

Winter Fishes of Stinking Fork

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Introduction

Stinking Fork of the Little Blue River is located in unglaciated terrain of the Crawford Upland Region (14) in the southcentral counties of Crawford and Perry, Indiana. The stream flows for approximately 19 kilometers in a southeasterly direction to its confluence with the Little Blue River, a tributary of the Ohio River. Stinking Fork drains an area of 70.7 square kilometers (6) and elevations within the drainage basin are 137 to 232 meters above sea level. Small towns along its course are West Fork and Sulfur Springs (Figure 1).

Stinking Fork is located in the Hoosier National Forest. It is a moderate to fast-flowing upper perennial riverine ecosystem (2) comprised of many riffles and pools. It flows primarily through hydrophytic to mesophytic forests consisting of sycamore, oak, silver maple, beech and, to a much lesser extent, through agricultural and grazing lands.

To our knowledge, no previous work on fishes in Stinking Fork has been published. The only fish study near, but not in Stinking Fork, was in the Little Blue River and Big Blue River (3). The purpose of this study was to accumulate winter base-line data on the type, distribution, relative abundance, and species diversity of fishes in Stinking Fork and its tributaries.

Material and Methods

Twenty-one sites were sampled in Stinking Fork drainage (Figure 1). These were

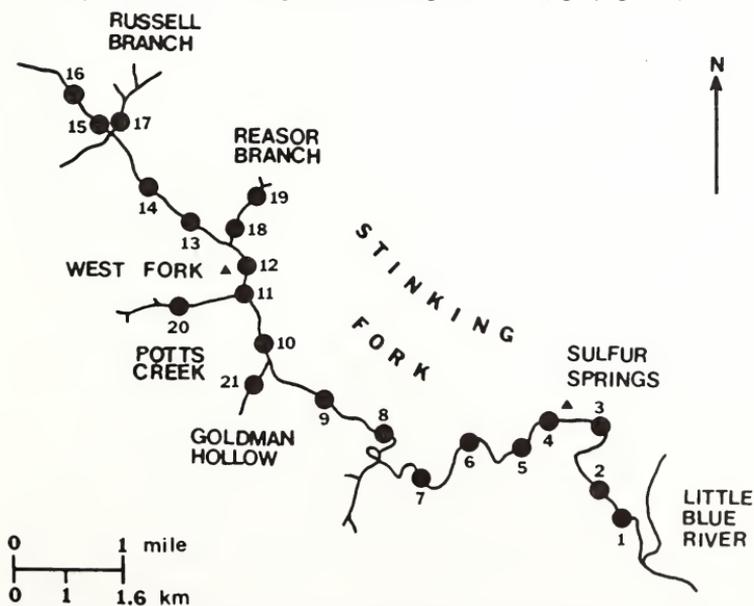


FIGURE 1. Map of Stinking Fork drainage. Solid circles represent collecting sites, while triangles depict towns.

TABLE 1. Frequency, Location and Diversity of Fish Species in Stinking Fork per Station

