Banisteria, Number 16, 2000

Species Composition and Biotic Condition of the Fish Community of Indian Creek, Tazewell County, Virginia

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INTRODUCTION

The Clinch River drainage of southwestern Virginia contains the greatest number of fish species in the Commonwealth. A total of 76 native and 15 introduced species are known from the Virginia portion of the Clinch River (Jenkins & Burkhead, 1994). Systematic fish surveys of the Clinch River did not occur until the 1960s by Wollitz (1965) and Masnik (1974). After these surveys, many mainstem reaches and tributaries were sampled to delimit species distributions (Jenkins & Burkhead, 1994). The purpose of recent fish sampling has been to examine the health of aquatic resources through the use of bioassessment studies (Angermeier & Smogor, 1993; J. Tuberville pers. comm.). Although most tributaries have received some level of fish sampling, resource managers still lack sufficient information to predict species composition or the ability to assess the overall health of smaller streams based on the fish community.

Indian Creek, a small montane stream in the headwaters of the upper Clinch River, has received moderate sampling effort. Between 1971 and 1972, Masnik (1974) developed an initial fish species list by surveying four sites on seven different occasions. Jenkins & Burkhead (1994) surveyed two sites near Masnik's original sampling stations in 1987. Angermeier & Smogor (1993) sampled one station during 1990 and 1991 for a bioassessment study. These collections documented 35 fish species, and based on the fish community, rated the quality of its waters as "good." However, it was not until the discovery of several species of rare and endangered mussels that additional survey effort was focused on Indian Creek (Winston & Neves, 1997).

Soon after endangered mussels were found, a deep coal mine was proposed in the headwaters of Indian Creek. The mine required construction of haul roads, spoil and waste rock storage, and a deep mine access area adjacent to the North Branch of Indian Creek. The Virginia Department of Game and Inland Fisheries and the U.S. Fish and Wildlife Service recommended measures to minimize potential impacts. Sediment control structures, off-site storage of chemicals, and a biomonitoring plan to evaluate mining impacts on water quality were proposed and incorporated into the mining permit. A comprehensive fish survey was initiated because much of Indian Creek had not been surveyed for fishes and because rare species had been documented in the stream. The objectives of this study were to determine the distribution and composition of fishes, and to develop a baseline reference of stream health before installation of a new mine in Indian Creek.

MATERIALS AND METHODS

Study Area

Indian Creek flows southwest for 20 km before entering the Clinch River at Cedar Bluff, Tazewell County, Virginia (Fig. 1). The stream descends from 707 m above sea level at the headwaters to 599 m at the mouth, with an average

total gradient of 5.4 m/km. Indian Creek watershed covers 8,702 ha and spans two physiographic provinces. The headwaters drain the Appalachian Plateau escarpment and the Ridge and Valley province underlies the remaining catchment area. The watershed is dominated by deciduous forest with agriculture along portions of the floodplain and residential areas primarily near its confluence with the Clinch River. Both active and abandoned deep coal mines are present in the headwaters and tributaries of Indian Creek (Fig. 1).

Fish Sampling

We sampled seven stations along Indian Creek at base-flow conditions during 18-24 September 1996 (Fig.1). The sampling period was selected to avoid the brooding period of federally protected mussel species. Stations were selected to represent a longitudinal distribution from the upper to lower reaches of Indian Creek. Secondary considerations were accessibility and sampling effective-ness. We intentionally placed our uppermost site (station 7) directly below the proposed mine site (Fig. 1). Because no fish were found above the proposed mine site, no station was selected upstream of this point. The lowermost site (station 1) on Indian Creek was placed 1 km from the mouth to avoid interaction with the species-rich Clinch River. Average distance between sites was 3.1 km; exact locations are defined in Table 1. We visually estimated stream width (m) during initial inspection. We then multiplied estimated stream width by 20 to determine the total length of the sampling unit. In this manner, one meander wavelength containing several riffle, run, and pool habitats was included at each station (Leopold et al., 1964). A minimum sample length of 100 m was chosen for channel widths estimated to be less than 5 m. Sampling lengths ranged from 100 m at stations near the headwaters to 180 m at station 1 near the mouth.

