

## FISHES OF THE TIPPECANOE RIVER, INDIANA: AN OUTSTANDING MIDWESTERN STREAM

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**ABSTRACT:** A total of 26 fish samples, taken at 22 sites along the length of the Tippecanoe River from 1985 through 1987, yielded 68 species. Historic and recent ichthyological records increase the total number of fish species known from the river to 84. The fish fauna of the Tippecanoe River is diverse and includes a number of species that are rare or declining throughout their historic ranges. Thus, the Tippecanoe River is a valuable aquatic resource that should be protected from further modification. A synopsis of distributional and habitat information on uncommon fishes that are extant in the river is presented in this paper. The uncommon species are *Ichthyomyzon bdellium*, *Hybopsis amblops*, *Notropis buchanani*, *Etheostoma camurum*, *E. maculatum*, *E. pellucidum*, *E. tippecanoe*, *Percina copelandi*, *P. evides*, and *P. shumardi*. Additionally, a rare form of logperch, *Percina caprodes manitou*, was identified from the Tippecanoe River. This subspecies is found in the glacial lakes region of northern Indiana and possibly further north. Type specimens of two nominal forms of *Percina* previously described from the glacial lakes of northern Indiana were examined. A preliminary analysis of the taxonomic status of *P. c. manitou* is presented.

### INTRODUCTION

The earliest studies of Tippecanoe River fishes were published in the late 1800s and early 1900s by David Starr Jordan and his proteges, Barton W. Evermann, Oliver P. Jenkins, and Carl H. Eigenmann. Jordan (1877) listed collections from three lakes tributary to the Tippecanoe River and described *P. manitou*, now considered a subspecies of *P. caprodes*, from Lake Manitou. Evermann and Jenkins (1889) reported fish collections made by Jenkins, who boated from Lake Maxinkuckee to the confluence of the Tippecanoe and Wabash rivers in August 1886; and by Evermann during his survey of the waters of Carroll County in August 1887. Jordan (1889) presented a list of fishes collected by Evermann in September 1888 from the Tippecanoe River at Marshland (now Delong) in Fulton County and described the Tippecanoe River as "one of the best streams in the State for the collection of darters". Evermann's collection included the type specimens of *Etheostoma tippecanoe*, formally described by Jordan and Evermann (1891). P. Kirsch also made a collection at the "Marshland" locality in August 1889 (Zorach and Raney, 1967). Eigenmann and Beeson (1894) and Hay (1894, 1902) published State-wide lists of Indiana fishes that included specific Tippecanoe River localities; however, these records were drawn largely from the publications of Evermann, Jenkins, and Jordan.

Ichthyological work in the Tippecanoe River drainage was apparently suspended for about 25 years, until publication of Evermann and Clark's (1920) exhaustive study of Lake Maxinkuckee. During the mid-1920s, several ichthyological collections were made in the Tippecanoe River by H.R. Becker and Carl L. Hubbs.

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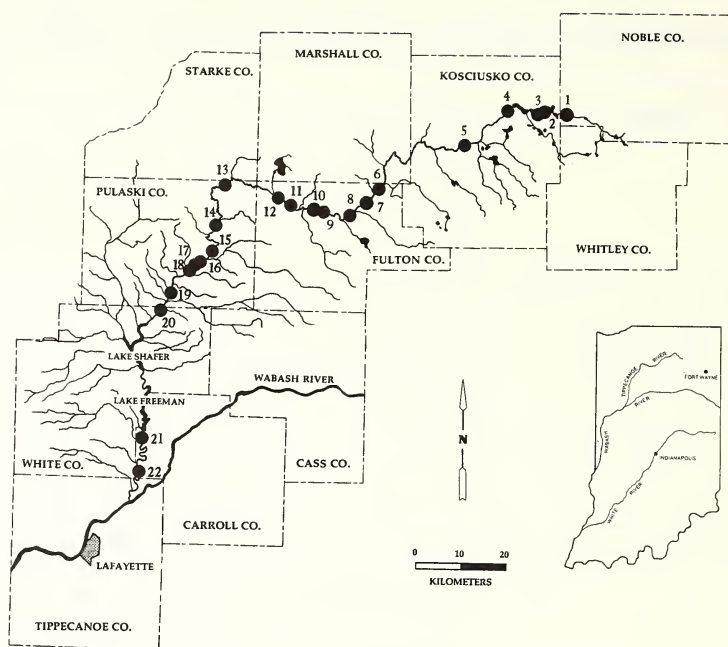


Figure 1. Collection sites (solid circles) on the Tippecanoe River, 12 July 1985 to 20 September 1987. Site numbers are identified in Table 1. Map from Cummings and Berlocher (1990).

Another 15 years of inactivity was followed by Shelby D. Gerking's Statewide survey, initiated in 1940, and publication of a comprehensive study on Indiana fish distributions (Gerking, 1945). Eight original collections from the Tippecanoe River were reported by Gerking (1945). The most recent publication to address Tippecanoe River fishes was the *Annotated Key to the Fishes of Indiana* (Nelson and Gerking, 1968), an update of the nomenclature and distribution of the Indiana ichthyofauna as reported by Gerking (1945).

The present study was initiated to determine the status and distribution of rare darters in Indiana. The scope was expanded to a general survey of the Tippecanoe River, because of the high diversity of fishes encountered and the discovery of several species that are now rare in the Midwest. Collection of *Percina caprodes manitou* prompted a preliminary analysis of its taxonomic status.

### STUDY AREA

The Tippecanoe River drains approximately 4895 square kilometers of northern and west-central Indiana (Wright, 1932). Headwaters of the Tippecanoe drainage are in Whitley and Noble Counties, and the river flows west-southwest for about 110 kilometers (Cummings and Berlocher, 1990) before emptying into the Wabash River in north-

eastern Tippecanoe County.

