

6.—A REPORT UPON EXPLORATIONS MADE IN EEL RIVER BASIN IN THE NORTHEASTERN PART OF INDIANA IN THE SUMMER OF 1892.

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The investigations upon which this report is based were made in the summer of 1892 under the direction of Hon. Marshall McDonald, U. S. Commissioner of Fish and Fisheries. A description of each stream and lake examined is given, with a list of the fishes found in these waters and such notes upon them as seemed to be of special interest. In the prosecution of the work the writer had the assistance of Messrs. C. Myers, Fred Webster, and George Ramp, of Columbia City, Ind., and of Mr. Charles Beeson, a student of Indiana University. For aid received in carrying out the inquiry the writer is under special obligations to Prof. B. W. Evermann, of the U. S. Fish Commission.

The following is a classified list of the waters examined:

The Eel River System.

1. Eel River.
2. Hull Lake, Allen Co.
3. Mud Creek, Whitley Co.
4. Blue River, Whitley Co.
5. Blue Lake, Whitley Co.
6. Thorn Creek, Whitley Co.
7. Round Lake, Whitley Co.
8. Cedar Lake, Whitley Co.
9. Shriner Lake, Whitley Co.
10. Blue Babe Creek, Whitley Co.
11. Meredith Creek, Whitley Co.
12. Stoney Creek, Whitley Co.
13. Spring Creek, Whitley Co.

The Eel River System—Continued.

14. Wilson Lake, Whitley Co.
15. Sugar Creek, Whitley Co.
16. Whistler Creek, Whitley Co.
17. Squirrel Creek, Wabash Co.
18. Paw-paw Creek, Miami Co.
19. Flowers Creek, Miami Co.
20. Weasaw Creek, Miami Co.
21. Twelve-mile Creek, Cass Co.

The Tippecanoe River System.

1. Loon Lake, Whitley and Noble counties.
2. Big Lake, Noble Co.
3. Crooked Lake, Whitley and Noble counties.

EEL RIVER SYSTEM.

Eel River with its tributaries drains a scope of country in northeastern Indiana lying between the basin of the Wabash River on the southeast and that of the Tippecanoe River on the northwest, and extending from the St. Joseph River basin, near Fort Wayne, to Logansport. This river basin has an average width of about 18 miles and a length of 72 miles. The surface of the region through which it flows is generally rolling and everywhere covered with glacial drift except in a limited area near Logansport where bed rock is exposed.

The mean temperature at Columbia City for a period of six years was 49.5°. The highest temperature at this place in the summer of 1892 was 94°; and the lowest temperature the past winter was on January 15, when the thermometer stood at -17°. During the winter of 1892-93, all the streams and lakes were frozen over, and on quiet waters the ice reached a thickness of about 2 feet. The ice left Blue River during the second week of March. The mean annual rainfall at Columbia City for a period of six years was 35.67 inches. The amount of snowfall during the past winter was 4 feet 8 inches. This was greater than for any winter during the eight preceding years.

The bottom lands along the streams are mostly covered with forests of oak, elm, maple, beech, hickory, and sycamore. Occasionally, along their upper courses, the streams are skirted with willows and a thick growth of underbrush.

The water in the lakes and streams is rather clear, and where there is sufficient depth an abundance of fish is found. These waters need not be stocked with new kinds of fish. They already contain some of the finest game and food fishes found anywhere. It is only necessary that the waters be properly protected, and in a few years they will produce fish beyond all expectation. Large numbers of crawfish, mussels, and various kinds of water weeds are found here.

Investigations in the Eel River system were made on the following streams and lakes:

1. *Eel River*.—The summit north of Wallen, in Allen County, is probably the highest point from which water flows into Eel River. This point has an elevation above sea level of 887 feet. Eel River at Logansport, where it empties into the Wabash River, has an altitude of 583 feet. The river has, therefore, a fall of 304 feet in its total length of 72 miles, or about 4 feet 2 inches to the mile.† The channel of Eel River at North Manchester has an altitude of 721 feet, and the stream from this point to its mouth, a distance of 36 miles, has a fall of 138 feet, or 3 feet 10 inches to the mile. In the upper 36 miles of its course, Eel River has a fall of about 4 feet 7 inches to the mile.