We collected fishes in one upstream pass at each station using gas-powered backpack electroshockers (Smith-Root, Vancouver, Washington). The four lower sites were surveyed using two backpack electroshockers to cover the greater creek width. Crew sizes varied from two to five individuals, and sampling effort (meters sampled) was recorded at each station. A block net was placed at the upstream end of the station, unless a natural barrier existed. We attempted to net all electroshocked fish. Fishes were identified to species, enumerated, examined for external anomalies (e.g., tumors, diseases) and hybridization, and released alive at the site of capture. Unidentified specimens were preserved in 10% buffered formalin and identified by Dr. Robert E. Jenkins of Roanoke College, Salem, Virginia.

Physical Habitat

Physical habitat measurements at each fish sampling station are summarized in Table 2. After the fish samples were processed, we measured stream width (m) at 10 equally-spaced intervals along the length of the sampling unit. These values were then used to obtain average stream width (m). At each stream width measurement site, we also recorded water depth and substrate type along a cross-section at 0.25, 0.50, and 0.75 intervals of the stream width. Calculation for average depth was according to Platts et al. (1983). Substrate particle size was classified using a modified Wentworth scale (Cummins, 1962).

Dominant/subdominant substrate type was determined by summation of the substrate classification types and selecting those that were the first and second most numerous. Flow (m^3/sec) was calculated from velocity (m/sec) [Marsh-McBirney velocity meter], depth (m), and distance from bank (m) measurements at a single cross-section within a sampling unit (Platts et al., 1983). The length of each habitat unit (pool, riffle, run) was measured longitudinally as defined in Rosgen (1996). Within the boundaries of each sampling station, we visually estimated embeddedness, which measures sedimentation by determining the proportion of fine particles (e.g., silt and sand) surrounding larger particles (e.g., gravel, pebble, cobble and boulder) (Platts et al., 1983). Presence of riparian vegetation and surrounding land use were noted at each station.

Biotic Condition

The index of biotic integrity (IBI) applies ecological-based metrics to fish community data at each station to assess the overall environmental quality of a stream (Karr, 1981). The IBI is sensitive to physical habitat degradation (e.g., siltation, mining impacts, and municipal sewage) (Karr et al., 1986). Twelve metrics are used that incorporate native fish species composition, trophic structure, abundance, and condition (Table 3). We used the IBI first developed by Karr (1981), and later modified by the Tennessee Department of Health and Environmental Conservation (1996) for use in the Tennessee River drainage to calculate the IBI for Indian Creek. Because scoring criteria for metrics vary among regions, a criterion specifically developed for the Tennessee River drainage should be directly comparable to Indian Creek.

Most metrics are easy to interpret, but a brief explanation may provide helpful background information to some readers. Intolerant fishes are those species that cannot survive or reproduce in streams that are