The upper drainage — above sample site 13 (Figure 1) in extreme northeast Pulaski Co. — is found in the Northern Lakes Natural Region, which is characterized by numerous glacial lakes (Homoya, *et al.*, 1985). This area is covered with complex Wisconsinan glacial deposits which are, in places, over 137 meters thick (Homoya, *et al.*, 1985). Natural community types in the Northern Lakes Natural Region include bog, fen, marsh, prairie, sedge meadow, swamp, seep spring, lake, and various deciduous forest types. Streams typically are clear, with medium to low gradients, and sand and gravel beds (Homoya, *et al.*, 1985).

The middle Tippecanoe drainage is in the Kankakee Sand Section of the Grand Prairie Natural Region (sample sites 13-20) (Figure 1) until the Lake Freeman impoundment of the lower river where it enters the Tipton Till Plain Section of the Central Till Plain Natural Region (sample sites 21-22) (Homoya, *et al.*, 1985). The Kankakee Sand Section is characterized by prairie and savanna communities associated with sandy soils. The Tipton Till Plain Section is a mostly undissected plain formerly covered by an extensive beech-maple-oak forest (Homoya, *et al.*, 1985).

Two large impoundments (Lake Shafer and Lake Freeman) have been constructed on the lower Tippecanoe River. Residential and recreational development is present along the banks of the river and is especially widespread in the glacial lakes region. Still, the banks are primarily wooded. Undeveloped lands bordering the river include the Tippecanoe River State Park and Winamac State Fish and Wildlife Area, both located in the middle Tippecanoe drainage. Most of the tributary streams have been channelized for agricultural drainage.

Tippecanoe River substrates are primarily clean gravel and sand. Cobble and, to a lesser extent, large boulders are present in some reaches. Moderate silt accumulation near stream margins and organic enrichment, as evidenced by abundant filamentous algae, was apparent at most sample sites.

## MATERIALS AND METHODS

A total of 26 samples of fishes was taken at 22 sites along the length of the Tippecanoe River between 12 July 1985 and 20 September 1987 (Table 1, Figure 1). Collections were made with a 3 m x 1.2 m minnow seine and a 9 m x 1.2 m bag seine, each with 3.2 mm mesh. Representatives of each species were preserved in 10% formalin and stored in 70% ethanol. All specimens were deposited at the Illinois Natural History Survey (INHS). Additional museum specimens from the University of Michigan Museum of Zoology (UMMZ) and U.S. National Museum (USNM) were examined. Nomenclature follows Page and Burr (1991).

## RESULTS AND DISCUSSION

A total of 68 fish species was collected (Table 2). Seven species not previously reported from the drainage were found: *Notropis buchanani*, *Extrarius aestivalis*, *Phenacobius mirabilis*, *Ictiobus bubalus*, *Carpiodes cyprinus*, *Percina copelandi*, and *P. shumardi*.

Sixteen species recorded from the Tippecanoe drainage prior to 1980 (Evermann and Jenkins, 1889; Blatchley, 1938; Gerking, 1945; Rohde, 1980) were not captured during this survey (Table 3). One species, the harelip sucker (*Moxostoma lacerum*),

Table 1. Collection sites, dates, and habitat characteristics for the Tippecanoe River, Indiana.

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1. Wilmot, Highway 5, Noble County; Sec. 19, T33N, R8E; 13 July 1985; rubble riffles and pools.
  2. North Webster, Kosciusko County; Sec. 15, T33N, R7E; 13 July 1985; gravel and sand pools and riffles.
  3. 0.5 miles southwest of North Webster, Kosciusko County; Sec. 15, T33N, R7E; 13 July and 7 September 1985; gravel-rubble, sand, and mud pools and runs; emergent vegetation.
  4. Oswego, Kosciusko County; Sec. 14, T33N, R6E; 13 July 1985; sand and debris.
  5. 4 miles west of Warsaw, Kosciusko County; Sec. 11, T32N, R5E; 12 July 1985; vegetated rubble riffle.
  6. Talma, Fulton County; Sec. 12, T31N, R3E; 12 July 1985 and 16 July 1987; gravel, rubble riffle; sandy run and pools.
  7. 5 miles northeast of Rochester, Fulton County; Sec. 22, T31N, R3E; 14 July 1985; rocky riffle; gravel, sand, and silt.
  8. Route 31 bridge, 3 miles north of Rochester, Fulton County; Sec. 29, T31N, R3E; 26 July 1987; sand, gravel, brush.
  9. County road crossing, 1.5 miles north of Pershing, Fulton County; Sec. 21, T31N, R2E; 20 September 1987; rubble riffles.
  10. 2 miles north of Pershing, Fulton County; Sec. 21, T31N, R2E; 29 July 1987; gravel and sand.
  11. Leiters Ford, Fulton County; Sec. 23, T31N, R1E; 14 July 1985; rubble riffle, sandy pools and runs.
  12. Delong, Fulton County; Sec. 9, T31N, R1E; 14 July and 7 September 1985, 20 September 1987; large rock riffle and gravel runs.
  13. Mouth of slough, 1 mile south of Ora, Pulaski County; Sec. 5, T31N, R1W; 19 September 1987; mud and brush.
  14. 4 miles northeast of Winamac, Pulaski County; Sec. 32, T31N, R1W; 14 July 1985; large rocky riffle.
  15. 3 miles south of Winamac, Pulaski County; Sec. 35-36, T30N, R2W; 15 July 1985; rocky riffle and pools.