SPECIES	STINKING FORK											SMALL TRIBUTARIES							Total			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		19	20	21
<i>Camptostoma anomalum</i> (Central Stoneroller)	1			2			5	1	8	7	21	26	3	41	8	49	13	31	17	34	130	397
<i>Erycymba buccata</i> (Silverjaw Minnow)									7	1	13	17		17	10	22		1	3	1	5	80
<i>Nothopis ardens</i> (Rosefin Shiner)	1	25	56	2	50	108		16	9	24	25	36	4	54	38					2	59	510
<i>Nothopis atherinoides</i> (Emerald Shiner)	7																					7
<i>Nothopis chrysocephalus</i> (Striped Shiner)		12	172	20	54	396	1	52	9	56	14	37	17	24	88	39	34	49	2	131	1207	
<i>Phoxinus erythrogaster</i> (Redbelly Dace)												1	55	44	44	53	27	50	5	17	252	
<i>Pimephales notatus</i> (Bluntnose Minnow)	1	28	5	274	19		101	54	128	11	15	58		82	1	4	8	3	115	907		
<i>Semotilus atromaculatus</i> (Creek Chub)							4				1	3	29			48	23	11	42	1	11	173
<i>Carostomus commersoni</i> (White Sucker)																4						4
<i>Hypentelium nigricans</i> (Hog Sucker)	1	2	2	2	2	1	1	1	3	1	1	1	1	3							17	17
<i>Moxostoma diquesnei</i> (Black Redhorse)	1	1	1	1	1	1	1							3							4	4
<i>Moxostoma erythrurum</i> (Golden Redhorse)	1																				2	7
<i>Labidesthes sicculus</i> (Brook Silverside)						3															3	3
<i>Ambloplites rupestris</i> (Rock Bass)	1						1								1						2	2
<i>Lepomis humilis</i> (Orangespotted Sunfish)																					1	1
<i>Lepomis megalotis</i> (Longear Sunfish)				3		1															4	4
<i>Etheostoma blennioides</i> (Greenside Darter)	7																					7
<i>Etheostoma caeruleum</i> (Rainbow Darter)	4	6	1	7	8	6	7	2	17	4	3	2	1	1	1					1	1	71
<i>Etheostoma flabellare</i> (Fantail Darter)	22	22	6	8	23	13	6	11	31	22	18	13	3	6	11	1	10	2	2	8	1	239
<i>Etheostoma nigrum</i> (Johnny Darter)	1	4	2	3	14	3	3	1														31
<i>Etheostoma spectabile</i> (Orangethroat Darter)	1	2		2	2	1	2	22	3	2	2	2	1	2	1	2	1	2	11	5	6	61
<i>Cottus caroliniae</i> (Banded Sculpin)				2	3	1	1									1	2		1			13
Total Number of Species	8	4	10	11	9	12	9	6	12	9	10	9	9	10	9	11	7	9	9	10	11	22
Total Number of Individuals	38	31	60	283	68	419	546	17	245	126	269	96	116	216	112	378	141	113	183	62	478	3997
Species Diversity (H')	1.9	1.2	2.5	1.8	2.5	1.7	1.3	1.7	2.6	2.3	2.3	2.6	2.4	2.6	2.2	2.8	2.2	2.4	2.5	2.3	2.4	

TABLE 1.—Continued

SPECIES	% OF TOTAL CATCH	% FREQUENCY OF OCCURRENCE
<i>Camptostoma anomalum</i> (Central Stoneroller)	9.9	81.0
<i>Ericymba buccata</i> (Silverjaw Minnow)	2.0	47.6
<i>Notropis ardens</i> (Rosefin Shiner)	12.8	81.0
<i>Notropis atherinoides</i> (Emerald Shiner)	0.2	4.8
<i>Notropis chrysocephalus</i> (Striped Shiner)	30.2	90.5
<i>Phoxinus erythrogaster</i> (Redbelly Dace)	6.3	38.1
<i>Pimephales notatus</i> (Bluntnose Minnow)	22.7	81.0
<i>Semotilus atromaculatus</i> (Creek Chub)	4.3	47.6
<i>Catostomus commersoni</i> (White Sucker)	0.1	4.8
<i>Hypentelium nigricans</i> (Hog Sucker)	0.4	57.1
<i>Moxostoma duquesnei</i> (Black Redhorse)	0.1	9.5
<i>Moxostoma erythrurum</i> (Golden Redhorse)	0.2	28.6
<i>Labidesthes sicculus</i> (Brook Silverside)	0.1	4.8
<i>Ambloplites rupestris</i> (Rock Bass)	0.1	9.5
<i>Lepomis humilis</i> (Orangespotted Sunfish)	<0.1	4.8
<i>Lepomis megalotis</i> (Longear Sunfish)	0.1	9.5
<i>Etheostoma blennioides</i> (Greenside Darter)	0.2	4.8
<i>Etheostoma caeruleum</i> (Rainbow Darter)	1.8	76.2
<i>Etheostoma flabellare</i> (Fantail Darter)	6.0	100.0
<i>Etheostoma nigrum</i> (Johnny Darter)	0.8	38.1
<i>Etheostoma spectabile</i> (Orangethroat Darter)	1.5	66.7
<i>Cottus caroliniae</i> (Banded Sculpin)	0.3	38.1

collected from 25 January to 22 February 1986. Each location was sampled using a combination of or singly a 4.3 × 1.1 meter (0.5 cm square mesh), 1.7 × 1.1 meter (0.6 cm ace mesh), or 1.7 × 1.3 meter (0.3 cm ace mesh) seine(s) for 0.5 to 1 hour. After collection, fish specimens were preserved in the field in 10% formalin. Fish specimens are presently housed within the University of Southern Indiana collection.