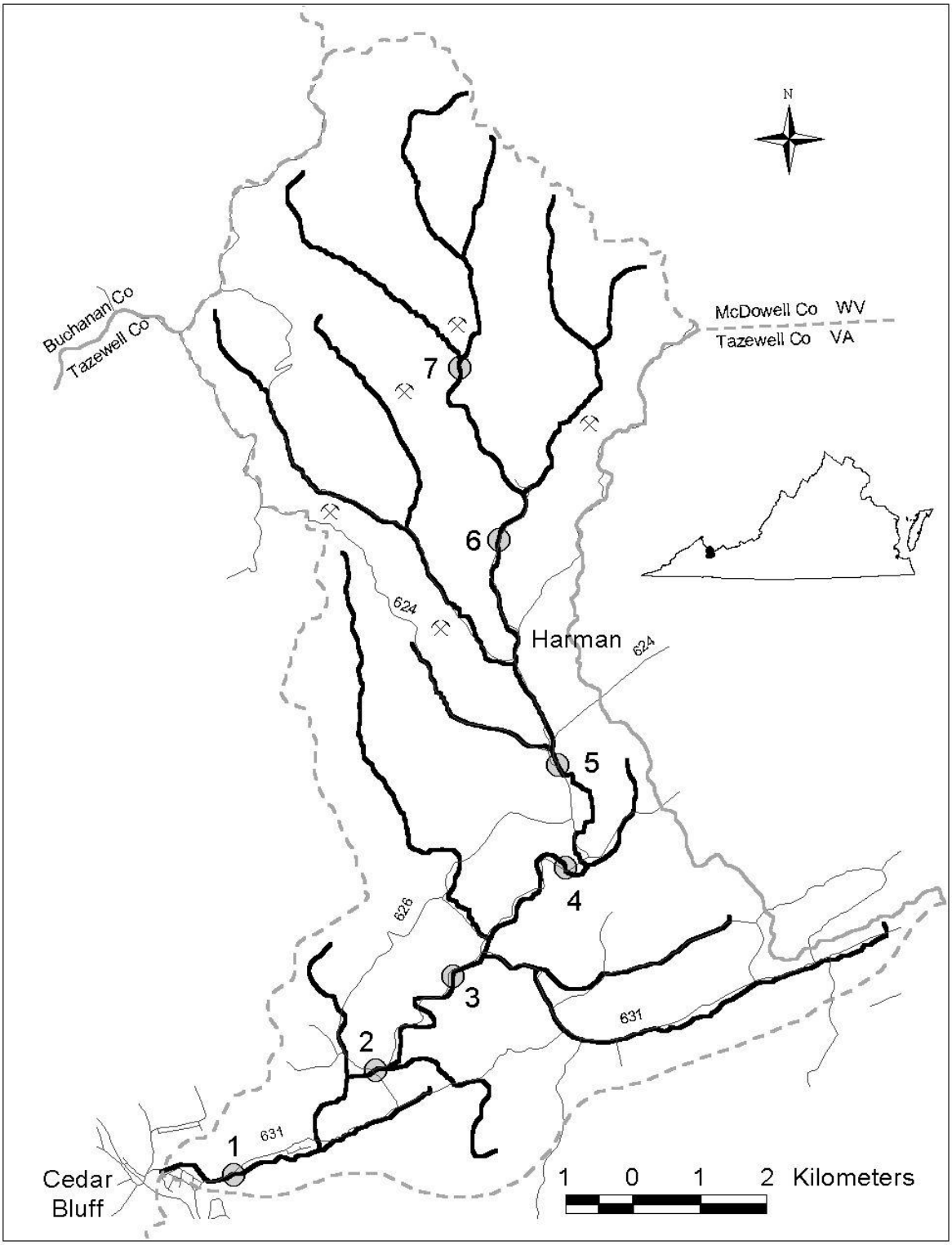

Fig. 1. Map of Indian Creek watershed, Tazewell County, Virginia. Each of the seven sampling stations is represented as circles. Proposed mine site is directly above station 7. Dashed line on the bottom of the map represents the approximate boundary between Indian Creek and mainstem Clinch River.

Table 1. Sampling stations on Indian Creek, Tazewell County, Virginia.

Site	River km above confluence	Nearby landmarks	Quadrangle	Sample date	Sample length (m)	Latitude/ Longitude	Basin area (ha)
1	0.8	From downstream side of Co. Rt. 631 bridge at Cedar Bluff to 50 m upstream above railroad bridge	Richlands	19 September 1996	180	37°05.16 N 81°45.32 W	8,624.7
2	4.4	From downstream side of Co. Rt. 626 bridge alongside Co. Rt. 630	Pounding Mill	19 September 1996	120	37°06.09 N 81°43.51 W	7,795.9
3	7.0	Alongside Co. Rt. 630 approximately 50 m downstream of railroad bridge	Pounding Mill	24 September 1996	100	37°06.54 N 81°43.05 W	7,303.8
4	10.1	Alongside Co. Rt. 627, 5 m above box culvert	Amonate	24 September 1996	100	37°07.46 N 81°41.58 W	4,972.8
5	13.2	50 m above Co. Rt. 627 bridge approximately 0.5 km from Co. Rt. 624 intersection	Amonate	20 September 1996	100	37°08.36 N 81°42.03 W	4,169.9
6	16.2	Approximately 0.75 km below confluence with Jackson Fork alongside Co. Rt. 628	Amonate	18 September 1996	100	37°10.23 N 81°42.40 W	2,590
7	19.7	100 m below confluence of South and North Branches alongside Co. Rt. 628	Amonate	18 September 1996	100	37°11.50 N 81°43.03 W	932.4

Table 2. Physical habitat characteristics of seven sites sampled on Indian Creek, Tazewell County, Virginia, September 18-24, 1996.