16. Route 119, 3 miles south of Winamac, Pulaski County; Sec. 35-36, T30N, R2W; 7 September 1987; rubble riffle, sandy pools and runs.
  17. 6 miles south of Winamac, Pulaski County; Sec. 35-36, T30N, R2W; 27 July 1985; collected by Thomas P. Simon.
  18. 2 miles northeast of Pulaski, Pulaski County; Sec. 3, T29N, R2W; 25 July 1987.
  19. 4 miles east of Lakeside, Pulaski County; Sec. 30, T29N, R2W; 15 July 1985; large rubble riffle, sandy pools.
  20. Mouth of Ackerman Ditch, 3 miles west of Headlee, White County; Sec. 1, T28N, R3W; 19 September 1987; silt and sand backwater, cobble and boulder run.
  21. Below Oakdale Dam (Lake Freeman), Carroll County; Sec. 33, T26N, R3W; 20 September 1987; gravel runs, some cobbles and boulders.
  22. 3 miles north of Americus, Carroll County; Sec. 33, T25N, R3W; 15 July 1985; large gravel and rubble riffles and runs.
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historically known from the Tippecanoe River (Evermann and Jenkins, 1889), is now extinct (Jenkins, 1980). The total number of species known from the river is 84.

Taxa taken only in the upper extremes of the Tippecanoe River (upper five sample sites) during this study were *Erimyzon sucetta*, *Noturus gyrinus*, *Etheostoma exile*, *E. flabellare*, *E. microperca*, *Perca flavescens*, and *Percina c. manitou*. These species are primarily associated with the glacial lakes of the upper watershed. Species captured only in the lower river (below Lake Schafer) were *Extrarius aestivalis*, *P. copelandi*, and *P. shumardi*.

Species generally distributed in the Tippecanoe River, based on the number of capture sites, were: *Cyprinella spiloptera* (19 sites), *Pimephales notatus* (18), *Nocomis micropogon* (17), *Lepomis megalotis* (17), *Etheostoma nigrum* (17), *E. blennioides* (16), *Notropis ludibundus* (14), *Cottus bairdi* (14), *Luxilus chrysocephalus* (13), *Hypentelium nigricans* (13), *Ambloplites rupestris* (13), and *Percina sciera* (12). Species that appeared to be locally abundant (i.e., represented by ten or more individuals captured at one or two sites) but were not widespread were *E. aestivalis*, *Notemigonus crysoleucas*, and *Rhinichthys atratulus*.

Many species were collected at only one or two sites (Table 2) and were represented by few individuals. Species taken during this survey that are likely to be truly rare in the Tippecanoe River drainage are *Ichthyomyzon bdellium*, *N. buchanani*, *Etheostoma camurum*, *E. maculatum*, *P. copelandi*, *P. c. manitou*, and *P. shumardi*. Species represented by several individuals and at three or more sites during this study, which maintain only limited populations elsewhere in the Midwest, were *Hybopsis amblops*, *Etheostoma pellucidum*, *E. tippecanoe*, and *Percina evides*.

Following is a synopsis of regional distribution and habitat information on uncommon fishes that occur in the Tippecanoe River. The capture site number and the number

Table 2. Fish species collected in the Tippecanoe River, Indiana, between 12 July 1985 and 20 September 1987. Site number is followed by number of individuals vouchered (in parenthesis) and is identified in Table 1.

TAXA	SITE NUMBER (NUMBER OF VOUCHERED INDIVIDUALS)
<b>PETROMYZONTIDAE</b>	
<i>Ichthyomyzon bdellium</i>	12(1), 15(1)
<b>CLUPEIDAE</b>	
<i>Dorosoma cepedianum</i>	8(12), 10(1), 12(1), 13(1), 18(5), 20(1)
<b>UMBRIDAE</b>	
<i>Umbra limi</i>	8(4)
<b>ESOCIDAE</b>	
<i>Esox americanus</i>	8(1), 13(1), 14(2), 18(2)
<b>CYPRINIDAE</b>	
<i>Campostoma anomalum</i>	6(4), 8(1), 9(2), 10(1), 12(2), 17(1), 18(1)
<i>Cyprinella spiloptera</i>	3(2), 5(12), 6(25), 7(93), 8(39), 9(1), 10(16), 11(51), 12(115), 13(12), 14(27), 15(61), 16(52), 17(35), 18(10), 19(75), 20(26), 21(3), 22(14)
<i>Ericymba buccata</i>	11(1), 12(1), 17(2), 18(7)
<i>Erimystax dissimilis</i>	6(1), 11(4), 12(2), 15(1), 17(1), 18(3), 19(1), 20(1), 21(31), 22(2)
<i>Extrarius aestivalis</i>	22(10)
<i>Hybopsis amblops</i>	11(1), 12(4), 15(1), 16(2), 17(4), 18(5), 22(1)
<i>Luxilus chrysocephalus</i>	1(1), 2(12), 3(2), 6(2), 7(7), 8(1), 9(1), 11(4), 12(4), 15(1), 18(2), 19(3), 20(6)
<i>Nocomis biguttatus</i>	5(1), 6(1), 8(1), 10(2), 12(3), 14(5), 16(3), 18(1), 20(1)