At its mouth, Eel River has a width of 447 feet; the Wabash River just before receiving Eel River is 507 feet wide; and the width of the Wabash immediately below the junction of the two rivers is 527 feet.

The upper 8 or 10 miles of Eel River was formerly very crooked and flowed through low, swampy lands, but within the past three years the channel has been dredged and straightened, in this way redeeming much valuable land. The stream is now shallow, with but few deep holes for fish. The river throughout the remainder of its course is crooked, and the bottom of the channel is of sand and gravel, rarely covered with rocks. There are many deep holes and many gravelly shoals with patches of water weeds. From Adamsboro to Logansport, a distance of 6 miles, the stream has cut its bed into solid limestone (Devonian of the Upper Helderberg Group), and has formed many broad shoals with numerous potholes, and many broad stretches filled with algæ and water weeds.

There are 14 dams on Eel River, about which good game and food fishes are abundant.

*All temperatures are given in Fahrenheit degrees.

†All the distances are taken in a straight line, not following the bends of the streams.

The following shows the place and time of investigations on Eel River and the location of dams:

- a. The upper course of Eel River at six different points, August 1 and 2, from near its source, in Allen County, to the mouth of Blue River.
- b. South Whitley, Whitley County, July 19 and 20, 1 dam.
- c. Collamer, Whitley County, July 21, 1 dam.
- d. Liberty Mills, Wabash County, July 22, 1 dam.
- e. North Manchester, Wabash County, August 26, 1 dam.
- f. Laketon, Wabash County, July 23, 1 dam.
- g. Roann, Wabash County, July 25, 1 dam.
- h. Pettysville, Miami County, August 26, 2 dams.
- i. Chili, Miami County, July 26 and August 24, 1 dam.
- j. Mexico, Miami County, July 27, 1 dam.
- k. Dennison's Mill, Miami County, August 25, 1 dam.
- l. Adamsboro, Cass County, July 28, 1 dam.
- m. Logansport, Cass County, July 29 and 30, 2 dams.

2. *Hull Lake*, in the west part of Allen County. This lake has an area of "about 150 acres"; its banks are low and swampy. The bottom of the lake near the shore is soft muck, and the water has an inky appearance, imparting a dark color to the fishes. This body of water is drained by a small creek which, after meandering in a northeasterly direction for $2\frac{1}{2}$ miles, joins Eel River in Allen County. Collections from this lake were made August 1. Fish are very abundant, but limited in number of species. Only five different species were secured from this lake.

3. *Mud Creek* has its origin in the east part of Whitley County, flows in a general westerly direction, and empties into Eel River on the opposite side and a few rods above the mouth of Blue River. It is fed by living springs, and consequently flows during the severest droughts. This stream was seined August 18, for a distance of 3 miles, in its middle course.

4. *Blue River*, Whitley County, has its source in Blue Lake, near Churubusco. After a general southwest course of about 11 miles it joins Eel River $2\frac{1}{2}$ miles south of Columbia City. The first 2 or 3 miles in its upper course Blue River flows through low, marshy land. Throughout the remainder of its course the channel is in the drift deposits and its bottom is of gravel and occasional long stretches of sand. This is a beautiful stream and well supplied with native fishes. Large numbers of suckers (*Catostomus teres* and *Moxostoma macrolepidotum duquesnei*) were caught with hook and line from Blue River, at Columbia City, from the time the ice left the stream, about March 18, to the last of April. The largest specimen of *Catostomus teres* taken weighed 5 pounds. The mud puppy or water dog (*Necturus maculatus*) was also frequently taken with angle worms, the bait used for suckers. Blue River was examined throughout its course at points not more than 3 miles apart, August 16, 18, and 22.

