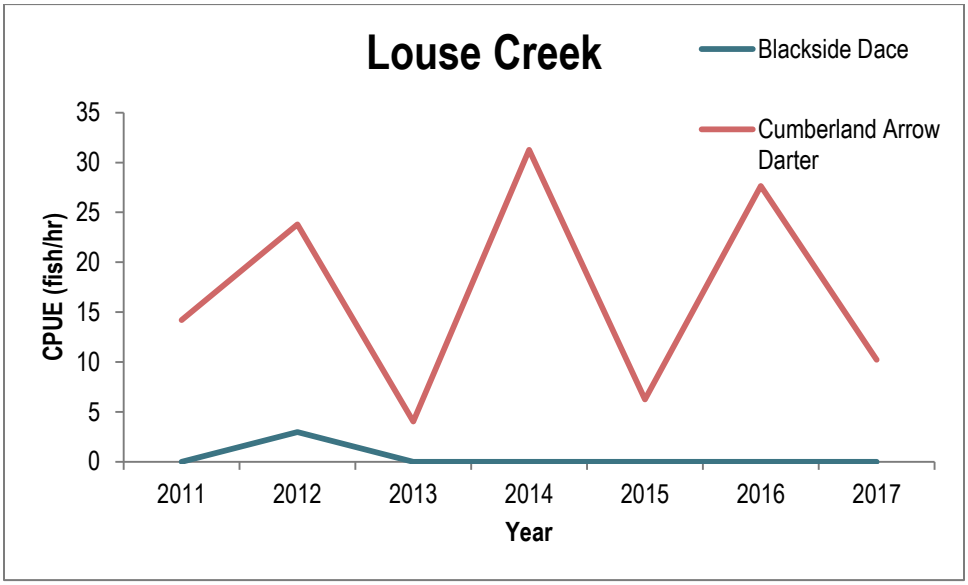

Figure 13. Catch per unit effort (fish/hour) for Blackside Dace Cumberland Arrow Darter from 2011-2017 in Louse Creek.

Collection Efforts to Locate Tennessee Dace in Seven East Tennessee Counties

Introduction

As a continuation of the project started in 2014 (Carter et al. 2015), the TWRA Region 4 Stream Unit conducted additional fish surveys in 2017 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 southwest VA). These streams typically have fairly low gradient, shallow, silt and gravel pools, or undercut banks in shady areas created by surrounding woody vegetation. Forty-five 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 known and historical locations. The surveys were conducted in April 2017.

Sample Methods

Fish were qualitatively collected with standard backpack electrofishing techniques (TWRA 2005). Collection from each stream was with a single backpack electrofishing unit operating at 200 to 300 VAC and a person assisting with a dipnet. Sample lengths were approximated in most cases and averaged around 200 m, but varied from about 200 to 400 m. 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

In 2017 four streams were sampled, Tarkiln Branch, Cure-al Branch, Little Mountain Branch, and Clear Creek, all of Blount County within the Little Tennessee River watershed. Tennessee Dace were found in 1 of the 4 streams sampled, Little Mountain Branch. Twenty-six Tennessee Dace were found here (CPUE = 71.2 fish/hr) in 250 m. Four of these were preserved four.

While looking for Tennessee Dace in the Little Tennessee River watershed of Blount County, we found Blacknose Dace in all four streams. Creek Chub were found in Clear Creek (common), Little Mountain Branch (several) and Cure-al Branch (few).

Sport Fish Surveys

Clinch River

Introduction

The Clinch River represents 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 43 species of mussels (Ahlstedt 1986). Additionally, it supports one of east Tennessee's better warmwater sport fisheries. The Clinch River has been the focus of numerous surveys and investigations conducted by both state and federal agencies with the major purpose of assessing and monitoring the fish and benthic communities. The Agency has made limited surveys of the river that focused primarily on collecting basic fish, benthic, and water quality data (Bivens 1988, Carter et al. 2000, 2003, 2006). Our survey of the Clinch River focused on re-evaluating the sport fish population originally sampled in 1999. Our 2017 assessment was derived from nine sample sites located between river mile 202 and river mile 152. After our initial evaluation in 1999, the Clinch River was put into a 3-year rotational schedule with eight other rivers in the region. Sport fish sampling sites were reduced to those that would best characterize these populations. 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 Clinch River originates in Virginia and flows in a southwesterly direction before emptying into Norris Reservoir near river mile 152. The river has a drainage area of approximately 3,838 kilometers2 (upstream of the reservoir). In Tennessee, all of the Clinch River flows through the Ridge and Valley province of east Tennessee coursing by the town of Sneedville before emptying into Norris Reservoir just northwest of Thorn Hill. 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 three developed launching areas managed by the Tennessee Wildlife Resources Agency (Kyles Ford, Sneedeville, Hwy. 25E Bridge).

Between May 22 and June 12, 2017, we conducted eight fish surveys between the Virginia state line and Norris Reservoir (Figure 14). Site 32 was not sampled. In our survey sites, the riparian habitat consisted primarily of wooded shorelines with interspersed agricultural fields. Submerged woody debris was 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 41.6 meters to 71.5 meters, while site lengths fell between 190 meters and 890 meters (Table 8). Water temperatures ranged from 21.5 C to 23.7 C and conductivity varied from 301 to 316 µs/cm (Table 8).

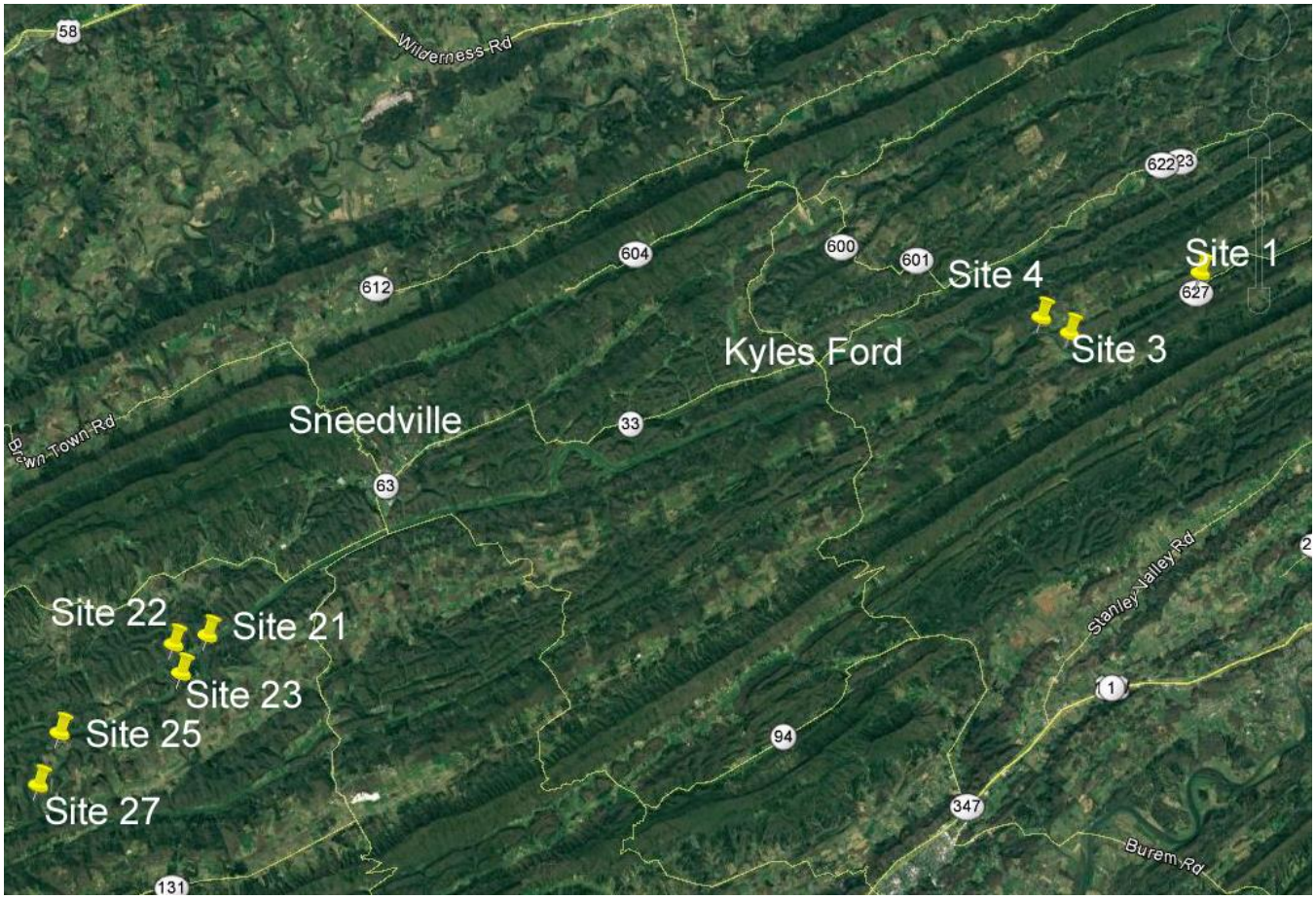

Figure 14. Site locations for samples conducted in the Clinch River during 2017.

Table 8. Physiochemical and site location data for samples conducted on the Clinch River during 2017. Secchi depth not recorded.