TAXA	SITE NUMBER (NUMBER OF VOUCHERED INDIVIDUALS)
<i>N. micropogon</i>	1(5), 3(4), 4(1), 5(1), 6(7), 7(12), 9(1), 10(2), 11(9), 12(14), 14(2), 15(16), 16(1), 18(1), 19(6), 20(3), 22(4)
<i>Notemigonus crysoleucas</i>	1(13), 7(1)
<i>Notropis atherinoides</i>	10(2), 12(1), 17(1), 18(2), 20(5), 22(1)
<i>N. buchanani</i>	19(1)
<i>N. ludibundus</i>	6(39), 7(13), 8(37), 9(11), 10(17), 11(12), 12(34), 14(5), 15(8), 16(10), 17(44), 19(3), 20(34), 22(2)
<i>N. rubellus</i>	5(1), 6(16), 7(2), 10(1), 11(4), 12(1), 14(1), 17(1), 18(1), 20(39)
<i>N. volucellus</i>	18(5)
<i>N. ludibundus</i> x <i>H. amblops</i>	11(1), 19(1)
<i>Phenacobius mirabilis</i>	12(1)
<i>Pimephales notatus</i>	2(4), 3(3), 4(10), 5(4), 6(8), 7(8), 8(4), 10(2), 11(6), 12(12), 13(4), 14(2), 15(19), 16(17), 17(9), 18(4), 19(2), 20(3)
<i>Rhinichthys atratulus</i>	8(11), 20(2)
<i>Semotilus atromaculatus</i>	1(3), 6(15), 7(35), 8(8), 9(8), 10(2), 11(17), 12(1), 18(3), 19(2)

#### CATOSTOMIDAE

<i>Carpionodes cyprinus</i>	12(1)
<i>Catostomus commersoni</i>	1(1), 6(6), 7(8), 8(7), 10(1), 11(8), 12(6)
<i>Erimyzon sucetta</i>	1(1)
<i>Hypentelium nigricans</i>	1(1), 3(2), 5(2), 6(3), 7(2), 8(3), 9(1), 11(5), 12(6), 17(1), 18(1), 20(1), 22(2)
<i>Ictiobus bubalus</i>	17(2)

TAXA	SITE NUMBER (NUMBER OF VOUCHERED INDIVIDUALS)
<i>Minytrema melanops</i>	8(13), 13(1), 15(2), 17(1), 18(1)
<i>Moxostoma erythrurum</i>	18(1)
<b>ICTALURIDAE</b>	
<i>Ameiurus natalis</i>	2(1), 3(3), 5(1), 6(1), 9(2), 18(1)
<i>Ictalurus punctatus</i>	6(1)
<i>Noturus eleutherus</i>	7(1), 12(1), 18(1), 22(6)
<i>N. flavus</i>	5(8), 6(3), 7(6), 9(4), 11(3), 12(2), 15(3), 16(1), 19(2), 22(1)
<i>N. gyrinus</i>	4(1)
<i>N. miurus</i>	8(5), 9(2), 14(1)
<i>Pylodictis olivaris</i>	20(1)
<b>FUNDULIDAE</b>	
<i>Fundulus notatus</i>	4(2), 13(4)
<b>ATHERINIDAE</b>	
<i>Labidesthes sicculus</i>	2(6), 8(1), 10(2), 13(2), 16(1), 18(2), 19(1)
<b>MORONIDAE</b>	
<i>Morone chrysops</i>	18(2)
<b>CENTRARCHIDAE</b>	
<i>Ambloplites rupestris</i>	2(1), 4(1), 5(3), 8(1), 9(2), 10(1), 12(1), 14(1), 15(1), 18(2), 19(3), 20(3), 22(1)
<i>Lepomis cyanellus</i>	8(1), 9(2), 13(1), 18(1)
<i>L. gibbosus</i>	5(4), 13(1), 20(1)
<i>L. gulosus</i>	2(1), 4(1)



TAXA	SITE NUMBER (NUMBER OF VOUCHERED INDIVIDUALS)
<i>L. macrochirus</i>	1(1), 3(1), 4(6), 5(2), 8(4), 9(1), 13(6), 21(1)
<i>L. megalotis</i>	1(1), 2(6), 3(2), 4(2), 5(2), 7(1), 8(5), 9(3), 10(6), 12(1), 13(2), 14(1), 15(1), 16(4), 18(2), 20(2), 21(1)
<i>Micropterus dolomieu</i>	18(2), 19(1), 22(1)
<i>M. salmoides</i>	1(3), 2(1), 4(1), 5(1), 8(10), 9(1), 10(1), 13(2), 18(3), 20(2), 21(1)
<i>Pomoxis nigromaculatus</i>	13(3)

**PERCIDAE**

<i>Etheostoma blennioides</i>	5(13), 6(4), 7(7), 8(24), 9(10), 10(13), 11(4), 12(4), 14(17), 15(6), 16(5), 17(1), 18(3), 19(3), 20(4), 22(2)
<i>E. caeruleum</i>	2(14), 3(6), 5(1), 7(3), 9(2), 12(3), 14(1), 15(5), 16(1), 20(1)
<i>E. camurum</i>	15(3), 17(3), 18(1)
<i>E. exile</i>	2(1)
<i>E. flabellare</i>	2(2), 3(2)
<i>E. maculatum</i>	17(4)
<i>E. microperca</i>	2(3), 4(1)
<i>E. nigrum</i>	2(1), 4(2), 5(4), 6(2), 7(9), 8(13), 9(4), 10(4), 11(1), 12(4), 13(5), 14(6), 15(1), 17(2), 18(2), 20(12), 21(1)
<i>E. pellucidum</i>	6(10), 8(5), 12(1), 17(1), 18(3), 20(7)
<i>E. spectabile</i>	19(1)
<i>E. tippecanoe</i>	14(2), 17(1), 18(1), 22(8)
<i>Perca flavescens</i>	2(1), 4(1)
<i>Percina c. caprodes</i>	3(2), 11(2), 12(10), 14(2), 15(2), 16(1), 17(1), 18(7), 19(1), 20(1)