Variable	1	2	3	4	5	6	7
Average stream width (m)	10.5	6.76	6.45	6.60	6.27	4.8	5.5
Average stream depth (m)	0.30	0.20	0.16	0.13	0.12	0.12	0.16
Flow (m^3/sec)	0.12	0.15	0.06	0.05	0.05	0.02	0.01
Pool (%)	47	52	28	38	37	65	85
Riffle (%)	40	33	24	11	29	14	10
Run (%)	13	15	48	51	34	21	5
Embeddedness (%)[a]	30	50	30	35	40	40	90
Dominant substrate type	Bedrock	Bedrock	Cobble	Bedrock	Cobble	Boulder	Silt
Subdominant substrate type	Sand	Cobble	Gravel	Gravel	Boulder	Cobble	Cobble

[a] Visually estimated

significantly altered physically, chemically, or biologically. For example, an intolerant species such as the speckled darter (*Etheostoma stigmaeum*) is generally not found in heavily silted or highly eutrophic streams. In contrast, a tolerant species such as the white sucker (*Catostomus commersoni*) can be abundant in disturbed streams. Metrics are based on observed condition of an assessed site compared to an unimpaired stream within the same drainage, physiographic region, or both (Angermeier & Smogor, 1993). Because the number of species tends to increase with increased drainage area, metrics 1 through 5 were adjusted to account for the drainage area above a sampling station (Table 4). For station 7, which had a drainage area < 1,295 ha (5 mi^2), we used alternative headwater metrics for 2, 3, 4, 5, and 11 that account for the naturally low fish diversity found in high-elevation, headwater streams. These metrics include "number of riffle species," "number of pool species," "percentage composition by two most dominant species," and "percentage of fish as simple lithophilic spawners." Each metric is scored as 1-poor, 3-intermediate, or 5-high. Individual metric scores were then totaled to produce an overall IBI score for the site that was placed into one of the following integrity classes: 60-58 (Excellent), 52-48 (Good), 44-40 (Fair), 34-28 (Poor), and 22-12 (Very poor).

RESULTS

Species Composition and Distribution

A total of 1,970 individuals representing 33 species and 6 families was collected (Table 5). Cyprinidae and Percidae were the most speciose families with 15 species and 8 species, respectively. The most common species were the central stoneroller (*Campostoma anomalum*), Tennessee shiner (*Notropis leuciodus*), and northern hogsucker (*Hypentelium nigricans*). Fantail darter (*Etheostoma flabellare*) was the only species found at all stations. The rosyside dace (*Clinostomus funduloides*) was collected only at headwater stations 6 and 7, while spotfin shiner (*Cyprinella spiloptera*), banded darter (*Etheostoma zonale*), wounded darter (*Etheostoma vulneratum*), and bluegill (*Lepomis macrochirus*) were collected only near the mouth at station 1. Species richness ranged from 5 at station 7 to 25 at station 1. Stations 3 and 5 had the greatest fish abundance. Nearly 50% of fishes captured at station 5 were central stonerollers (*Campostoma anomalum*).

Biotic Condition

The IBI scores ranged from 48 (station 1) to 36 (stations 5 and 7) (Table 6). The native status and ecological condition of species collected is listed in Table 7. All collected species were considered native except redbreast sunfish (*Lepomis auritus*) and brown trout (*Salmo trutta*). Stations 2, 3, 4, and 6 scored "fair," station 1 scored "good," and stations 5 and 7 scored "fair/poor." Metrics for station 7 scored low for "number of riffle species," "number of intolerant species," and "percentage of piscivores" designating the integrity class between "fair" and "poor." In contrast, metrics for station 1 scored high for "number of species," "number of darters," "number of suckers," "number of intolerants," "percentage of tolerants," and "percentage of piscivores."

The metrics "number of species," "percentage of tolerants," and "percentage of specialized insectivores" scored moderate to high for all stations. Metrics for "number of sunfish species," "percentage of omnivores," and "catch rate" generally scored moderate or low for all stations except station 7, which scored high for "percentage of omnivores." The metrics "percentage of hybrids" and "percentage of anomalies" scored high at all sites indicating

Table 3. List of metrics used in calculating Index of Biotic Integrity for stations sampled on Indian Creek, Tazewell County, Virginia. Metrics are based on those developed by Karr (1981) and modified by the Tennessee Department of Health and Environmental Conservation (1996) for the Tennessee River drainage.