Site	Latitude	Longitude	River mile	Mean width (m)	Site length (m)	Temp (C)	Conductivity (µs/cm)
1	36.59361	-82.88944	202	44.6	376	22.3	313
3	36.57667	-82.94139	199	50.6	190	23.1	308
4	36.58139	-82.95444	197.8	41.6	381	23.7	316
21	36.47722	-83.28917	172.5	53	718	21.8	304
22	36.47528	-83.30306	170.7	71.5	480	21.5	301
23	36.46500	-83.30083	169.6	50	217	21.6	302
25	36.44583	-83.34917	166.6	63	890	21.9	301
27	36.42917	-83.35778	164.5	68.5	520	21.7	304

Results

Catch per unit effort (fish/hr) estimates for Smallmouth Bass averaged 34.3 fish/h (SD 12.0) (Table 9) and Rock Bass averaged 20.0 fish/hr (SD 12.5) (Table 9). We did not collect Spotted Bass or Largemouth Bass. Comparatively,

there was an overall mean decrease in catch rates for Spotted Bass, Largemouth Bass, and Rock Bass (Figure 15). The cate rate for Smallmouth Bass had no significant change between 2017 and 2011, the last year it was sampled. The catch rate for Rock Bass decreased by 69% between 2011 and 2017. The decline was throughout the entire sampling area, not just in the upper or lower reaches.

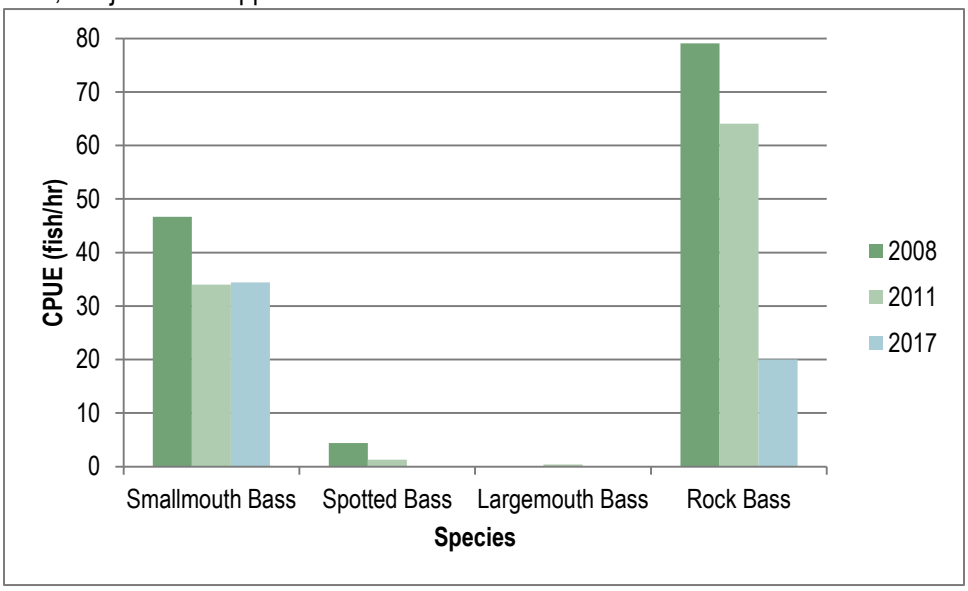

Figure 15. Catch per unit effort (fish/hr) for Black Bass and Rock Bass in 2008, 2011, and 2017 in the Clinch River.

Table 9. Catch per unit effort (fish/hr) and Length-categorization analysis for Smallmouth Bass and Rock Bass on the Clinch River 2017.

Site	Smallmouth Bass CPUE	Rock Bass CPUE
3	56	0
4	32	44
21	16	16
22	36	20
23	28	24
25	36	24
27	36	12
Mean	34.3	20
STD. DEV.	12.0	12.5
Length-Categorization Analysis		
PSD	25	38
RSD-P	3	0
RSD-M	6	0
RSD-T	0	0

Size distribution of Smallmouth Bass sampled between 1999 and 2017 has varied somewhat among the nine sampling sites. We observed good representation in the 150 to 275 mm size range (Figure 16). The occurrence of

quality size and larger Smallmouth Bass was lower than 2011 (Figure 17), which explains the lower PSD (25) compared to 2011 (33.9). This is below the statewide average of 34 (Fiss et al. 2001). No trophy size Smallmouth Bass were captured. Given the high frequency of Smallmouth Bass between 175 and 250 mm, we would have expected to find a higher PSD in 2014, however the Clinch River was not sampled that year, and we may have missed seeing that year class recruit into the population. We do see a strong stock sized year class, which we expect to see recruit into the memorable size class next time we sample the Clinch River.

Length categorization analysis indicated the relative stock density (RSD) for preferred Smallmouth Bass slightly decreased, from 5.3 to 3, however the RSD for memorable size Smallmouth Bass increased from 3.5 in 2011 to 6 in 2017 (Table 8). No Trophy size bass was found this year, however only two have been found since 1999. Catch per usnit effort estimates by RSD category depicted generally no changed between 2011 and 2017. Overall, we observed good recruitment into stock size and the trend persisted throughout the larger size groups just at a lower frequency. Based on the abundance of sub-stock and stock size class, we should observed recruitment into the larger size categories over the next few years.

As stated and found in previous reports, it takes about 4.7 years to reach 305 mm (12 inches; Quality size) and 7.8 years to reach 406 mm (16 inches; Preferred size). Thus, Smallmouth Bass sampled this year in the stock size 180 mm will take at least 4 years to reach the preferred size range.

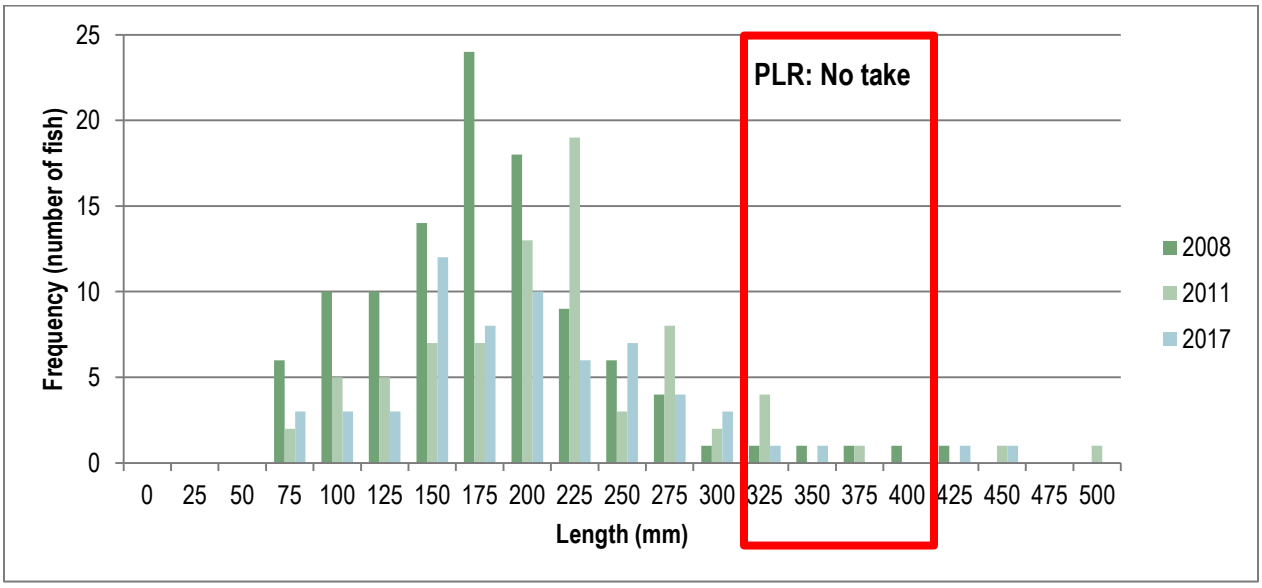

Figure 16. Length-frequency (number of fish) distribution for Smallmouth Bass collected in the Clinch River in 2008, 2011, and 2017. PLR (Protected length range) indicated by the red box [330-431 mm]).

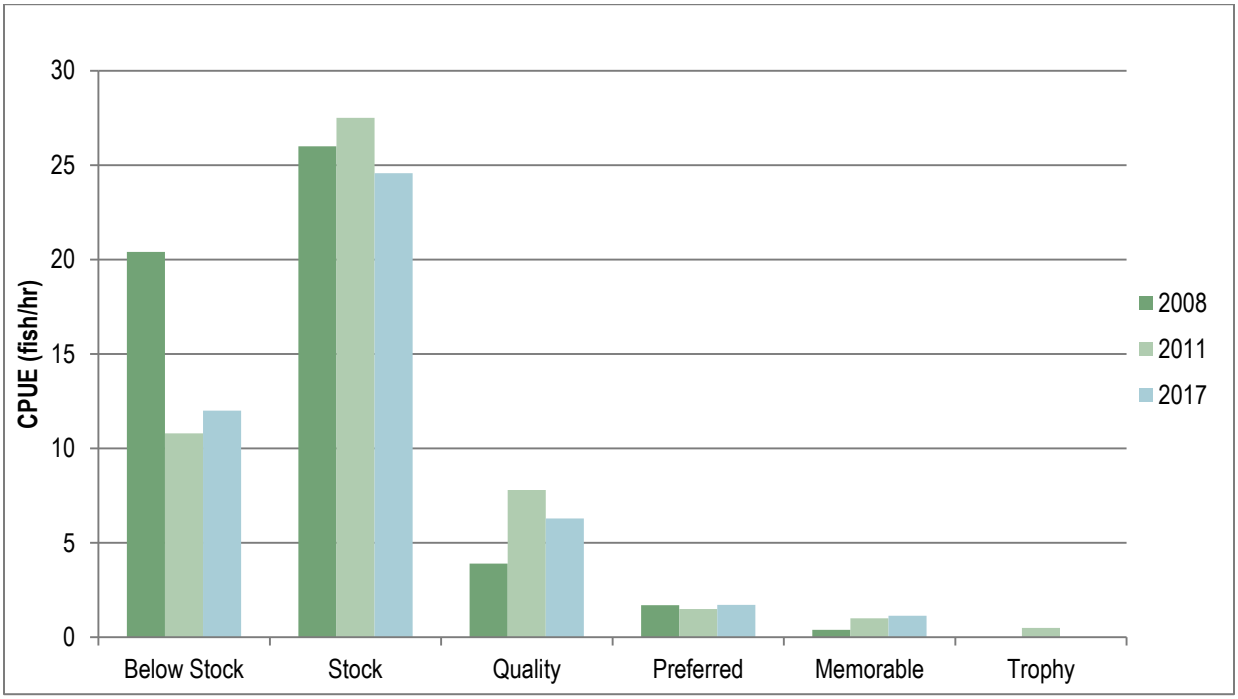

Figure 17. Catch per unity effort for relative stock density categories of Smallmouth bass collected in the Clinch River in 2008, 2011, and 2017.