TAXA	SITE NUMBER (NUMBER OF VOUCHERED INDIVIDUALS)
<i>P. c. manitou</i>	3(3)
<i>P. copelandi</i>	22(1)
<i>P. evides</i>	5(6), 6(13), 7(7), 9(1), 10(2), 11(8), 12(2), 16(1), 18(2)
<i>P. maculata</i>	2(3), 3(49), 5(3), 6(1), 8(8), 9(2), 10(3), 11(2), 12(4), 14(2)
<i>P. sciera</i>	5(11), 6(7), 7(9), 8(21), 9(5), 10(7), 11(1), 12(2), 13(1), 16(3), 18(6), 20(17)
<i>P. shumardi</i>	21(2)
<i>P. caprodes</i> x <i>P. maculata</i>	3(1)

## COTTIDAE

<i>Cottus bairdi</i>	1(6), 5(16), 6(2), 7(5), 8(2), 9(2), 10(1), 11(4), 12(19), 14(3), 15(2), 16(1), 19(1), 20(5)
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of individuals vouchered are given in Table 2.

***Ichthyomyzon bdellium* (Jordan), Ohio lamprey.** *Ichthyomyzon bdellium* inhabits streams ranging from small creeks to big rivers. Smaller streams are utilized for spawning and provide habitat for ammocoetes, which are found in pools and backwaters in mud and debris (Burr and Warren, 1986). The individuals collected during this survey were both adults.

Historically, *I. bdellium* has been recorded from the Tippecanoe River near Rochester, Fulton County (Hubbs and Trautman, 1937) and north of Winamac, Pulaski County (Gerking, 1945). The latter record represents the most recent capture of *I. bdellium* in Indiana (collected in 1944) prior to this study. Additional records for the species in Indiana are: Mud Creek, Cass County, Wabash drainage (Gerking, 1945); Lake Maxinkuckee outlet, Culver, Marshall County (Evermann and Clark, 1920); Wabash River, Terre Haute, Vigo County (Hubbs and Trautman, 1937); Whitewater River drainage, Wayne County (Plummer, 1851).

Hubbs and Trautman (1937) suggested that the Ohio lamprey and the chestnut lamprey (*Ichthyomyzon castaneus*) may intergrade in the lower Ohio River. Noting an overlap of characteristics, Burr (1980) arbitrarily identified parasitic lampreys in the upper and middle Ohio River and major tributaries as *I. bdellium* and lower Ohio forms as *I. castaneus*. Populations in the Ohio River bordering Indiana may represent intergrades of the two forms, although additional study is needed.

Table 3. Species reported historically from the Tippecanoe River but not collected during this survey.

TAXA	SOURCE
<i>Ichthyomyzon fossor</i>	Gerking (1945), UMMZ
<i>Hiodon tergisus</i>	Evermann and Jenkins (1889)
<i>Esox lucius</i>	Gerking (1945)
<i>Cyprinus carpio</i>	Gerking (1945)
<i>Notropis chalybeus</i>	Gerking (1945)
<i>N. photogenis</i>	Gerking (1945), UMMZ
<i>Moxostoma carinatum</i>	Evermann and Jenkins (1889)
<i>M. duquesnei</i>	Gerking (1945)
<i>M. lacerum</i>	Evermann and Jenkins (1889)
<i>Ameiurus melas</i>	Gerking (1945)
<i>A. nebulosus</i>	Gerking (1945)
<i>Noturus exilis</i>	Evermann and Jenkins (1889)
<i>N. stigmosus</i>	Rohde (1980), UMMZ
<i>Lepomis microlophus</i>	Gerking (1945)
<i>Pomoxis annularis</i>	Gerking (1945)
<i>Stizostedion vitreum</i>	Blatchley (1938)

Trautman (1981) presented evidence of the decline of this species in Ohio, where it is now protected (Johnson, 1987). *Ichthyomyzon bdellium* is considered to be extirpated in Illinois, where it apparently has been supplanted by *I. castaneus* in the Embarras and lower Wabash rivers (Starrett, *et al.*, 1960; Smith, 1979).

***Hybopsis amblops* (Rafinesque), bigeye chub.** Historic Tippecanoe River records for *H. amblops* were from Carroll County (Evermann and Jenkins, 1889); and Fulton County between Talma and Rochester in 1925 (UMMZ 66569), in 1938 (UMMZ 99951),

and in 1941 (Gerking, 1945). Our collections of *H. amblops* throughout the middle and lower reaches of the Tippecanoe River indicate the presence of a sizeable population. Gerking (1945) and Nelson and Gerking (1968) considered *H. amblops* to occur in all major drainages in Indiana except the Kankakee River system. Clemmer (1980) reported a decidedly smaller range for the species in Indiana, with most records occurring in the upper half of the Wabash River system. Clemmer (1980) indicated no *H. amblops* records in the Whitewater River drainage and only one locality each in the White and Blue river drainages.

*Hybopsis amblops* has suffered dramatic declines since 1940 as a result of habitat modification in Illinois (Smith, 1979) and Ohio (Trautman, 1981). The species inhabits pools with moderate flow, raceways, and the bases of riffles in small to large streams, where clear water and firm sand or rocky substrates are present (Burr and Warren, 1986). *Hybopsis amblops* is protected in Illinois (Illinois Endangered Species Protection Board, 1990) and Michigan (Johnson, 1987). The present range of *H. amblops* in Indiana deserves further study because of population declines noted in adjacent States, where the species historically was common.