Metrics	Score 1	3	5
1. Number of native species	Expectations for metrics 1-5 vary with drainage area (See Table 4)		
2. Number of native darter species or Number of riffle species (headwater streams)			
3. Number of native sunfish (less *Micropterus* spp.) or Number of pool species (headwater streams)			
4. Number of native sucker species or Percentage composition by two most dominant species (headwater streams)			
5. Number of intolerant species or Number of headwater intolerant species (headwater streams)			
6. Percentage of tolerant species	> 20	20-10	< 10
7. Percentage of fish as omnivores and stoneroller species	> 30	30-15	< 15
8. Percentage of fish as specialized insectivores	< 25	25-50	> 50
9. Percentage of fish as piscivores	< 2	2-5	> 5
10. Catch rate (average number/300 ft^2 [28.7 m^2] or 5 minutes of boat shocking)*	< 16	16-32	> 32
11. Percentage of fish as hybrids or Percentage of fish as simple lithophilic spawners (headwater streams)	> 1	1-Tr**	0
12. Percentage of fish with disease, tumors, fin damage, and other anomalies	> 5	5-2	< 2

*Metric and criteria modified by the Tennessee Valley Authority
**Tr = value between 0 and 1%

Table 4. Scoring criteria of each sample station as a function of drainage area for species richness metrics used to assess biotic integrity in Indian Creek, Tazewell County, Virginia. HW streams = alternate metric used for headwater streams.

Metric	Site	1	3	5
Number of native fish species	1	< 12	12-22	> 22
	2	< 11	11-21	> 21
	3	< 11	11-21	> 21
	4	< 10	10-19	> 19
	5	< 10	10-18	> 18
	6	< 8	8-15	> 15
	7	< 5	5-9	> 9
Number of native darter species	1	< 3	3-4	> 4
	2	< 3	3-4	> 4
	3	< 3	3-4	> 4
	4	< 3	3-4	> 4
	5	< 2	2-3	> 3
	6	< 2	2-3	> 3
Number of riffle species (HW streams)	7	< 2	2	> 2
Number of native sunfish species	1	< 2	2	> 2
	2	< 2	2	> 2
	3	< 2	2	> 2
	4	< 2	2	> 2
	5	< 2	2	> 2
	6	< 2	2	> 2
Number of pool species (HW streams)	7	< 4	4-7	> 7
Number of native sucker species	1	< 2	2	> 2
	2	< 2	2	> 2
	3	< 2	2	> 2
	4	< 2	2	> 2
	5	< 2	2	> 2
	6	< 2	2	> 2
Percentage of two most dominant species (HW streams)	7	> 84	70-84	< 70
Number of intolerant species	1	< 2	2-3	> 3
	2	< 2	2-3	> 3
	3	< 2	2-3	> 3
	4	< 2	2-3	> 3
	5	< 2	2-3	> 3
	6	< 2	2	> 2
Number of headwater intolerant species (HW streams)	7	< 2	2-3	> 3

Table 5. Distribution and abundance of fishes collected in Indian Creek, Tazewell County, Virginia, September 1996.