There were no Spotted Bass or Largemouth Bass collected in 2017. Both species are rarely collected due to their scarcity and no real inferences about their contribution to the fishery can be made. However, they both do persist in the river and may offer some opportunity to anglers. Largemouth Bass are even scarcer than Spotted Bass in this section of the Clinch River.

Individuals in the 100 to 225 mm range represented the majority of Rock bass in our samples between 1999 and 2017 (Figure 18). For the most part, we observed decreased in larger size > 225 and smaller size < 100 mm classes of Rock Bass. Although in the length frequency histogram shows the relative size structure of all fish caught and increase in middle sized fish caught this year in comparison to the rest of the fish caught, there was an overall decline in the number of fish caught this year by 69%.

Relative stock density (RSD) analysis indicated the RSD for preferred, quality, memorable and trophy size Rock Bass were all zero, because no Rock Bass caught were considered preferred size. PSD for Rock bass increased from 28 to 38.5 however. This is due to the large decrease in the number of stock size Rock Bass caught this year, making the ratio of quality to stock size Rock Bass larger compared to previous years with more stock size Rock Bass.

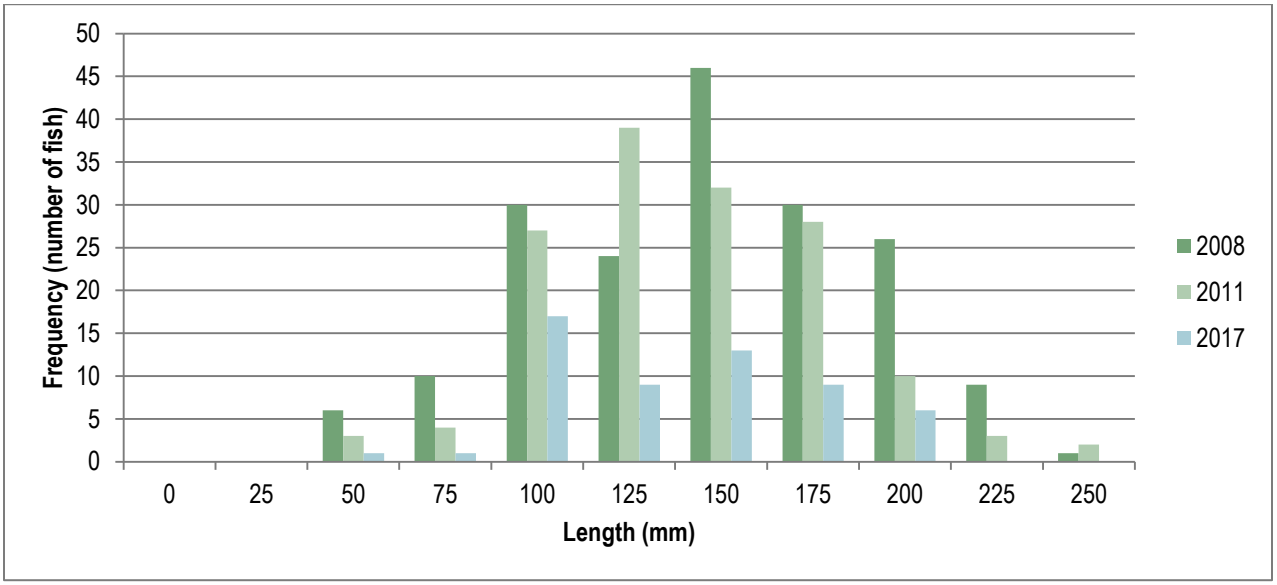

Figure 18. Length-frequency (number of fish) distribution for Rock Bass collected in the Clinch River in 2008, 2011, and 2017.

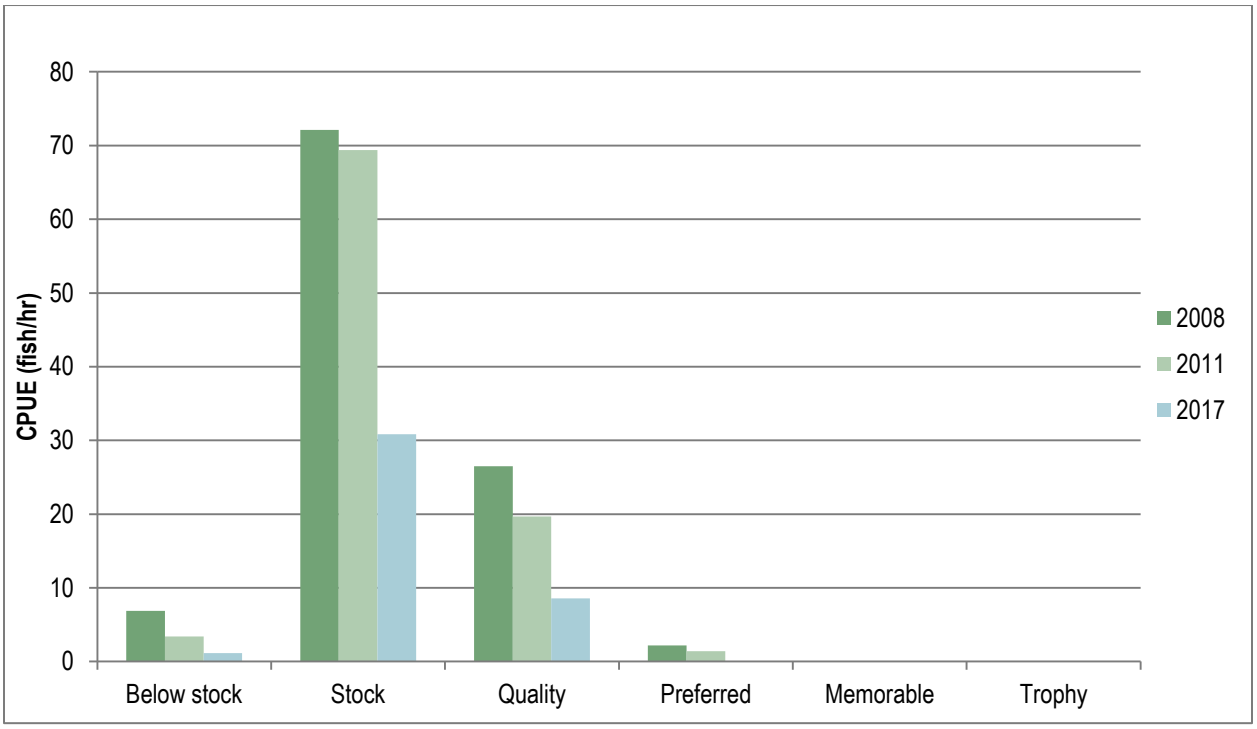

Figure 19. Catch per unit effort for relative stock density categories of Rock Bass collected in the Clinch River in 2008, 2011, and 2017.

Discussion

The Clinch 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 Clinch River, angling opportunities for these species are limited.

The popularity of this riverine fishery has grown and anglers from Kentucky use this fishery. Currently we have no angler use/harvest data to aid in evaluating the effects of angler use or angler opinion on this fishery. It is imperative we obtain this data to answer fisheries management questions, public inquiries, and aid in the development of regulations. From the data it doesn't appear that the PLR (protected length range) of 13-17 inches regulations is affective. A PLR is put in place with the objective of producing large fish (larger than the PLR) due to no harvest inside that range and allowing those fish to grow. However, for this to work, there has to be substantial harvest below the PLR to decrease the number of fish going into that protected range. Data, is inconclusive on whether or not this is meeting objectives. A statewide or region-wide management plan should be developed to manage black bass in these different rivers in order to provide the best resources for our anglers.

The occurrence of musky in the river warrants continued investigations. The consistent stockings made by Virginia Department of Game and Inland Fisheries upstream of the state line could lead to the development of a fishery in Tennessee. According to Tom Hampton (VAGF) their stocking shave been quite successful and have resulted in the establishment of a sport fishery.

Surveys on the Clinch River will be conducted on a three-year rotation in order to assess any change in the fishery. Our return trip in 2020 will focus on these sample sites surveyed this year.

Management Recommendations

1. Initiate angler use and harvest survey.
2. Develop a fishery management plan for the river or statewide, setting objectives for catch rates, angler satisfaction, and size class of fish. These should be in line with the TWRA Fisheries Operational Plan.

Little River

No bass surveys were conducted on Little River in 2017 as were scheduled. Surveys on the Little River will be conducted on a three-year rotation in order to assess any change in the fishery. Our return sport fish survey trip will be in 2020.