***Notropis buchanani* (Meek), ghost shiner.** *Notropis buchanani* is characteristic of low-gradient sections of large creeks and rivers having moderate flow and moderately clear to turbid water. It inhabits larger pools and protected backwaters without noticeable current (Gilbert, 1980) over a bottom of mixed sand, mud, and silt (Burr and Warren, 1986). Although *N. buchanani* occupies an expansive range in the United States, the species' occurrence east of the Mississippi River appears to be sporadic and localized (Gilbert, 1980).

In Indiana, *N. buchanani* was previously known only from the Ohio and lower White Rivers (Gerking, 1945). Our record from the Tippecanoe River represents a substantial range extension to the upper Wabash drainage of northern Indiana.

***Etheostoma camurum* (Cope), bluebreast darter.** *Etheostoma camurum* is sporadically distributed and absent in many rivers within its range in the eastern United States. The species occupies fast riffles of large, clear streams at a preferred depth of 10 to 30 cm. Adults are almost always found near large boulders (Page, 1983).

Historic documentation of *E. camurum* in the Tippecanoe River includes records from the middle (Fulton County; Jordan, 1889) and lower (Carroll County; Evermann and Jenkins, 1889) reaches. A museum record for *E. camurum* (UMMZ 187513) from Fulton County by B.W. Evermann was probably from the late 1800s and may represent the same record cited by Jordan (1889). Additional records for the Tippecanoe River were from Fulton County in 1925 (UMMZ 66565 and 66602). Gerking (1945) collected *E. camurum* in this vicinity during his survey of Indiana fishes.

Our collection sites for *E. camurum* (Sites 15 and 18) and Tom Simon's collection site (Site 17) were all from the middle reaches of the river in Pulaski County. From these data, it appears that the range of *E. camurum* in the Tippecanoe River has diminished, and the few specimens collected indicate that the population is small. *Etheostoma camurum* is generally distributed throughout the Wabash-Ohio drainage of Indiana. However, only in the Big Blue River (Ohio drainage) is there evidence of a large population (Whitaker and Gammon, 1988). The species is listed as endangered in Indiana (Indiana Department of Natural Resources, 1990) and is also protected in Illinois (Illinois Endangered Species Protection Board, 1990).

***Etheostoma maculatum* Kirtland, spotted darter.** Three subspecies of *E. maculatum* were recognized by Zorach and Raney (1967). Page (1985) and Etnier and



Williams (1989) demonstrated that *E. maculatum* is specifically distinct from the southern forms, now known as *E. sanguifluum* and *E. vulneratum*, and has a much smaller range than previously thought. *Etheostoma maculatum* occurs sporadically in a few tributaries of the Ohio River system (Page, 1983). The habitat of *E. maculatum* was described by Zorach and Raney (1967) as swift riffles of medium to large streams.

*Etheostoma maculatum* is extremely rare in Indiana. Zorach and Raney (1967) examined two specimens collected by P. Kirsch on 25 August 1899 from the Tippecanoe River at "Marshland", Fulton County, Indiana. Jordan (1889) reported an earlier collection of four specimens from the "Marshland" locality and a single specimen from Deer Creek, a Wabash River tributary at Camden, Carroll County, Indiana. Tom Simon's collection of four *E. maculatum* at Site 17 indicates that the species is extant but rare in the Tippecanoe River. Baker, *et al.* (1985) reported the recent collection of over 32 specimens of *E. maculatum* in the Blue River, a tributary of the Ohio River in Washington, Crawford, and Harrisburg Counties in southern Indiana.

*Etheostoma maculatum* is endangered in Indiana (Indiana Department of Natural Resources, 1990) and is also protected in Kentucky (Warren, *et al.*, 1986) and Ohio (Johnson, 1987).

***Etheostoma pellucidum* (Putnam), eastern sand darter.** Gerking (1945) collected *E. pellucidum* at four localities in the middle Tippecanoe River in Marshall, Fulton, and Pulaski Counties, Indiana and reported one literature record in the lower river in Carroll County. Earlier Tippecanoe River records are from Fulton County between Talma and Rochester in 1925 (UMMZ 66562, 12 specimens) and near Rochester in 1938 (UMMZ 99936, 59 specimens). Our 1987 collection at the latter locality (Site 8) yielded only five individuals and may indicate a decline in *E. pellucidum* populations in the Tippecanoe River. Statewide, this species has been reported from scattered localities in large- and medium-sized streams in the Wabash, Maumee, White, and Ohio drainages (Gerking, 1945).

Habitat loss due to excessive siltation of sandy streams has led to declines in habitat for *E. pellucidum* throughout much of its range, thus the species may deserve Federal protection (Johnson, 1987). This species is protected in Illinois (Illinois Endangered Species Protection Board, 1990), Ohio, and Michigan (Johnson, 1987) and is of special concern in Indiana (Indiana Department of Natural Resources, 1990) and Kentucky (Warren, *et al.*, 1986).

***Etheostoma tippecanoe* Jordan and Evermann, Tippecanoe darter.** *Etheostoma tippecanoe* was described by Jordan and Evermann (1891) from specimens collected in the Tippecanoe River at "Marshland", Fulton County, Indiana. The only additional recorded locality for this species from the Tippecanoe River prior to this study was from Fulton County in 1925 (UMMZ 66560). Elsewhere in Indiana, specimens have been collected from the East Fork White River, Martin County (Gerking, 1945) in 1936 and 1942. Our recent attempts to collect *E. tippecanoe* at known East Fork White River localities were unsuccessful.

The results of this study indicate that *E. tippecanoe* is presently restricted in Indiana to long, gravel and rubble riffles along the middle Tippecanoe River and in the lower river just below Lake Freeman. The species occurred only sporadically in the middle Tippecanoe River but was common just below Lake Freeman, presumably as a result of reduced suspended sediments in waters released from the dam.