Common name	Scientific name	Station 1	2	3	4	5	6	7	Total
Rosyside dace	*Clinostomus funduloides*	-	-	-	-	-	4	1	5
Blacknose dace	*Rhinichthys atratulus*	-	-	24	5	61	10	13	113
Central stoneroller	*Campostoma anomalum*	82	117	88	71	217	11	-	586
Creek chub	*Semotilus atromaculatus*	-	-	-	2	-	7	5	14
River chub	*Nocomis micropogon*	12	7	15	-	2	-	-	36
Bigeye chub	*Hybopsis amblops*	8	9	9	32	7	-	-	65
Whitetail shiner	*Cyprinella galactura*	16	7	4	16	-	-	-	43
Spotfin shiner	*Cyprinella spiloptera*	1	-	-	-	-	-	-	1
Warpaint shiner	*Luxilus coccogenis*	4	21	69	1	-	-	-	95
Striped shiner	*Luxilus chrysocephalus*	10	11	25	23	3	2	-	74
Mountain shiner	*Lythrurus lirus*	-	-	3	-	-	-	-	3
Tennessee shiner	*Notropis leuciodus*	7	19	73	1	53	-	-	153
Telescope shiner	*Notropis telescopus*	2	4	29	53	-	22	-	110
Sawfin shiner	*Notropis* sp.	1	1	-	3	-	-	-	5
Mirror shiner	*Notropis spectrunculus*	-	4	-	14	1	2	-	21
Bluntnose minnow	*Pimephales notatus*	12	5	35	26	18	16	-	112
Northern hogsucker	*Hypentelium nigricans*	45	13	14	26	18	2	-	118
Black redhorse	*Moxostoma duquesnei*	6	8	-	2	-	-	-	16
White sucker	*Catostomus commersoni*	1	-	-	3	-	11	4	19
Brown trout	*Salmo trutta*	-	-	-	-	-	1	-	1
Banded sculpin	*Cottus carolinae*	2	11	-	-	-	-	-	13
Rock bass	*Ambloplites rupestris*	20	11	12	10	8	10	-	71
Smallmouth bass	*Micropterus dolomieu*	9	3	2	2	4	2	-	22
Redbreast sunfish	*Lepomis auritus*	15	3	1	1	-	2	-	22
Bluegill	*Lepomis macrochirus*	3	-	-	-	-	-	-	3
Blotchside logperch	*Percina burtoni*	-	-	-	1	-	-	-	1
Greenside darter	*Etheostoma blennioides*	26	6	7	5	3	-	-	47
Banded darter	*Etheostoma zonale*	2	-	-	-	-	-	-	2
Snubnose darter	*Etheostoma simoterum*	10	3	7	11	28	10	-	69
Speckled darter	*Etheostoma stigmaeum*	3	-	10	3	1	2	-	19
Redline darter	*Etheostoma rufilineatum*	-	8	19	6	3	-	-	36
Wounded darter	*Etheostoma vulneratum*	3	-	-	-	-	-	-	3
Fantail darter	*Etheostoma flabellare*	2	3	6	9	29	19	4	72
Number of specimens		302	274	452	326	456	133	27	1970
Species richness		25	21	20	24	16	17	5	33

Table 6. Index of biotic integrity scores on stations sampled on Indian Creek, Tazewell County, Virginia. Metrics based on those developed by Karr (1981) and modified by the Tennessee Department of Health and Environmental Conservation (1996) for the Tennessee River drainage.

	Station						
Metrics	1	2	3	4	5	6	7
Number of native species	5	3	3	5	3	3	3
Number of native darter species	5	3	5	5	5	3	1*
Number of native sunfish species (less *Micropterus* spp.)	3	1	1	1	1	1	3*
Number of native sucker species	5	3	1	5	1	3	5*
Number of intolerant species	5	5	5	5	3	5	1*
Percentage of tolerant species	5	5	5	3	5	3	3
Percentage of individual fishes as omnivores and stonerollers	1	1	3	1	1	3	5
Percentage of individual fishes as specialized insectivores	3	3	5	5	3	5	3
Percentage of individual fishes as piscivores	5	5	3	1	3	5	1
Catch rate	1	1	3	1	1	1	1
Percentage of individual fishes as hybrids	5	5	5	5	5	5	5*
Percentage of individual fishes with disease, tumors, fin damage, and other anomalies	5	5	5	5	5	5	5
IBI total score	48	40	44	42	36	42	36
Integrity class	Good	Fair	Fair	Fair	Fair/ Poor	Fair	Fair/ Poor

*Calculated with metric for headwater streams

Table 7. Fish species collected in Indian Creek, Tazewell County, Virginia, with designations for native species, trophic guild, family group, and tolerance for the Tennessee River drainage. (HW Intolerant = Headwater Intolerant, used for stations with a drainage area < 1,295 ha [5 mi^2]. Spec. Insectivore = specialized insectivore). Native status and ecological information are presented by Pflieger (1975), Smith (1979), Lee et al. (1980), Etnier & Starnes (1993), and Jenkins & Burkhead (1994).