Species diversity: $H' = C/N (N \log_{10} N - \sum n_i \log_{10} n_i)$, where C is the constant for conversions of logarithms from base 10 to base 2 ($C = 3.32$); N equals the total number of individuals in the population; and n_i is the number of individuals of a particular species (4). Results are independent of sample size (10).

Fishes were identified to species using standard references (1, 8, 9, 12, 13). All scientific and common names in this report are currently acceptable names (11).

Results

Twenty-two species of fish from six families were collected in the Stinking Fork drainage. These species are listed with their distribution and relative abundance in Table 1. The fantail darter was ubiquitous, while the rosefin shiner, striped shiner, central stoneroller, bluntnose minnow, and rainbow darter were found in 75% or greater of the 21 stations sampled. The other sixteen species were restricted in their distribution in the drainage. The redbelly dace was found in the upper region of Stinking Fork and its small tributaries, while the hog sucker, golden redhorse, and johnny darter were limited to the middle and lower regions of the main stream. The few centrarchids found were restricted to the Sulfur Springs area and the emerald shiner was exclusively collected at Station 1 near the mouth. The creek chub, silverjaw minnow, and orangethroat darter were limited to the upper half of Stinking Fork drainage, while the banded sculpin demonstrated a uniquely disjunct distribution. It was collected in the headwater tributaries above West Fork, absent in Stinking Fork above and below West Fork, and found again

in the middle and lower regions of the main stream. The black redhorse was found at two headwater stations, whereas the white sucker, greenside darter, and brook silverside were collected at only one station in this study. The white sucker was found in the upper headrun of Stinking Fork (Station 16); the brook silverside in the middle region of the main stream (Station 6); and the greenside darter in the lower region (Station 3). The distributions of the orangethroat and rainbow darters were different. The orangethroat darter outnumbered the rainbow darter in the headwaters, while the rainbow darter outnumbered the orangethroat darter in the lower region of Stinking Fork (2×3 Chi Square = 29.2; $df = 2$; $p < .005$). Their numbers were similar in the middle region.

The most abundant fishes in Stinking Fork drainage were the striped shiner and bluntnose minnow (Table 1). These 2 species comprised 52.9% of the total catch. The rosefin shiner, central stoneroller, redbelly dace, creek chub, and fantail darter made up 39.3% of the total catch. Together, the above 7 species comprised 92.2% of the collection, while the remaining 15 species constituted but 7.8% of the total catch. Ninety-eight percent of the fishes collected in Stinking Fork drainage belonged to the minnow (88.4%) and darter (9.6%) families.

The species diversity of fishes in Stinking Fork drainage (Table 1) ranged from 1.2 to 2.8 and averaged 2.2 ± 0.4 . Species diversity was rather uniform and averaged 2.4 ± 0.2 ($N = 13$; Range = 2.2 to 2.8) upstream from Station 9 and 1.8 ± 0.5 ($N = 8$; Range = 1.2 to 2.5) downstream. The lowest diversity indexes found were at Stations 2 and 7.

Discussion

Eighty-eight percent of the fishes collected in this study belonged to the minnow family. The most abundant minnows were the striped shiner, bluntnose minnow, rosefin shiner, central stoneroller, redbelly dace, and creek chub, all common inhabitants of pools in small streams. Their abundance is reflective of the number and extent of pools available in Stinking Fork drainage. The silverjaw minnow was collected in modest numbers and limited to the upper half (Station 9 on upstream) of Stinking Fork drainage. The silverjaw minnow is a sand-inhabiting species and reaches its greatest abundance only in brooks and small streams of moderate gradients where the sand on the bottom of the pools, bars, and riffles are free from a covering of clayey silts (13). We found from Station 8 to the mouth of Stinking Fork an increase in silty mud. Such conditions presumably exclude the silverjaw minnow from this region of the drainage. The rosefin shiner is allopatric with the redfin shiner in southern Indiana (3). We found only the rosefin shiner in this investigation. This species inhabits smaller and swifter streams than the redfin shiner (13).

Of the twenty-two species of fish collected in this investigation, the redbelly dace was the only species not collected previously in Crawford or Perry counties (3). In Gerking's monumental, statewide survey of 720 sites sampled in the summers of 1940 to 1943, he never collected the redbelly dace any further south than the White River drainage. Our recent discovery of this new Crawford County record in Stinking Fork probably represents an isolated population that existed during his time, but not sampled since he never ventured into Stinking Fork and because this fish tends to occur as isolated populations at widely spaced intervals (9). Its preferred habitat is spring-fed brooks and other clear, cool streams in wooded ravines (12) with overhanging vegetation (5). Streams of clear, cool water with "cut banks" are prime habitat (13). It is a gregarious fish often found in association with the central stoneroller and creek chub (9).