Nolichucky River

Introduction

The Nolichucky River represents an important recreational resource for the state both in consumptive and non-consumptive uses. It provides critical habitat for species of special concern and is home to approximately 50 species of fish and has historically supported at least 21 species of mussels (Ahlstedt 1986). Additionally, it supports one of east Tennessee's best warmwater sport fisheries. The Nolichucky River and its tributaries have been the subject of numerous biological and chemical studies that span some 40 years. These studies have concentrated on evaluating pollution levels and documenting sources for mitigation. Much of the upper reach of the Nolichucky River has been consistently impacted by sand dredging and mica mining in North Carolina along with extensive agricultural development along the entire length in Tennessee. However, in recent years, the Nolichucky River has improved in water quality as a result of mitigation and education conducted during these early studies. The Agency has conducted limited surveys of the river, which focused primarily on collecting basic fish, benthic, and water quality data (Bivens 1988). Extensive sport fish population surveys were conducted in 1998 (Carter et al. 1999) from the North Carolina state line to the confluence with

the French Broad River. Our survey of the Nolichucky River focused on re-evaluating the sport fish populations and developing long-term community assessment sites. Our 2017 assessment of the sport fish populations was derived from 10 sample sites between river mile 27.9 and mile 99.1. Our 1998 survey consisted of 31 sample sites, falling between river mile 7.6 and mile 99.1. After our initial evaluation in 1998, the Nolichucky River was put into a 3-year rotational sampling schedule with eight other rivers. Sport fish sampling sites were reduced to those that would best characterize these populations. 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 Nolichucky River originates in North Carolina and flows in a southwesterly direction before emptying into the French Broad River near river mile 69.0. The river has a drainage area of approximately 2,827 km^2. In Tennessee, approximately 159 km of the Nolichucky River flows through the Blue Ridge and Ridge and Valley provinces, coursing through or by the towns of Erwin, Greeneville, and Morristown before joining the French Broad River near the community of White Pine.

Public access (found in Unicoi, Washington, Greene, Cocke, and Hamblen counties) 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 five developed launching areas managed by the Tennessee Wildlife Resources Agency (Easterly Bridge, Birds Bridge, and Davy Crocket State Park), the City of Greeneville (Kinser Park), and the U.S. Forest Service (Chestoa).

Between June 21 and August 22, 2017 we conducted 9 fish surveys between the North Carolina state line and the French Broad River (Figure 20).

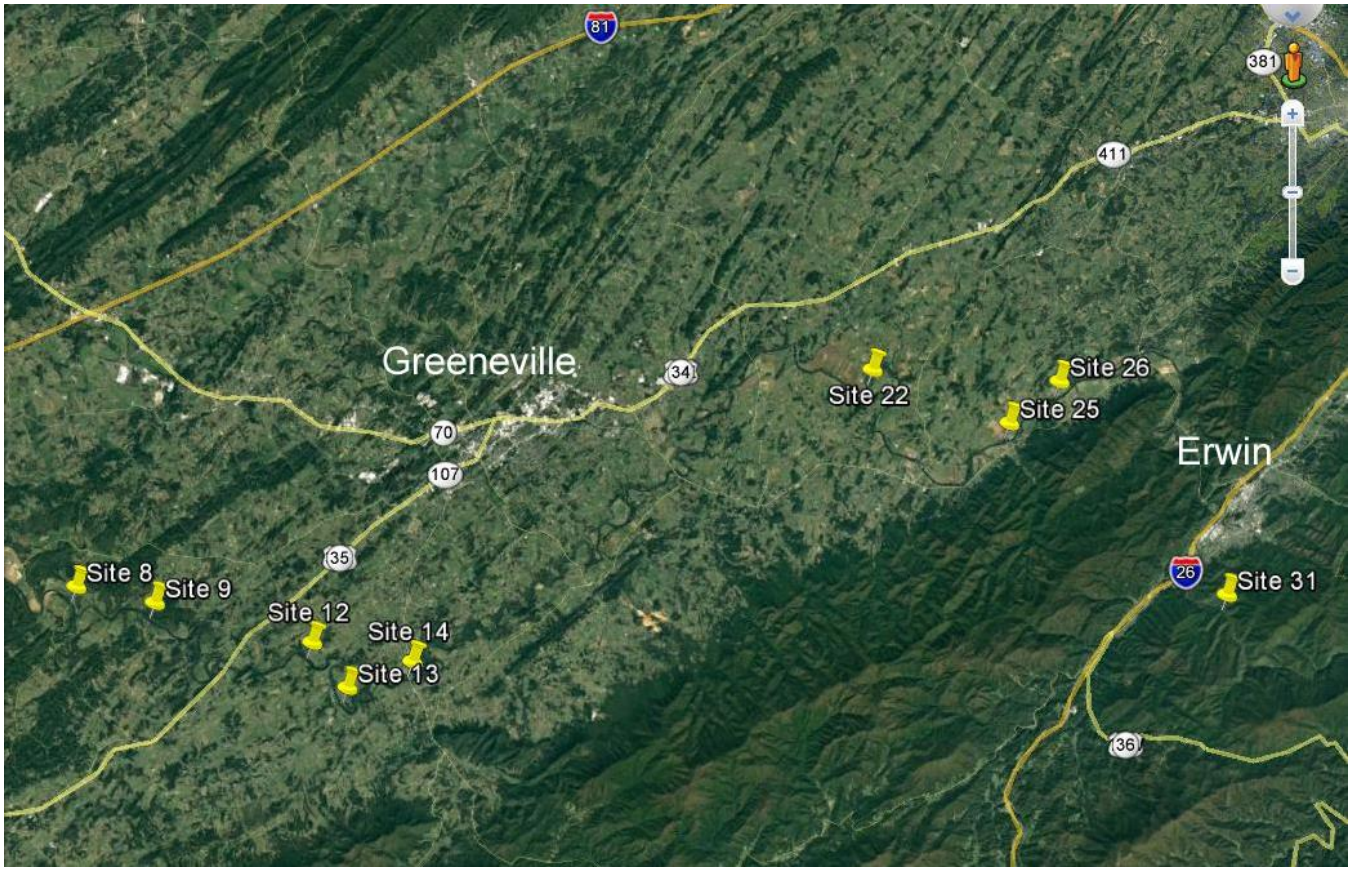

Figure 20. Site locations for samples conducted on the Nolichucky River during 2017.

In our survey sites, the riparian habitat consisted primarily of wooded shorelines with interspersed agricultural fields. There were several reaches of the river where one or both sides of the river were confined within rock palisades. Submerged woody debris was fairly common in most of our sample areas. The river substrate was predominately boulder/cobble in riffle areas and bedrock with interspersed boulders/cobble in the pool habitat. Measured mean channel widths ranged from 50 meters to 100.6 meters, while site lengths fell between 241 meters and 1,224 meters (Table 10). Water temperatures ranged from 22.9 C to 26.6 C and conductivity varied from 75 to 189 µs/cm (Table 8).

Table 10. Physiochemical and site location data for samples conducted on the Nolichukcy River during 2017. Secchi depth not taken.

Site	Latitude	Longitude	River mile	Mean width (m)	Site length (m)	Temp (C)	Conductivity (µs/cm)
8	36.09707	-83.05132	27.9	87.3	1094	25.8	161
9	36.09037	-83.00844	30.9	57.3	321	25.2	156
12	36.07348	-82.92312	39.1	59.6	663	23.8	189
13	36.05399	-82.90385	42.5	100.6	650	24.3	155
14	36.06542	-82.86884	45.7	80.5	1224	23.3	150
22	36.19329	-82.62080	71.4	66.3	300	24.8	113
25	36.17006	-82.54678	80.3	57.7	890	23.3	90
26	36.18831	-82.51960	82.9	50	769	22.9	89
31	36.09449	-82.42855	99.1	80.3	426	26.6	75

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 1023 to 2000 seconds. Catcher per unit effort (fish/hr) 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 and Rock Bass averaged 31.9 fish/hr (SD 27.5) and 13.8 fish/hr (SD 18.0), respectively (Table 11). Very few Spotted Bass and Largemouth Bass were collected during the survey, however more than in previous year. Comparative to 2011, the CPUE was higher than 2011 (26.4 fish/hr; SD = 22.3); however the variability is also high, thus this is unlikely to be a significantly higher catch rate than in 2011. Alternatively, the CPUE for Rock Bass was lower than in 2011 (20.1 fish/hr; SD 24.0), however again, the variability is so high that this is unlikely a statistically different amount. However, the catch rate for Rock Bass is similar to 2007 and 2004 samples (Figure 21).

Table 11. Catch per unit effort (CPUE; fish/hr) and length categorization indices of target species collected at 8 sites in the Nolichucky River during 2017.