On May 20, 1893, Blue River, at Columbia City, had an average width of 36 feet, an average depth of 18 inches, and a current of $6\frac{3}{8}$ inches per second. This gives a flow of not less than 10,000 gallons per minute. The temperature of the water at 3 p. m. was 70° ; of the air, in the sun, 94° .

5. *Blue Lake*, $1\frac{1}{2}$ miles northwest of Churubusco, Whitley County. This lake has a length of $1\frac{1}{2}$ miles and a width of half a mile, and is said to have a "very uniform depth of 40 to 55 feet." It receives its waters from Upper Blue River, a small stream from Noble County, and from springs along the sides and bottom of the lake. The

bottom of the lake is rather solid, and in the shallower places is covered with a dense growth of water weeds. The outlet of Blue Lake is at its west end and only a few rods from the entrance of Upper Blue River. This beautiful sheet of water was examined June 16 and 17 and August 22. Large-mouthed black bass, blue-gill, ringed perch, and calico bass are found in abundance.

6. *Thorn Creek*, the outlet of Round Lake, flows south $2\frac{1}{2}$ miles and empties into Blue River at Blue River Church. It has a shallow and swift current, with but little deep water for the concealment of fishes. This little stream is chiefly important as a fishway between Round Lake and Blue River, and for this reason it should be kept clear of rubbish and other obstructions that would impede the passage of fish. The specimens noted from Thorn Creek were taken from a point $1\frac{1}{2}$ miles from its mouth, August 16.

7. *Round Lake*, in the northern part of Whitley County, has a length from southwest to northeast of seven-eighths of a mile and a width of half a mile. The greatest depth we found was 63 feet. The bottom is mostly firm, and along the south side it is scattered over with logs; the shore at the northeast end is gravelly. There are many waterweeds in the shallow water. This lake contains an abundance of fish. It has an outlet on its south side into Thorn Creek. Round Lake was investigated August 8 and 9. This is the only water in which *Lepomis heros* was taken.

8. *Cedar Lake* lies immediately west of Round Lake, into which it empties its waters by means of a broad, weedy channel. Cedar Lake has a length northwest and southeast of about $1\frac{1}{2}$ miles and a width of $\frac{1}{4}$ mile. By numerous soundings we found its greatest depth was about 79 feet. This lake was fished August 10, but on account of the very soft bottom and dense growth of water weeds but little collecting was done.

9. *Shriner Lake*, the last of this beautiful trio of lakes, is parallel to and immediately south of Cedar Lake and west of Round Lake. Shriner Lake has a length of $1\frac{1}{4}$ miles and a width of $\frac{1}{4}$ mile. The water is shallow for only a few rods from the shore, when the bottom suddenly descends at a sharp angle to a depth, in some places, of 70 feet. Shriner Lake is fed by springs, and has an outlet through an artificial channel into Round Lake. Forty years ago it had a natural outlet directly into Thorn Creek. This lake was examined June 15, 16, and August 10.

Round, Cedar, and Shriner lakes are well stocked with native food-fishes. Among the most abundant species are large-mouthed black bass, blue-gill, common sunfish, ringed perch, calico bass, and cisco.

10. *Blue Babe Creek*, near Columbia City. This little stream has its rise in the northern part of Whitley County, takes a southerly course, and flows into Blue River about a mile above Columbia City. During long droughts, except in the lower course, it becomes dry on the ripples. Blue Babe Creek is well supplied with fishes, 25 different species being secured in it August 13 by a few hours' seining.

11. *Meredith Creek* is a small stream west of Columbia City; it flows southwest and empties its waters into Eel River about $\frac{3}{4}$ of a mile below the mouth of Blue River. This stream was examined at a point 2 miles above its mouth August 19. Here the channel has a gravelly bottom covered with innumerable loose rocks. There are many deep holes. The water is cold and clear.