Species name	Native	Trophic guild	Family group	Tolerance
Clinostomus funduloides	Yes	Spec. Insectivore	Cyprinidae	Intolerant
Rhinichthys atratulus	Yes	Spec. Insectivore	Cyprinidae	----
Campostoma anomalum	Yes	Herbivore	Cyprinidae	----
Semotilus atromaculatus	Yes	Insectivore	Cyprinidae	Tolerant
Nocomis micropogon	Yes	Omnivore	Cyprinidae	----
Hybopsis amblops	Yes	Spec. Insectivore	Cyprinidae	HW Intolerant
Cyprinella galactura	Yes	Insectivore	Cyrpinidae	----
Cyprinella spiloptera	Yes	Insectivore	Cyprinidae	Tolerant
Luxilus coccogenis	Yes	Spec. Insectivore	Cyprinidae	HW Intolerant
Luxilus chrysocephalus	Yes	Omnivore	Cyprinidae	Tolerant
Lythrurus lirus	Yes	Spec. Insectivore	Cyprinidae	HW Intolerant
Notropis leuciodus	Yes	Spec. Insectivore	Cyprinidae	HW Intolerant
Notropis telescopus	Yes	Spec. Insectivore	Cyprinidae	Intolerant
Notropis sp.	Yes	Spec. Insectivore	Cyprinidae	HW Intolerant
Notropis spectrunculus	Yes	Spec. Insectivore	Cyprinidae	----
Pimephales notatus	Yes	Omnivore	Cyprinidae	----
Hypentelium nigricans	Yes	Insectivore	Catostomidae	HW Intolerant
Moxostoma duquesnei	Yes	Insectivore	Catostomidae	Intolerant
Catostomus commersoni	Yes	Omnivore	Catostomidae	Tolerant
Salmo trutta	No	Piscivore	Salmonidae	----
Cottus carolinae	Yes	Insectivore	Cottidae	----
Ambloplites rupestris	Yes	Piscivore	Centrarchidae	Intolerant
Micropterus dolomieu	Yes	Piscivore	Centrarchidae	----
Lepomis auritus	No	Insectivore	Centrarchidae	----
Lepomis macrochirus	Yes	Insectivore	Centrarchidae	----
Percina burtoni	Yes	Spec. Insectivore	Percidae	----
Etheostoma blennioides	Yes	Spec. Insectivore	Percidae	----
Etheostoma zonale	Yes	Spec.Insectivore	Percidae	----
Etheostoma simoterum	Yes	Spec. Insectivore	Percidae	----
Etheostoma stigmaeum	Yes	Spec. Insectivore	Percidae	Intolerant
Etheostoma rufilineatum	Yes	Spec. Insectivore	Percidae	----
Etheostoma vulneratum	Yes	Spec. Insectivore	Percidae	----
Etheostoma flabellare	Yes	Spec. Insectivore	Percidae	Intolerant

a low incidence of hybridization and anomalies. We found that <1% of fishes had blackspot, a nonlethal trematode infection that appears as dark specks on the fins and body (Post, 1987).

DISCUSSION

Indian Creek, containing 35 indigenous species, has one of the most diverse fish communities in the Clinch River drainage. Among Clinch River tributaries in Virginia, Indian Creek ranks third behind Little River with 42 species and Copper Creek with 63 species (Jenkins & Burkhead, 1994). Most species collected in our survey were the same as those in earlier sampling efforts by Masnik (1974), Angermeier & Smogor (1993), and Jenkins & Burkhead (1994). However, species not collected by us include gizzard shad (*Dorosoma cepedianum*) and mountain brook lamprey (*Ichthyomyzon greeleyi*) (Masnik, 1974); golden redhorse (*Moxostoma erythrurum*) (Angermeier & Smogor, 1993); and Clinch sculpin (*Cottus* sp.) and largemouth bass (*Micropterus salmoides*) (Jenkins & Burkhead, 1994). Our collections of blotchside logperch (*Percina burtoni*), wounded darter (*Etheostoma vulneratum*), and rosyside dace (*Clinostomus funduloides*) represent additions to the species known from Indian Creek.

Non-native species from Indian Creek include rainbow trout (*Onchoryncus mykiss*), (Jenkins & Burkhead, 1994), redbreast sunfish (*Lepomis auritus*) (Angermeier & Smogor, 1993), and brown trout (*Salmo trutta*) (this study). Because the Virginia Department of Game and Inland Fisheries has never stocked Indian Creek or permitted stocking by private citizens, the presence of salmonids is probably the result of illegal stocking, escapees from privately-owned ponds, or recruits from nearby streams. Our sampling indicates that redbreast sunfish are now well established throughout Indian Creek. Redbreast sunfish have been widespread in the upper Tennessee drainage since 1975 (Jenkins & Burkhead, 1994). The first record of this species in Indian Creek was reported in Angermeier & Smogor (1993). Of the two *Lepomis* species native to the upper Tennessee drainage, the longeared sunfish (*L. megalotis*) and bluegill (*L. macrochirus*), we only collected the latter.