Site	Smallmouth Bass CPUE	Spotted Bass CPUE	Largemouth Bass CPUE	Rock Bass CPUE
8	35.19	0	0	0
9	30.7	2.56	0	5.12
12	0	5.54	13.85	5.54
13	31.68	8.64	2.88	5.76
14	12.6	10.8	5.4	3.6
22	16.62	0	0	5.54
25	36	0	0	47.08
31	92.37	0	2.37	37.89
Mean	31.90	3.44	3.06	13.82
SD	27.54	4.37	4.78	17.96
Length-Categorization Analysis				
PSD	20	14	33	36
RDS-P	5	0	0	0
RSD-M	0	0	0	0
RSD-T	0	0	0	0

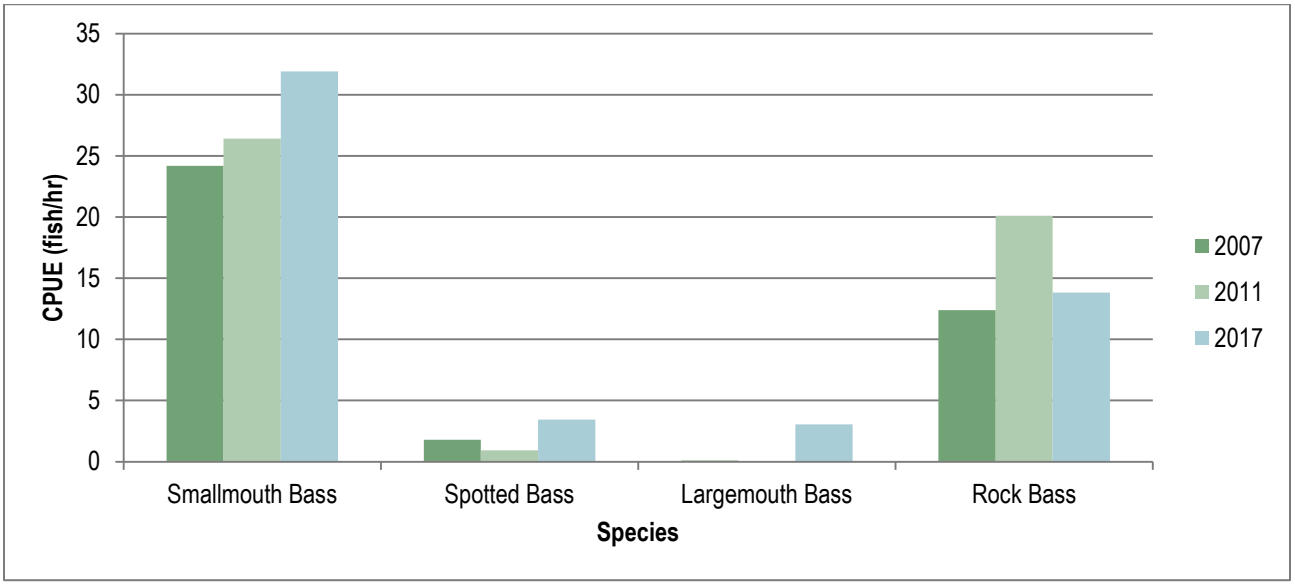

Figure 21. Trends in mean catch per unity effort (CPUE; fish/hr) of black bass and Rock Bass collected in the Nolichucky River from 2007, 2011, and 2017.

The size distributions of Smallmouth Bass between 2007 and 2017 changed somewhat among out sampling stations. Generally, we observed decrease in the number of larger fish. In previous years we observed Smallmouth Bass over the 14 in range and in the "memorable" size category, however in 2017 we found no Smallmouth Bass larger than 13 inches. We did however see more juvenile fish compared to previous years, which could contribute to larger size classes in future years (Figure 22).

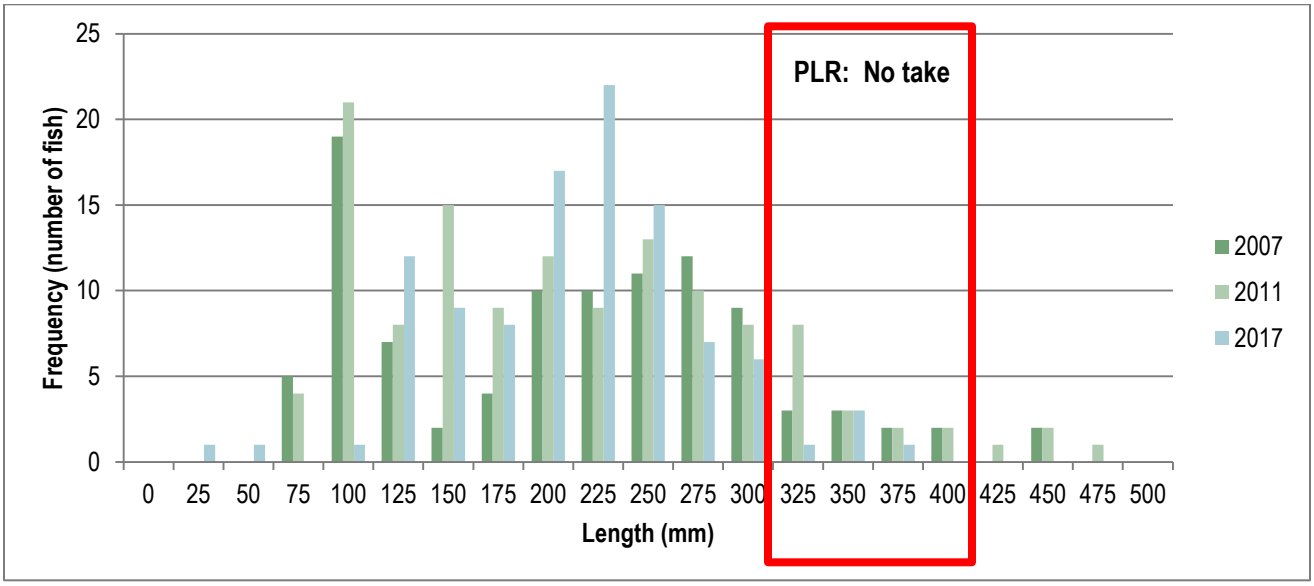

Figure 22. Length-frequency (number of fish) distribution for Smallmouth Bass collected in the Nolichucky River in 2007, 2011, and 2017. PLR (Protected length range) indicated by the red box [330-431 mm]).

Length categorization analysis indicated the proportional stock density of Smallmouth Bass (ratio of quality size to stock size bass) was 20, which is low compared to last sampling (2011; PSD 43.4; Table 11). This is due to the high number of smaller (stock size) Smallmouth Bass compared to larger (quality size) Smallmouth Bass. This is also shown in the relative stock density of preferred Smallmouth bass of 5 in 2017 compared to 14.4 in 2011. In 2017 we saw decreases in CPUE of all size categories except stock size compared to 2017 (Figure 23).

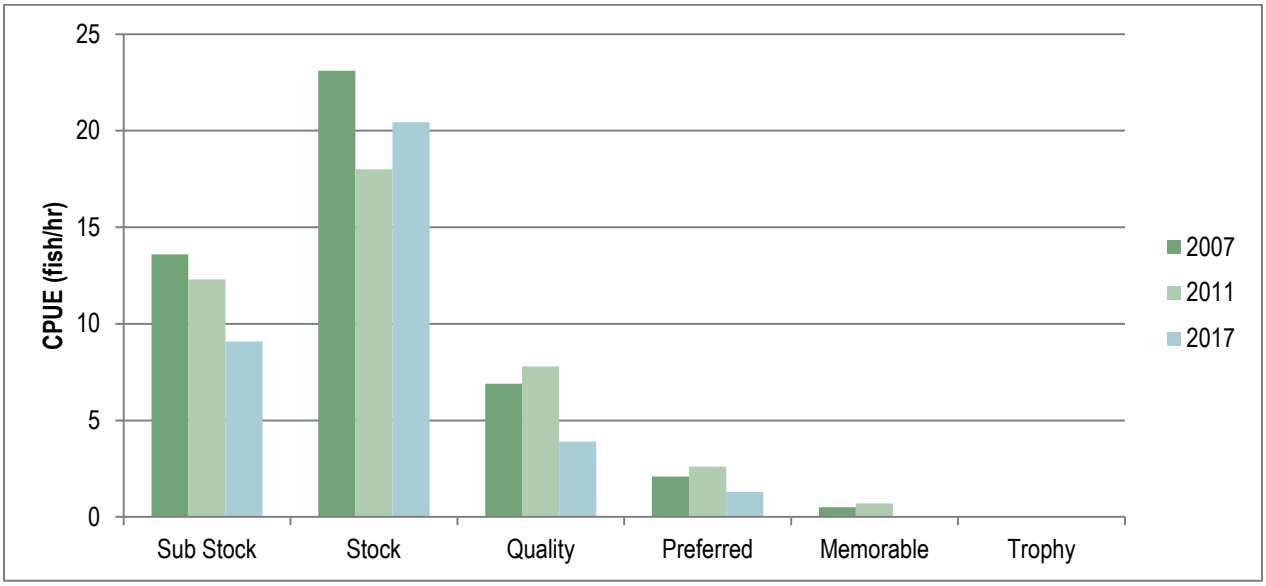

Figure 23. Catch per unit effort for relative stock density categories of Smallmouth Bass collected in the Nolichucky River in 2007, 2011, and 2017.

Twelve Spotted Bass were collected this year and five Largemouth Bass were collected this year, which is an increase compared to previous years, however they are still scarce in the Nolichucky River. Of the twelve Spotted Bass, five were below stock size, six were stock size, and one of quality size. Similarly, of the five Largemouth Bass collected, two were below stock size, two stock size and one quality size, which indicate some recruitment into larger size classes. The collection of Largemouth and Spotted bass in the Nolichucky River has been sporadic and generally restricted to the lower reaches of the river, where preferred habitat occurs. This is fairly typical of most large river systems in east Tennessee where these bass species contribute very little to the overall fishery.

The majority of Rock Bass in our 2017 sampling comprised of individuals in the 150 to 200 mm range. The length frequency distribution was fairly similar to previous samples, however there were lower numbers caught compared to 2007 (Figure 24).

The proportional stock density of Rock Bass was 36 compared to 47.2 in 2007, indicated a slightly smaller proportional of quality to stock size Rock Bass this year compared to 2007 (Table 11). The length categorization analysis of relative stock density of preferred Rock Bass this year was zero, which was similar to 2007. The maximum size Rock Bass this year was larger than that collected in 2007, however still did not reach the preferred size class (Table 11 and Figure 25).