12. *Stony Creek* has its rise in the east part of Whitley County and flows west into Eel River. Except for 3 miles in its lower course, it becomes dry during the summer. The fish from this stream were collected from its lower course August 19.

13. *Spring Creek* has its source in Black and Wilson lakes, in the west part of Whitley County, and it receives many springs along its course. It flows south and empties into the mill pond $1\frac{1}{2}$ miles above South Whitley. This stream was seined in its lower course (July 20) and upper course (August 15).

14. *Wilson Lake* is $4\frac{1}{2}$ miles west of Columbia City. It has a length northwest and southeast of $\frac{1}{2}$ mile and a width of $\frac{1}{4}$ mile. The bottom near the shore is soft and overgrown with weeds and the banks are high and gravelly. Wilson Lake has an outlet at the east end into the east fork of Spring Creek. The outlet is at present being deepened, and when this is completed the surface of the lake will be lowered about 6 feet. This lake was examined August 15. Local fishermen report game fish very abundant. On account of difficult seining only a small collection of 8 different species was made. The large-mouthed black bass seems to be the prevailing game fish.

15. *Sugar Creek*, near South Whitley. This small stream has a northwesterly course and pours its waters into the mill pond $\frac{1}{2}$ mile above South Whitley. Sugar Creek was seined near its mouth July 20.

16. *Whistler Creek*, near Collamer, July 21. This stream flows south and empties into the Eel River 1 mile below Collamer. It has a winding course. Its bottom is everywhere smooth and sandy, with many deep holes. Fish are abundant. *Etheostoma pellucidum*, *E. nigrum*, *Moxostoma macrolepidotum duquesnei*, and *Notropis megalops* are the most common species. The collection from this stream was made near its mouth. During my work in this vicinity I was materially aided by Mr. M. L. Galbreath, of Collamer, Whitley County.

17. *Squirrel Creek*, near Roann. This stream flows south and empties into the mill pond at Stockdale, 1 mile northwest of Roann, Wabash County. It is a winding stream with sandy bottom, flowing for the most part through low woodland. Squirrel Creek was seined July 25 in its lower course.

18. *Paw-paw Creek*. This stream flows west through Wabash County, and enters the milldam near Pettysville, Miami County. Paw-paw Creek was investigated August 26 for a distance of 1 mile in its lower course. The channel has a gravelly bottom, and the water is clear and cold. *Camptostoma anomalum*, *Etheostoma pellucidum*, and *Moxostoma macrolepidotum duquesnei* are especially common.

19. *Flowers Creek* empties its waters into Eel River below the dam at Chili, Miami County. Its bed is of coarse gravel, and the water is cool. July 25 this stream was seined from the railroad to its mouth.

20. *Weasaw Creek*. This stream flows southerly and southwesterly through the western part of Miami County and discharges its waters into Eel River near the town of Denver. About a mile above the junction with Eel River it receives Little Weasaw Creek from the east. The water in these creeks is somewhat muddy and cooler than river water. A few fishes were collected in Little Weasaw Creek in 1877 by Mr. J. C. Cunningham, of Denver, Ind., who has kindly allowed me to include them in the present list.

21. *Twelve-mile Creek*, near Adamsboro. After a general southwest course this stream enters Eel River 2 miles above Adamsboro, Cass County. The bottom of the channel is very rocky and the water is shallow and swift.

FISHES OF THE EEL RIVER SYSTEM.