Several rare fishes occur in Indian Creek. The mirror shiner (*Notropis spectrunculus*) has special concern status in Virginia and is known from only a few tributaries in the Powell, Clinch, and Holston rivers in Virginia (Jenkins & Burkhead, 1994). Masnik (1974) reported mirror shiners in most of his samples from Indian Creek, but Jenkins & Burkhead (1994) later reidentified several of his specimens as sawfin shiners (*Notropis* sp.). Our collection of mirror shiner and those of Angermeier & Smogor (1993) indicate that this species continues to persist in Indian Creek. The blotchside logperch (*P. burtoni*) is endemic to the upper Tennessee drainage and listed in Virginia as a species of special concern. It is known from a few sections of the North Fork Holston and Clinch rivers and tributaries (Jenkins & Burkhead, 1994). The presence of a blotchside logperch in a small system like Indian Creek is unusual for a species that typically populates medium to large streams and small rivers. Our record represents the furthest documented upstream collection of this species in the Clinch River drainage.

Our biotic assessment indicates that Indian Creek is in "fair" condition with portions "good" near the mouth and "fair/poor" at the headwaters. Sources of degradation at the headwaters are likely due to siltation caused by poorly maintained access roads that parallel and cross the creek, as well as the lack of riparian vegetation. High siltation levels have a negative effect on riffle, darter, and intolerant species that require clean substrate to reproduce and feed. Central stonerollers are herbivorous fish that were abundant at stations 1 to 5. This occurrence level decreased scoring for the metric "percentage of fishes as omnivores and stonerollers." Nutrient enrich-ment due to agriculture, and the opening of streamside canopy to sunlight may increase stoneroller numbers by providing an abundance of an algal food source.

Previously, Angermeier & Smogor (1993) assessed Indian Creek as "good" in 1991 and 1992. They surveyed one site that was nearest to our station 3. Our score of 44 was lower than their score of 50 in 1991 and 54 in 1992. Although Karr et al. (1986) indicate that total IBI scores should differ four points before a change in site quality can exist, we believe that these differences can be explained by sampling methods, metric descriptions, and scoring. For example, Angermeier & Smogor (1993) sampled a 500 m section and used a more efficient electric seine compared to our 100 m section and backpack shockers. Their metrics tended to score higher for "percentage of tolerant species" and "percentage of piscivores." Additionally, their metric "number of native sunfish species" included smallmouth bass whereas our metric excluded *Micropterus* sp. Because we found smallmouth bass (*Micropterus dolomieu*) at all stations except the headwaters, our exclusion of this species lowered our metric score. Finally, the numerical range of each integrity classes (i.e., excellent, fair, poor) in Angermeier & Smogor (1993) tended to be two and four points lower than that of our classification. The result of this scoring would be higher classification for their sites even if our sites had the same final IBI score.

The importance of tributaries to the overall health of the Clinch River fauna cannot be overemphasized. Resource managers have recognized tributaries as important refugia during catastrophic events and a source of recolonization thereafter in the Clinch River. In 1967 and 1973, fly ash

accidents from the APCO plant in Carbo, Virginia killed thousands of fish for over 126 rkm. Fish populations in Copper Creek are thought to be responsible for re-establishment of many species in the Clinch River (Jenkins & Burkhead, 1994). Tributaries also serve as nursery areas for early life stages of many fish species and source populations of endangered mussels (Winston & Neves, 1997). Protecting water quality in tributaries like Indian Creek is critical to maintaining the biological health of the Clinch River.

ACKNOWLEDGMENTS

We thank Shay Garriock, John Jessee, Paul Lawrence, Monte McGregor, Dewayne Sprinkle, and Johnny Tilson for assistance in fish sampling, and Dr. Robert E. Jenkins for providing fish identifications. Chris Mattson, VDGIF Fish and Wildlife Information System, provided us with the map and geographical information. Finally, we wish to thank the many reviewers that provided many useful comments on the manuscript.

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