*Etheostoma tippecanoe* is endangered in Indiana (Indiana Department of Natural Resources, 1990), is protected in Ohio (Johnson, 1987), and is of special concern in



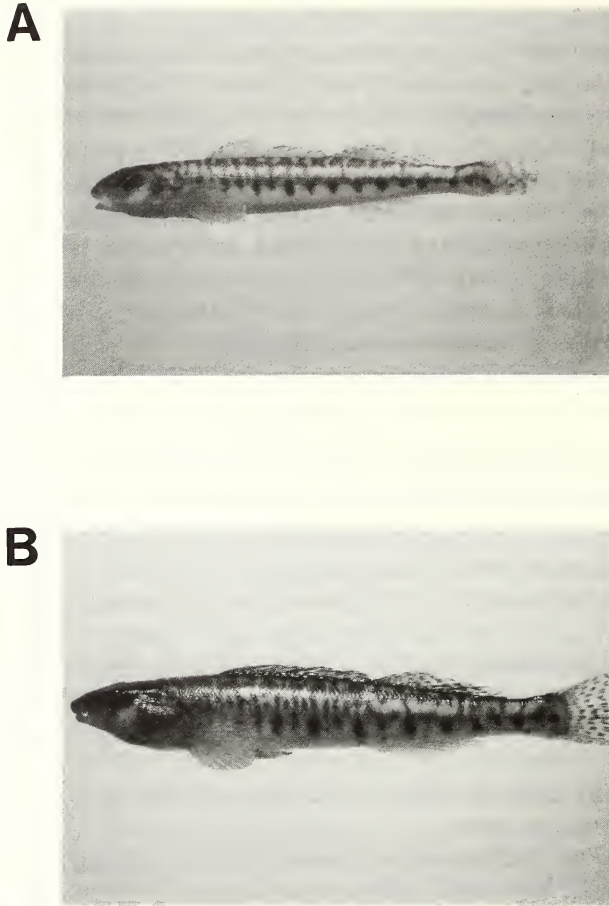


Figure 2. **A.** *Percina caprodes manitou*. 86-mm SL female collected in Lake Wawasee, Kosciusko County, Indiana, 7 September 1985. **B.** *P. c. caprodes* x *P. c. manitou*, 115-mm SL male, Tippecanoe River, Kosciusko County, Indiana, 7 September 1985.

Kentucky (Warren, *et al.*, 1986).

***Percina caprodes manitou* (Jordan), Indiana logperch.** Our sampling efforts in the upper Tippecanoe River produced a form of logperch which we believe to be a valid but currently unrecognized subspecies of *Percina caprodes*. This form is found in the glacial lakes region of northern Indiana and possibly further north.

The taxonomy of logperches in Indiana has a confused history. Two subspecies (*P. c. caprodes* and *P. c. semifasciata*) of logperch are known to occur in the State (Gerking, 1945). Two other nominal forms of logperches were described from the glacial lakes of northern Indiana but subsequently were not recognized, because one form was consid-

ered to be a synonym of *P. caprodes* and one was considered to be based on hybrids. These were, respectively, *Percina manitou* Jordan 1877, from Lake Manitou, Fulton County, and *Hadropterus evermanni* Moenkhaus 1903, from Lake Tippecanoe, Tippecanoe County.

*Hadropterus evermanni* was considered by Hubbs (1926) and Collette and Knapp (1966) to be based on hybrids of *P. c. semifasciata* and *P. maculata*. We examined two paratypes of *Hadropterus evermanni* (USNM 50834, 126919). Characteristics of the poorly preserved specimens (both females) were: lateral line scales 81-82; pored scales on the caudal fin 0-2; modified scales between pelvic fins 1-2; nape squamation 50-80%; belly midline squamation 0-30% (scales located posteriorly); black basicaudal spot present; and snout not produced or slightly produced. One specimen had 13 vertically elongate blotches along the side and the other had rounded dark blotches. We agree with earlier conclusions that *Hadropterus evermanni* is based on *P. caprodes* X *P. maculata* hybrids.

*Percina manitou* was considered by Collette and Knapp (1966) to be a synonym of *P. c. semifasciata* and gave the following counts for the lectotype (USNM 23458): lateral line scales 86, dorsal spines 15, dorsal rays 14, and anal rays 11. Our examination of the poorly preserved lectotype, a female, revealed these additional characteristics: modified scales between pelvic fins 1 (but also with 2 scars where scales had been); nape and belly midline unscaled; black basicaudal spot present; and snout produced.

We currently believe, based on material collected in 1985 and additional museum specimens examined (UMMZ 55876, 56443, 63049, 66606, 81496, 81864, 81972, 89990, 98617, 101956, 112042, 132283, 160792, 162977, 194604, 213163, 213165, and 213168), that the form described by Jordan (1877) is a distinct taxon, *Percina caprodes manitou*. This conclusion is based on the fact that *P. c. manitou* (Figure 2A) is morphologically distinguishable from both *P. c. caprodes*, which occurs south of the range of *P. c. manitou*, and from *P. c. semifasciata*, which occurs to the north. It appears to be intergrading with *P. c. caprodes* in the upper Tippecanoe River (Figure 2B) and thus is not considered a full species.

Available data suggesting that the Indiana logperch is a subspecies of *P. caprodes* include the following:

1. The pigmentation pattern is unique. The vertical bars on the side tend to anastomose on the back, forming dark circles. Also, the bars are interrupted on the posterior half of the body, creating a light longitudinal stripe along the posterior half of the upper side. In both *P. c. caprodes* and *P. c. semifasciata*, the bars continue uninterrupted over the back to join those of the other side.
2. The nape is unscaled and the belly is unscaled or barely scaled. *Percina c. caprodes* in the Tippecanoe River usually (93%, N = 14) has a partly or fully scaled nape and partly to fully scaled belly. Intergrades in the upper Tippecanoe River (near North Webster, N = 3) have a partly or fully scaled nape but an unscaled to partly scaled belly and thus are intermediate between *P. c. manitou* and *P. c. caprodes*.