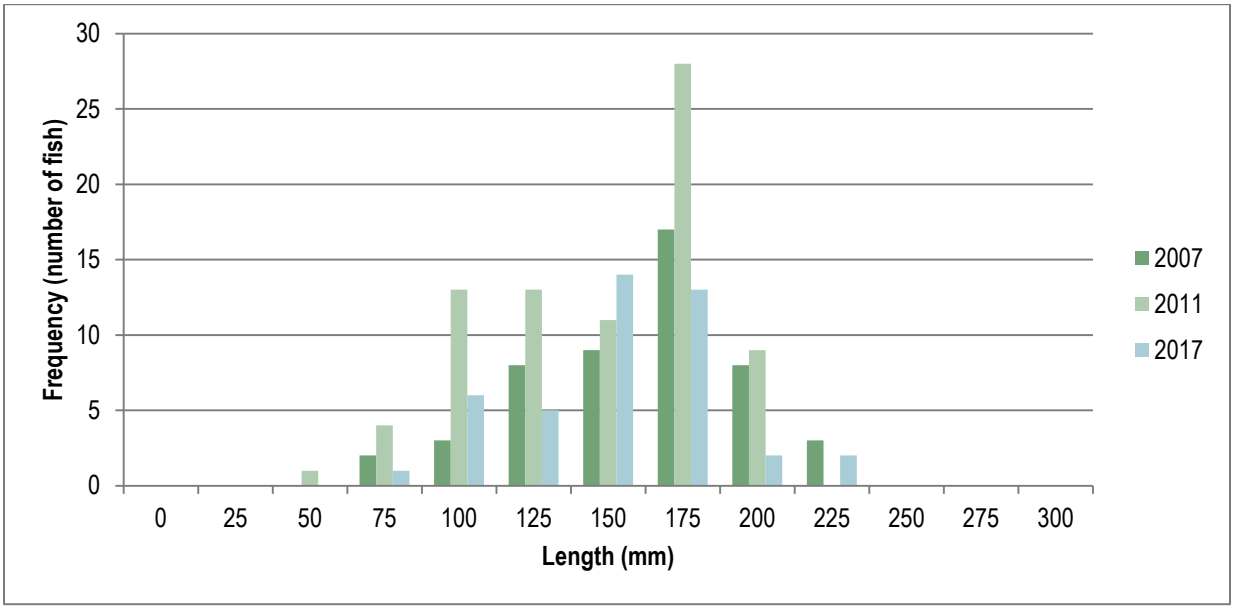

Figure 24. Length-frequency (number of fish) distribution for Rock Bass collected in the Nolichucky River in 2007, 2011, and 2017.

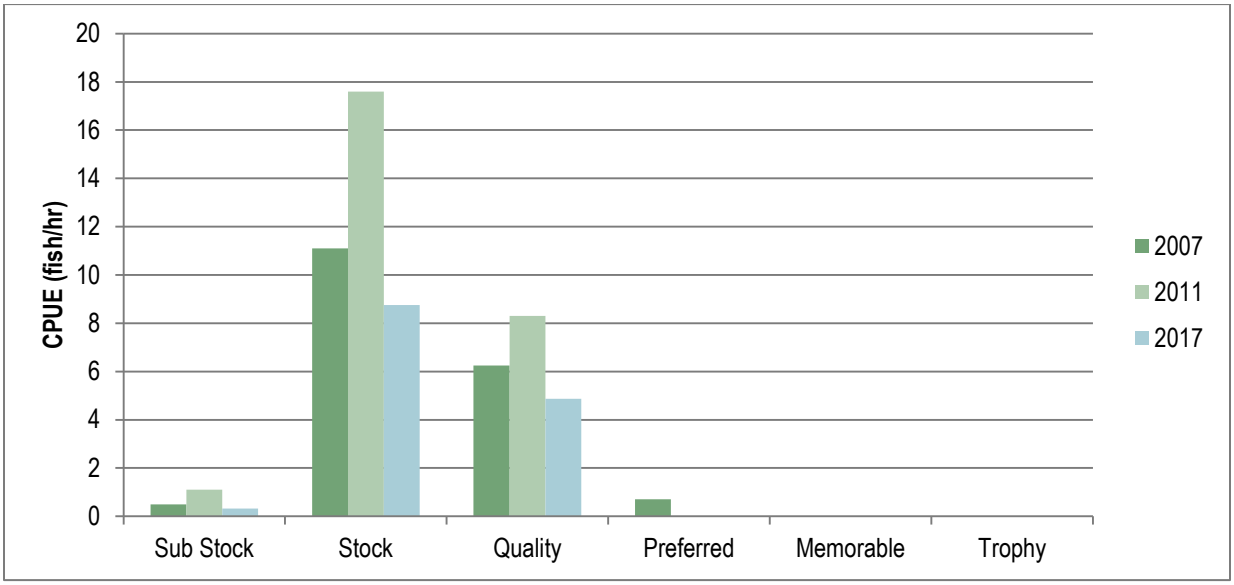

Figure 25. Catch per unit effort for relative stock density categories of Rock Bass collected in the Nolichucky River in 2007, 2011, and 2017.

No age and growth characteristics were collected this year for any species. These data are assumed to be similar to those reported in our 1998 assessment.

Discussion

The Nolichucky River provides angler with the opportunity to catch all species of black bass, and Rock Bass, Muskellunge, Channel Catfish, Flathead Catfish and other sunfish. During the winter months, the upper reaches of the

Nolichucky are stocked with Rainbow Trout from the U.S. Fish and Wildlife Service hatchery in Erwin. This provides additional recreational opportunities for winter anglers frequenting the river. In recent years, the river has seen an increase in use, with the establishment of several rafting companies and the increased recognition of the river's sport fishery.

It is imperative we obtain angler use data to answer fisheries management questions, public inquiries, and aid in the development of regulations. From the data it doesn't appear that the PLR (protected length range) of 13-17 inches regulations is affective. A PLR is put in place with the objective of producing large fish (larger than the PLR) due to no harvest inside that range and allowing those fish to grow. However, for this to work, there has to be substantial harvest below the PLR to decrease the number of fish going into that protected range. Data here shows a decrease in larger fish from 2007 to 2017, indicating the PLR is ineffective at meeting this objective. A statewide or region-wide management plan should be developed to manage black bass in these different rivers in order to provide the best resources for our anglers.

The occurrence of musky in the river warrants continued stocking musky when available. Based on our observations and information from anglers the stocking program has been successful and there are rumors of reproduction in the river, although these claims have not been verified. We didn't not collect any musky during the 2017 survey, however one was collected (415 mm) during a qualitative run outside the standard sampling sites.

Survey on the Nolichucky River will be conducted on a three-year rotation in order to assess any changes in the fishery. Our return trip in 2020, will repeat survey conducted this year.

Management Recommendations

1. Initiate angler use and harvest survey.
2. Develop a fishery management plan for the river or statewide, setting objectives for catch rates, angler satisfaction, and size class of fish. These should be in line with the TWRA Fisheries Operational Plan.
3. Continue to stock musky 203 to 254 mm at a rate of 27-40/mile when available.

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. 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 2017 assessment was derived from eight sample sites located between river mile 115 and river mile 75. 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 km^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 22 and June 9, 2017, we conducted eight fish surveys between the Virginia state line and Norris Reservoir (Figure 26). In our survey sites, the riparian habitat consisted primarily of wooded shorelines with interspersed agricultural fields. Submerged woody debris 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 12). Water temperatures ranged from 19.7 C to 21.7 C and conductivity varied from 385 to 428 µs/cm (Table 12).

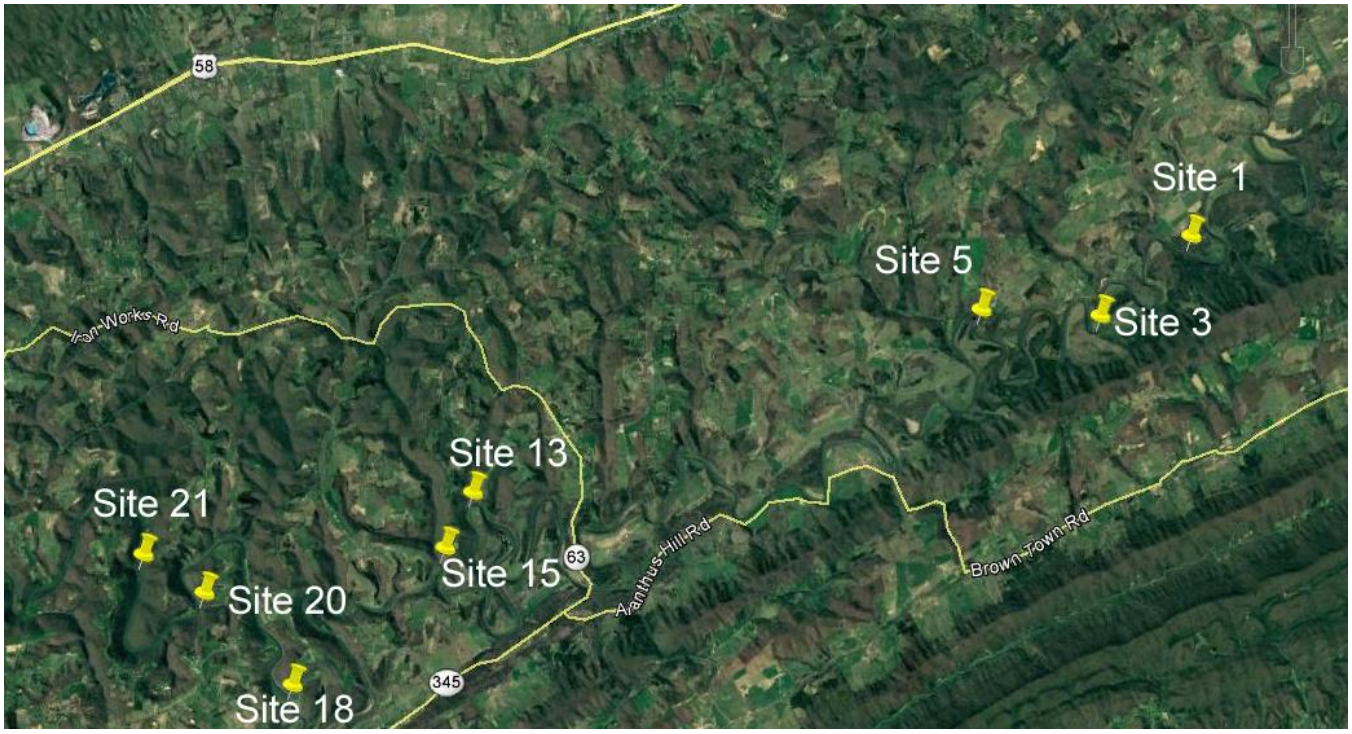

Figure 26. Site locations for samples conducted in the Powell River during 2017 (Sites 28 and 29 not sampled).