1. *Petromyzon concolor* (Kirtland). *Lamprey*. One specimen, 6 inches long, was taken from Blue River, at Columbia City, July 14, 1893. Others were seen at the same place.
2. *Lepisosteus osseus* (Linnaeus). *Common Gar-pike*. Very common in all the lakes examined. A few small specimens from Blue River were seen.
3. *Amia calva* Linnaeus. *Dogfish*. Taken in quiet or sluggish waters in Blue Lake, Eel River, and in nearly all of its upper tributaries.
4. *Ameiurus natalis* (Le Sueur). *Yellow Cat*. Found in sluggish waters. Common in all the lakes.
5. *Ameiurus nebulosus* (Le Sueur). *Common Bullhead*. Common in the lakes. Less common throughout Eel River and its tributaries.
6. *Noturus flavus* Rafinesque. Common in flowing water at nearly all points in Eel River. A single specimen from Twelve-mile Creek.
7. *Noturus miurus* Jordan. Scarce. A few specimens were taken in the middle course of Eel River and one from Meredith Creek.
8. *Noturus eleutherus* Jordan. A number of specimens were secured in the middle course of Eel River. Largest taken, 3½ inches long.
9. *Noturus gyrinus* (Mitchill). Two small specimens were obtained from weedy bottom, in the upper course of Blue River.
10. *Carpionides velifer* (Rafinesque). Found by me only in Eel River, below the lower dam at Logansport, where it is very abundant. The largest specimen taken is 9 inches long.
11. *Catostomus teres* (Mitchill). *Small-scaled Sucker; Black Sucker*. Taken in none of the lakes except Round Lake, but it is common in all the streams. One of the commonest of fishes in this region. The largest seen from Blue River weighed 5 pounds.
12. *Catostomus nigricans* Le Sueur. *Hog Sucker*. None were seen in any of the lakes, but they are common in swift waters in all the streams. The largest specimen measured 13 inches.
13. *Erimyzon sucetta* (Lacépède). *Chub Sucker; Sweet Sucker*. Taken in none of the lakes except Round Lake. Very common in Eel River and all its tributaries above South Whitley.
14. *Minytrema melanops* (Rafinesque). *Striped Sucker*. Common in Blue and Round lakes. Less common but also found in all the streams examined. The largest taken is 12 inches long.
15. *Moxostoma macrolepidotum duquesnei* (Le Sueur). *White Sucker*. None were taken in any of the lakes, but it is exceedingly abundant in all the streams. Large specimens were taken with hook and line at Columbia City during March, 1893. The largest seen was about 13 inches long.
16. *Cyprinus carpio* Linnaeus. *Carp*. This well-known fish was taken at several points on Eel and Blue rivers. They found their way into the streams from private fish ponds.
17. *Cyprinus carpio specularis* Linnaeus. *Mirror Carp*. A single specimen of about 3 pounds weight was secured in the upper courses of Blue River.
18. *Cyprinus carpio coriaceus* Linnaeus. Mr. M. L. Galbreath, of Collamer, Ind., reports having seen one which was caught in Eel River at that place a few years ago.
19. *Camptostoma anomalum* (Rafinesque). Taken in all the streams examined. None were seen in the lakes. Mostly found in flowing water.
20. *Chrosomus erythrogaster* Rafinesque. *Red-bellied Minnow*. Taken by Mr. J. C. Cunningham in Little Weasaw Creek, near Denver, Ind. We have no knowledge of this fish having been taken anywhere else in the Eel River basin.
21. *Hybognathus nuchalis* Agassiz. A single specimen, 7 inches long, was taken from Eel River below the lower dam at Logansport.
22. *Pimephales notatus* (Rafinesque). Common at all points in the streams examined. Found in all the lakes except Hull and Blue lakes.
23. *Notropis cayuga* Meek. This minnow was secured in Round and Shriner lakes, from the upper course of Blue River, and in Blue Babe Creek. Nowhere common. Largest specimen, 2½ inches long. Head, 4 to 4½ in length of body; depth, 4¼. Eye, about 3¼ in length of head. Mouth somewhat oblique, lower jaw not the shorter. First ray of dorsal nearer tip of snout than to base of caudal fin. Pectoral fins not quite extending to base of ventrals. Lateral line not complete. Scales in lateral line, 36 to 38. The dark lateral bands pass forward through the eyes and meet on the upper jaw in front. D. 8; A. 7 or 8.