The most abundant species of sucker collected in Stinking Fork was the hog sucker. From our experience, the hog sucker is usually accompanied by the white sucker. However, we found a disproportionate ratio of 17 hog suckers to 4 white suckers with the former species collected at 12 stations; whereas, the latter species at only one station. The hog sucker prefers riffles, while the white sucker inhabits pools (3). Both suckers are migratory

and winter in larger streams (13). With commencement of water temperatures of 4° C or greater, Trautman found in Ohio a vernal migration of these two species into tributaries for spawning purposes. In this study, the hog sucker probably was first to migrate upstream and this is why they were collected more than the white sucker, especially since all of the white suckers collected were of pre-reproductive age. Other suckers found in Stinking Fork were the black and golden redborses. Their numbers were similar, but the black redborse was found in the headwaters, while the golden redborse was collected in the middle to lower regions of the drainage. Where these two species occur together, the black redborse tends to predominate in short, rocky pools with current, whereas, the golden redborse is most abundant in larger pools and backwaters without noticeable current (9).

The banded sculpin demonstrated a disjunct and puzzling distribution in Stinking Fork drainage. Its hiatus was above and below the town of West Fork, Indiana. We attribute this distribution to an impermanence in flow, substrate, or possibly to pollution since sculpins are sedentary fishes. In contrast, the more mobile sunfishes in Stinking Fork were unexpectedly low in number and restricted in their distribution. Their scarcity in the drainage may be attributed to the season for they, like the suckers, probably winter in deeper waters of the Little Blue River. A summer investigation of Stinking Fork drainage would be interesting to substantiate or refute such speculation.

The rainbow darter outnumbered the orangethroat darter in the deeper, lower region of the drainage, while the opposite was true in the shallower headwaters. Interspecific competition is suggested for these two species (13). Stream size, depth and speed of current determines for the most part which species will become established and which species will be supplanted. The orangethroat darter prefers small to moderate, first-order and limestone-bedded second order streams with riffles of relatively low gradient and with a depth often 6 inches or less (1, 7). In contrast, the rainbow darter prefers moderate to large, third-order streams with wide riffles of at least moderate to high gradient and minimum of 6 to 12 inches (1, 7, 13). In the middle region of Stinking Fork, the above environmental preferences of each species overlapped and coexistence appeared operative. Furthermore, the greenside darter usually occurs in the same habitat as the rainbow darter (1). Our results concur even though the greenside darter was found only at one station near the mouth. The fantail darter was cosmopolitan in Stinking Fork drainage. Their abundance usually indicates the presence of a variety of fishes (7) as demonstrated in this investigation. Finally, the johnny darter was limited to the middle and lower regions of Stinking Fork. It is tolerant of a number of diverse conditions (13), but prefers shallow, slow-flowing pools (1). This habitat is especially available in the middle and lower regions of Stinking Fork. Darters comprised 9.6% of the total catch in this study. Their abundance is reflective of the number and extent of riffles available in the drainage.

The species diversity observed in Stinking Fork drainage was good for a stream of its size. Indexes from Station 9 on upstream were relatively stable; however, species diversity downstream of Station 9 fell dramatically. Diversity should have increased with flow creating more habitats and thus, more species in the lower region of the drainage. However, this was not the case. It was found that the lower stations in the drainage displayed mud to organic sediments and seining was difficult. Whether anoxic sediments or bias in sampling or both produced such results is unknown. A preferred method of collection in this region of the drainage may be electroshocking the pools along with seining the riffles.

Conclusion

Stinking Fork drainage is a fast to moderate-flowing riffle and pool ecosystem and consequently, demonstrated in our winter study a predominance of minnows and darters. Twenty-two species of fish from six families were collected in this investigation. The red-

belly dace, a new record for Crawford County, was discovered in the upper headwaters. The most abundant species were the striped shiner and bluntnose minnow. Interspecific competition between the rainbow darter and orangethroat darter appeared operative in the drainage as demonstrated by their distributions. The distribution of the banded sculpin was puzzling. The species diversity was good for a small stream and averaged 2.2 ± 0.4 . A depressed fish fauna was evident in the lower region of Stinking Fork.

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