Although museum specimens have sometimes been labelled as such, we do not consider it tenable to conclude that *P. c. manitou* is an F<sub>1</sub> hybrid between *P. caprodes* and *P. maculata*. The large number of individuals involved make that extremely unlikely and, more importantly, on 7 September 1985, we collected true hybrids in the Tippecanoe River (INHS 69039; 1 specimen, 2 frozen) between *P. caprodes* and *P. maculata*. The hybrids were not similar in morphology to *P. c. manitou* but instead were intermediate

between *P. c. manitou* and *P. maculata*. They had the light longitudinal stripe along the posterior half of the upper side and dark vermiculations on the nape as in *P. c. manitou*, but also had large oval black blotches along the side of the body and a short snout as in *P. maculata*.

The range of *P. c. manitou* is presently unknown. It occurs in lakes in the upper Tippecanoe River system, in adjacent tributaries of the St. Joseph River system (Lake Michigan drainage), and probably extends into the State of Michigan.

***Percina copelandi* (Jordan), channel darter.** *Percina copelandi* occurs in pools of large streams and along lake shores where there is sufficient current to maintain a bottom of sand or sand mixed with gravel or rocks (Page, 1983; Burr and Warren, 1986). Our capture of one specimen represents the first record of *P. copelandi* from the Tippecanoe River. Gerking (1945) recorded the species from the Wabash River, Warren County, Indiana and one of its tributaries (Big Pine Creek) in Fountain County. Page (1983) mapped five additional records for *P. copelandi* in the Wabash River, spread along most of its length, and two records in the upper and middle reaches of the West Fork White River. The occurrence of *P. copelandi* in the lower Tippecanoe River and Wabash River may be underrepresented. However, further investigation of the species' status is warranted. This species is protected in Michigan and Ohio (Johnson, 1987).

***Percina evides* (Jordan and Copeland), gilt darter.** *Percina evides* lives in riffles of clean, small- to medium-sized rivers. Larger individuals inhabit larger and faster riffles, often over rubble. Smaller individuals are in smaller, gravel riffles (Page, 1983). The species is now extirpated or uncommon in many areas, where it previously existed in large populations. Stream degradation has severely reduced the range of *P. evides*, and it has been extirpated from Ohio (Trautman, 1981) and Illinois (Smith, 1979).

Historic Tippecanoe River records were from the late 1800s and early 1900s in Fulton County (UMMZ 61577, 66561, 167077, and 213115). Since 1900, a drastic reduction in the abundance and range of *P. evides* in Indiana has been noted (Gerking, 1945; Nelson and Gerking, 1968). Gerking's (1945) Statewide survey did not produce this species, though he sampled five of the 11 known Indiana localities, and six Tippecanoe River sites in the range of our *P. evides* collections. Margulies, *et al.* (1980) collected a single specimen in 1977 from the West Fork White River, Morgan County. The collection represented only the second record for this species in Indiana in this century and the first record in 52 years. Our capture of 59 specimens at nine sites indicates that a good population of *P. evides* is present in the upper and middle Tippecanoe River. This species is endangered in Indiana (Indiana Department of Natural Resources, 1990) and is of special concern in Kentucky (Warren, *et al.*, 1986).

***Percina shumardi* (Girard), river darter.** *Percina shumardi* has not been previously reported from the Tippecanoe River. The nearest known locality was the Wabash River, Carroll County, upstream of the confluence with the Tippecanoe River, which was reported as a literature record by Gerking (1945). Additional Indiana records are from the West Fork White River, Marion County; East Fork White River, Martin County; and from scattered localities along the middle and lower Wabash River (Gerking, 1945; Whitaker and Wallace, 1973). The species is also known to occur in the main channel of the Ohio River along the Indiana border (Burr and Warren, 1986).

The habitat of *P. shumardi* is moderate to fast current over rocks or gravel in medium to large rivers (Page, 1983). The difficulty of sampling this habitat probably accounts for the paucity of records for *P. shumardi* in Indiana. *Percina shumardi* is protected in Ohio (Johnson, 1987).



## THE TIPPECANOE RIVER AS AN AQUATIC ECOSYSTEM

The fish fauna of the Tippecanoe River is diverse and includes a number of species that are rare or declining throughout their historic ranges. Cummings and Berlocher (1990) presented evidence that the unionid mollusk fauna of the Tippecanoe River is among the richest in the upper Midwest. Despite the fact that the watershed is primarily composed of erodable agricultural land and the river system has been subjected to channelization, urban development, and mainstem impoundment, the Tippecanoe River retains a variety of instream habitats and water of sufficient quality to support a rich aquatic fauna. The aquatic fauna appears to have been less adversely affected by habitat modification than is commonly observed in other Midwestern streams (Smith, 1971; Cummings and Berlocher, 1990). We hypothesize that the predominance of sandy soils in the watershed and sediment retention by lakes in the drainage have reduced the degree of turbidity and silt deposition responsible for the decline of many fish species in the Wabash River drainage (Smith, 1971). Unlike many Midwestern streams, the Tippecanoe River continues to support a rich and diverse biota and it should be protected from adverse development. Protection of the middle reach of the Tippecanoe River (between sample sites 13 and 18) is of particular importance due to the presence of the greatest variety of rare fishes in this segment.

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