24. *Notropis anogenus* Forbes. Found in Blue River and Blue Lake only. Very abundant in the lake, less so in the river. The largest specimen taken has a length of $1\frac{1}{2}$ inches. Head, 4 to $4\frac{1}{2}$ in length of body; depth, 4 to $4\frac{1}{2}$. Eye somewhat longer than snout, and about 3 in length of head. Scales before dorsal, 13; scales in lateral line, 36. Lateral line complete. D. 8; A. 8 (a very few 7). The black lateral bands pass forward through the eyes and across both jaws in front.
25. *Notropis heterodon* (Cope). Taken in Round, Cedar, and Shriner lakes. Common in all these waters. The largest taken, $2\frac{1}{2}$ inches long. Lateral line complete. Lateral bands pass forward through the eyes and meet on both jaws in front.
26. *Notropis deliciosus* (Girard). Found in Eel River from South Whitley down to the mouth. Not common. Head, about 4 in length of body; depth, 5. Eye about equal to length of snout and slightly more than 3 in length of head; 13 or 14 scales before the dorsal; 36 scales in lateral line.
27. *Notropis whipplei* (Girard). *Silver-fin*. Very common in Eel River and all its tributaries from Liberty Mills down to the mouth.
28. *Notropis megalops* (Rafinesque). *Common Shiner*. Very abundant in all the streams. Two small specimens from Cedar Lake and three from gravelly bottom in Round Lake. Also a few small specimens from Wilson Lake. None from the other lakes.
29. *Notropis jejunus* Forbes. Taken only in the pool below the lower dam at Logansport on limestone bottom. Very numerous. Head, 4; depth, $4\frac{1}{2}$; D. 8; A. 7. Largest specimen taken $3\frac{3}{8}$ inches long.
30. *Notropis umbaetilis cyanocephalus* (Copeland). *Red-fin*. Common. Taken everywhere except in the lakes.
31. *Notropis dilectus* (Girard). Numerous at all points examined in Eel River and its tributaries below South Whitley. A single specimen from the lower course of Blue River. Head, 4 to $4\frac{1}{2}$ in length of body; depth, $4\frac{2}{3}$ to 5; length of eye equal to that of snout, and $3\frac{1}{2}$ in length of head. D. 9; A. 10. Largest specimen taken, $2\frac{3}{4}$ inches long.
32. *Notropis arge* (Cope). Taken in Eel River, from North Manchester to the mouth; also in Pawpaw, Flowers, and Twelve-mile creeks. Scarce. Found nowhere else. Head, $4\frac{1}{2}$ in length of body; depth, $5\frac{1}{2}$; eye slightly longer than snout and 3 in length of head; mouth very oblique, maxillary reaching to front of eye. The front of dorsal is midway between the center of the pupil and base of caudal fin.
33. *Ericymba buccata* Cope. Found nowhere except on rocky bottom on the lower 6 miles of Eel River and in Twelve-mile Creek near its mouth.
34. *Hybopsis hyostomus* Gilbert. A few small specimens only were secured in Eel River, below the lower dam at Logansport. The largest specimen taken is $2\frac{1}{2}$ inches long. Eye $3\frac{1}{2}$ to nearly 4 in length of head.
35. *Hybopsis watauga* Jordan & Evermann. Scarce. The largest specimen $3\frac{1}{2}$ inches in length. On four specimens noted the scales in the lateral line number respectively 42, 46, 48, and 50. On the larger specimens the black spots on the sides have almost disappeared.
36. *Hybopsis amblops* (Rafinesque). Taken in Shriner and Cedar lakes, and in the middle and lower courses of Eel River and its tributaries.
37. *Hybopsis storerianus* (Kirtland). Several specimens, 5 inches in length, were caught in the pool below the lower dam at Logansport.
38. *Hybopsis kentuckiensis* (Rafinesque). *River Chub*. At all points examined on Eel River. Especially common and of large size in the lower course of this stream.
39. *Semotilus atromaculatus* (Mitchill). *Creek Chub*. Common in all the streams. The largest specimens from the upper course of Eel River.
40. *Notemigonus chrysoleucus* (Mitchill). *Golden Shiner*. From Blue Lake, Eel and Blue rivers, Blue Babe and Mud creeks. Scarce at all these points. Always found on grassy or muddy bottom in quiet waters.
41. *Dorosoma cepedianum* (Le Sueur). *Hickory Shad*. Many specimens from 2 to 10 inches in length were taken below the lower dam at Logansport. Found nowhere else.
42. *Coregonus artedii sisco* (Jordan). *Cisco*. Three specimens, each 14 inches in length, were secured in Shriner Lake at a depth of 45 feet. They are also common in Cedar Lake, but none are known to inhabit Round and Blue lakes. They spawn in shallow water from about the 25th of November to the 20th of December.