Table 12. Physiochemical and site location data for samples conducted in the Powell River during 2014.

Site	Latitude	Longitude	River mile	Mean width (m)	Site length (m)	Temp (C)	Conductivity (µs/cm)	Secchi (m)
1	36.59472	-83.31444	115	29.5	290	19.9	428	0.7
3	36.58111	-83.33472	112.1	30	577	19.7	424	0.7
5	36.58194	-83.36194	107.6	33.5	480	20	420	0.7
13	36.54917	-83.47417	91	38.5	537		404	0.7
15	36.53972	-83.48028	87.1	39	649	21.5	392	0.7
18	36.515	-83.51444	81	40	383	21.6	385	0.7
20	36.53139	-83.53389	77.3	38	570	21.5	393	0.7
21	36.53833	-83.54750	75	38.5	467	21.7	390	0.7

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 of 900 seconds. Catch per unit effort values were calculated for each target species at each site. Length categorization indices were calculated for target species following Gabelhouse (1984).

Results

Site 28 and 29 were not sampled so data comparisons among years may be skewed, however trends seem consistent. Similarly in 2014, the last year the Powell was sampled, no comparisons among years were made due to sampling only consisted of sites 1-18.

Catch per unit estimates for Smallmouth Bass and Rock Bass averaged 51.5 fish/hr (SD 22.7) and 60.0 (SD 11.3), respectively (Table 13). These are similar to both 2014 and 2011 in CPUE. Trends show CPUE for Rock Bass declining, however Smallmouth Bass increase this year compared to previous years (Figure 27). No Spotted Bass or Largemouth Bass were captured in this sample, similar to 2014. Overall, the contribution of Largemouth Bass and Spotted Bass to the overall fishery has been insignificant in past years.

Table 13. Catch per unit effort (CPUE; fish/hr) and length categorization indices of target species collected at 8 sites in the Powell River during 2017.

Site	Smallmouth Bass CPUE	Rock Bass CPUE
1	48	60
3	36	84
5	64	56
13	92	52
15	52	56
18	40	56
20	64	68
21	16	48
Mean	51.50	60.00
SD	22.67	11.31
Length-Categorization Analysis		
PSD	29	46
RSD-P	8	4
RSD-M	0	1
RSD-T	0	1

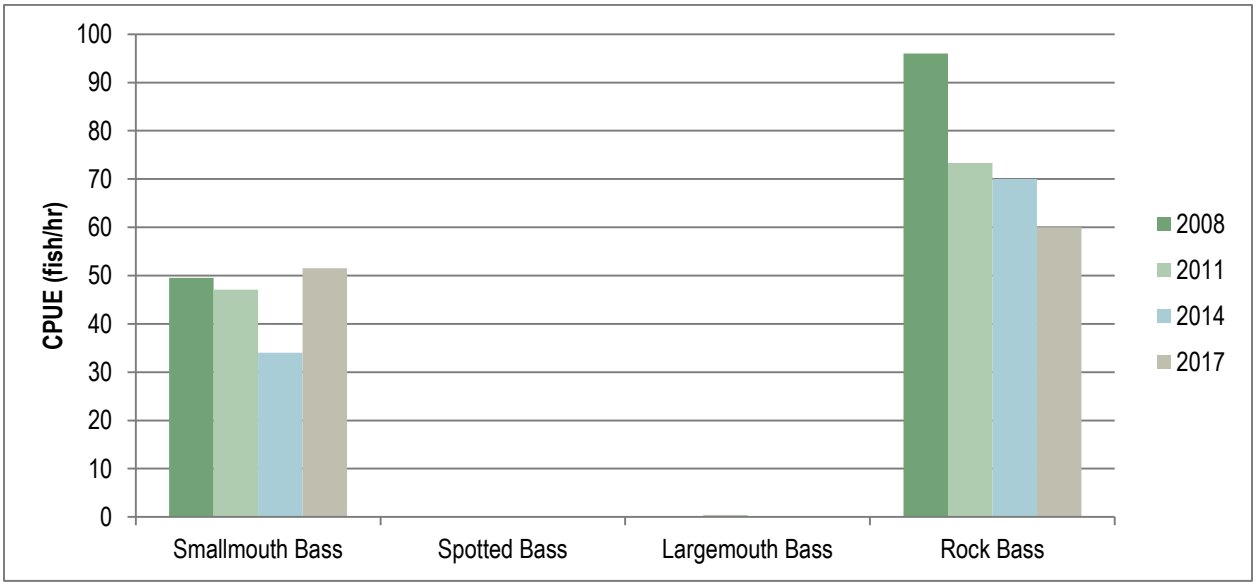

Figure 27. Trends in mean catch per unit effort (CPUE; fish/hr) of black bass and Rock Bass collected in the Powell River from 2008, 2011, 2014, and 2017.

The size distribution of Smallmouth Bass for the 2017 sample was most abundantly represented by fish in the 125 to 324 mm range (Figure 28). The frequency of larger fish (>400 mm) in this sample was substantially lower than observed in the 2011 survey, but similar to the 2014 survey.

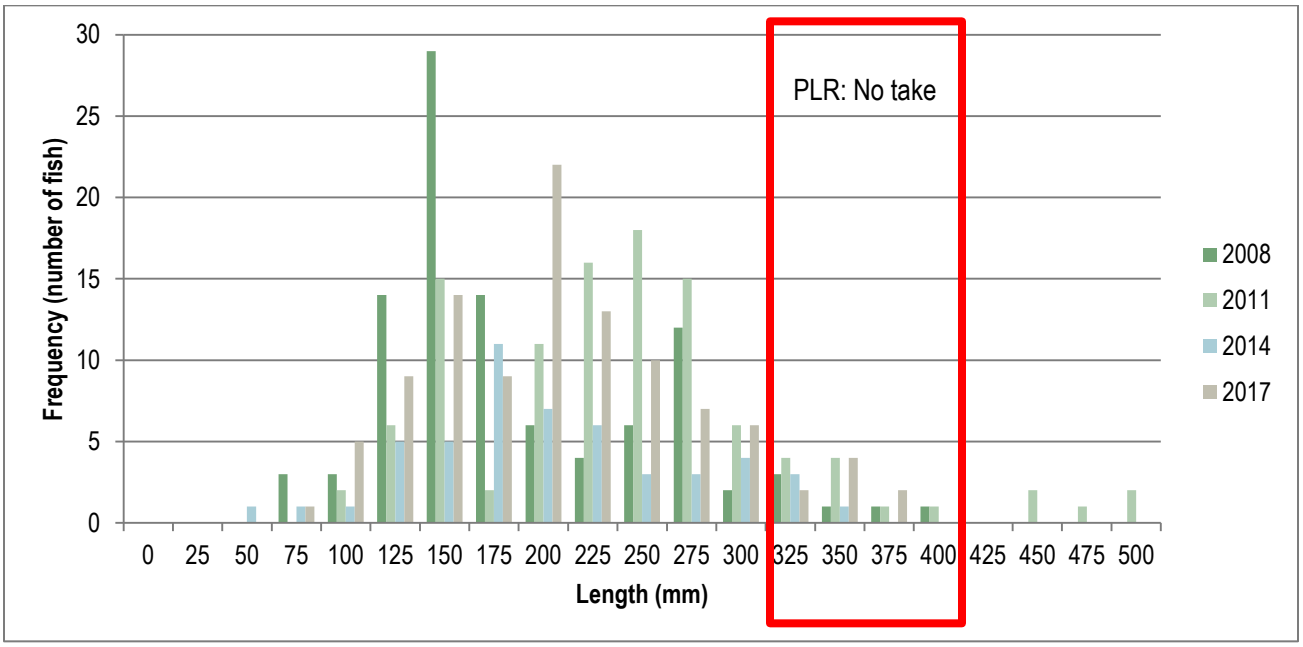

Figure 28. Length-frequency (number of fish) distribution for Smallmouth Bass collected in the Powell River in 2008, 2011, 2014, and 2017. PLR (Protected length range) indicated by the red box [330-431 mm]).

Length categorization analysis indicated the relative stock density (RSD) of preferred Smallmouth Bass was 8 and RSD for memorable and trophy size Smallmouth bass was 0 (Table 13 and Figure 29). The PSD of Smallmouth Bass (ratio of quality size to stock size fish) was 51.5, which is higher than previous samples on the Powell and higher than the statewide average (Fiss et al. 2001).

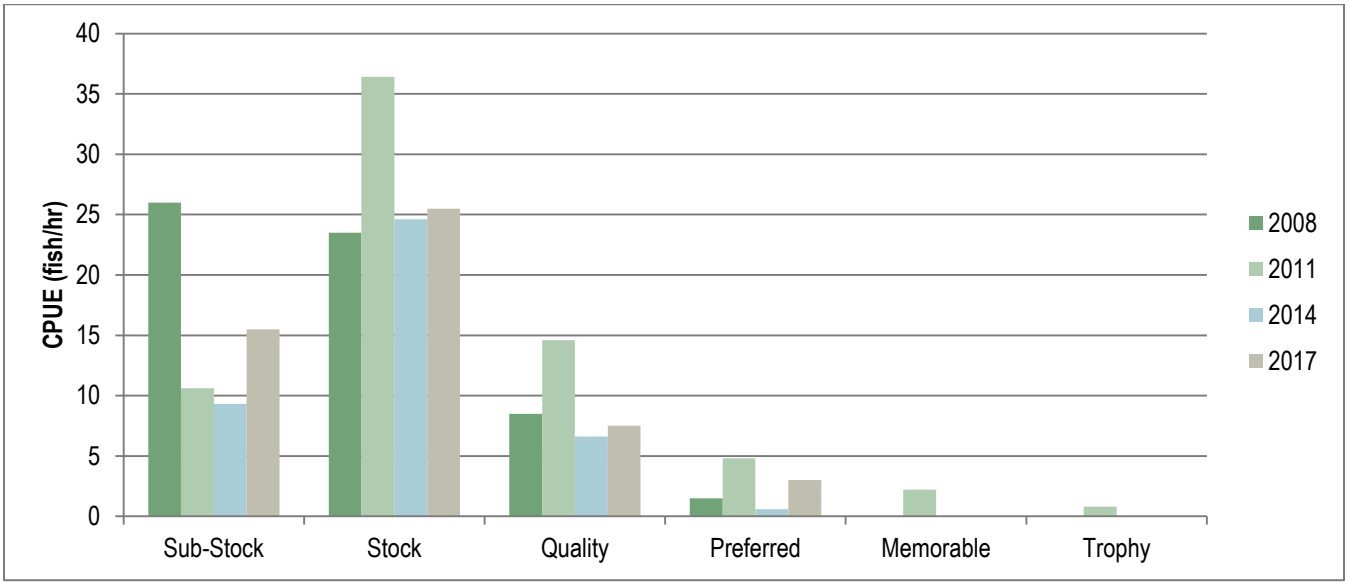

Figure 29. Catch per unit effort for relative stock density categories of Smallmouth Bass collected in the Powell River in 2008, 2011, 2014, and 2017.

The majority of Rock Bass in our 2017 sampling comprised of individuals in the 150 to 225 mm length range represented the majority of the sample (Figure 30). The size distribution this year had more, larger fish than other years sampled and one large trophy size Rock Bass > 375 mm.

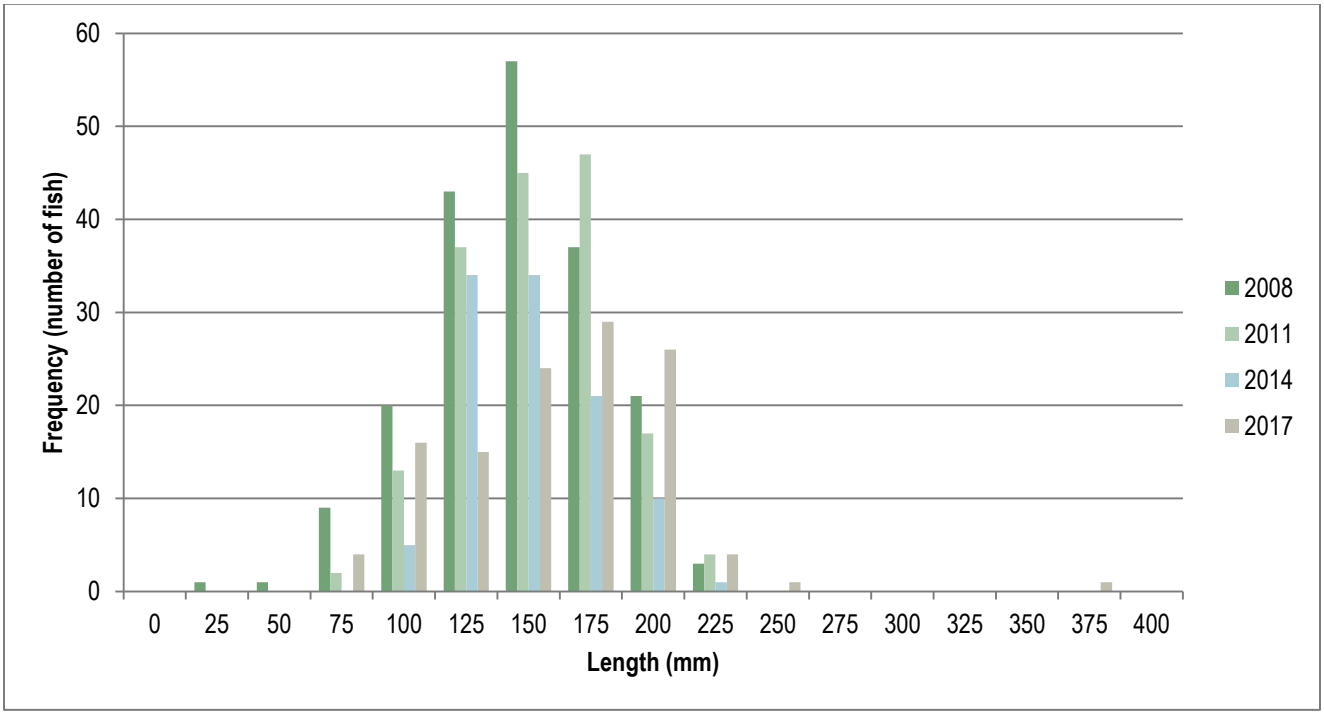

Figure 30. Length-frequency (number of fish) distribution for Rock Bass collected in the Powell River in 2008, 2011, 2014, and 2017.

Length categorization analysis indicated the RSD for preferred, memorable, and trophy Rock Bass was 4, 1 and 1, respectively (Table 13). The PSD of Rock bass was 46, indicating a near equal amount of quality to stock sized Rock Bass. This is different than previous samples of Rock Bass that have high representation of stock size Rock Bass. There were also some preferred size Rock Bass captured along with a trophy size Rock Bass (Figure 31).

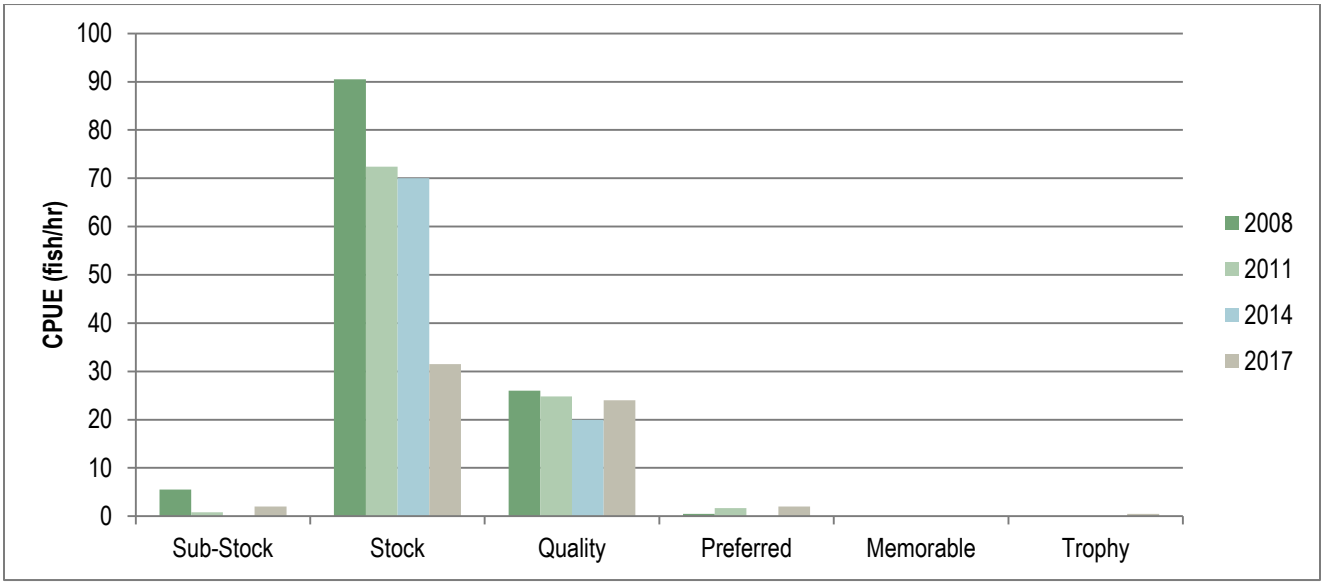

Figure 31. Catch per unit effort for relative stock density categories of Rock Bass collected in the Powell River in 2008, 2011, 2014, and 2017.

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, is 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 to rivers. This trend will undoubtedly continue as the use of reservoirs increase. 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, an aid in the development of regulations. From the data it doesn't appear that the PLR (protected length range) of 13-17 inches regulations is affective. A PLR is put in place with the objective of producing large fish (larger than the PLR) due to no harvest inside that range and allowing those fish to grow. However, for this to work, there has to be substantial harvest below the PLR to decrease the number of fish going into that protected range. Data here in inconclusive, or shows little changed in Smallmouth Bass size distribution, thus the PLR may be ineffective at meeting this objective. A statewide or region-wide management plan should be developed to manage black bass in these different rivers in order to provide the best resources for our anglers.

Overall the Powell River represents one of east Tennessee's premier warmwater river resources. It provides angler 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 on-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 the three-year rotation to assess any changes in the fishery. Our return trip in 2020 will focus of the same areas as 2017.

Management Recommendations

1. Initiate angler use and harvest survey.
2. Develop a fishery management plan for the river or statewide, setting objectives for catch rates, angler satisfaction, and size class of fish. These should be in line with the TWRA Fisheries Operational Plan.

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