43. *Zygonectes notatus* (Rafinesque). *Top Minnow*. Not very common, but generally distributed throughout Eel River and its tributaries. A few specimens were also taken in Blue, Shriner, and Cedar lakes.
44. *Umbra limi* (Kirtland). *Mud Minnow*. This little fish was found in sluggish waters in the upper courses of Eel and Blue rivers, and in Thorn and Blue Babe creeks.
45. *Lucius vermiculatus* (Le Sueur). *Grass Pike; Little Pickerel*. Common in all waters examined except Hull Lake, where none were caught. Fishermen report it common in this lake also. Especially abundant in the larger lakes, where specimens 12 inches in length were seen.
46. *Lucius lucius* (Linnaeus). *Pike; White Pike*. A number of specimens were taken at various places in Eel River; the largest of these was 2 feet in length and weighed 5 pounds. Two smaller specimens were taken in Stony Creek; their stomachs were filled with crawfish. Last summer a 7-pound pike was taken with hook and line in Eel River, near Columbia City.
47. *Anguilla chrysypa* Rafinesque. *Eel*. We did not secure a single specimen, but saw the skin of one which had been taken from Eel River, at Collamer. It was formerly very common in Blue River.
48. *Labidesthes sicculus* Cope. *Brook Silverside; Smelt*. Common in Shriner, Cedar, and Round lakes, and throughout Eel River and its tributaries. In the lakes this fish forms a large portion of the food supply of carnivorous fishes.
49. *Aphredoderus sayanus* (Gilliams). *Pirate Perch*. Inhabits quiet or sluggish waters in upper Eel and Blue rivers. A few specimens were also taken in Thorn Creek.
50. *Pomoxis sparoides* (Lacépède). *Calico Bass*. Common in all the waters of Eel River basin.
51. *Pomoxis annularis* Rafinesque. *Bachelor*. A few specimens from Eel and Blue rivers and Meredith Creek. Generally found associated with the calico bass.
52. *Ambloplites rupestris* (Rafinesque). *Rock Bass; Goggle-eye; Red-eye*. Distributed throughout all the streams. None were found in the lakes.
53. *Chænobryttus gulosus* (Cuvier & Valenciennes) *Warmouth*. Found in Eel River and in nearly all of its larger tributaries, and in all the lakes except Hull Lake. It frequents quiet waters. Nowhere common.
54. *Lepomis cyanellus* Rafinesque. *Green Sunfish*. Not common. Eel River and all its larger tributaries, and Round and Wilson lakes. It was not seen by me in the other lakes, but it no doubt inhabits them also.
55. *Lepomis pallidus* (Mitchill). *Blue-gill; Blue Sunfish*. Frequents all the waters examined. The largest from Shriner Lake measured 9½ inches in length. This is one of the most important food-fishes in the lakes.
56. *Lepomis megalotis* (Rafinesque). *Long-eared Sunfish*. Common in Eel River and in nearly all its larger tributaries. Found in none of the lakes except in Hull Lake, where one small specimen was caught.
57. *Lepomis euryorus* McKay. Only three specimens were taken, one each from Cedar and Shriner lakes and one from an old side channel in the upper course of Eel River. The largest specimen is 4½ inches long. These specimens have some points of difference from *Lepomis euryorus* McKay, but for the present they are identified with that species. The dorsal outline slightly more convex than the ventral. Head, 3; depth, 3; eye, 4; snout, 4. Mouth small, oblique, maxillary reaching to front margin of eye. Teeth on vomer. Pharyngeal teeth conical. Gill-rakers short, about 8 or 9 in number. Scales on the cheeks in 5 rows and not 6 or 7 rows as in McKay's description of *L. euryorus*. Scales on the opercle larger than those on the cheeks. Subopercle with a single row of scales. The flap of the opercle a shiny black color surrounded by a membranous margin which is whitish above and below in the alcoholic specimen. Front of dorsal somewhat behind base of pectorals and directly over insertion of ventrals. Dorsal spines all curved backwards, those in the middle the highest and equal in length to the distance from the tip of the snout to the center of the eye. Soft portion of dorsal slightly higher than spinous dorsal. Posterior insertion of soft dorsal and that of anal fin are opposite. The base of anal fin is contained twice in that of dorsal fin. The third spine of anal the longest. Ventrals inserted behind pectorals. The ventrals extend just over the vent. Pectorals not quite reaching vent. Scales ctenoid, 5-43-11. Color in spirits, above axis of body, dark olive; below, yellowish. Top of head black. The membranes of vertical fins dusky. Ventrals also dusky, with lighter margins. The pectorals are whitish. D. x, 10 or 11; A. III, 10.

58. *Lepomis heros* (Baird & Girard). Caught by me nowhere except in Round Lake, where it is not scarce. Dorsal and ventral outlines similarly curved. Head, $3\frac{1}{2}$; depth, $2\frac{1}{2}$; snout, $3\frac{1}{2}$; eye, 4 to $4\frac{1}{2}$. Opercular flap black, smaller than eye, edged with pale. Four rows of scales on cheeks. Largest dorsal spine $2\frac{1}{2}$ in length of head. Pectorals as long or longer than head, extending past front of anal. Color, dusky olive, silvery beneath, no wavy lines on cheeks, sides of body not spotted, and dorsal not mottled. Scales on lateral line about 37. D. x, 11; A. III, 10.
59. *Lepomis gibbosus* (Linnaeus). *Common Sunfish*. Common in all the lakes except Hull Lake. Also common in the dam at South Whitley; scarce in the streams.
60. *Micropterus dolomieu* Lacépède. *Small-mouthed Black Bass*. Common in flowing water throughout Eel River and its larger tributaries. The largest specimen observed by me from Eel River was taken with hook and line in the dam at Pettysville. It weighed 4 pounds. None were taken in the lakes.
61. *Micropterus salmoides* (Lacépède). *Large-mouthed Black Bass*. Very common in all the lakes, where it is the most important game and food fish. It was also taken in Eel River and some of its larger tributaries.
62. *Etheostoma pellucidum* Baird. *Sand Darter*. Numerous specimens were taken in Eel River and all its tributaries from Collamer to Logansport. None were seen above Collamer.
63. *Etheostoma nigrum* (Rafinesque). *Johnny Darter*. One of the most common of darters in the streams. Also found in Cedar and Round lakes, but less common.
64. *Etheostoma blennioides* Rafinesque. *Green-sided Darter*. In all the streams, but nowhere common. None were found in the lakes.
65. *Etheostoma caprodes* (Rafinesque). *Hogfish*. From the lower course of Eel River, Paw-paw, Flowers, and Twelve-mile creeks. None were seen above Roann.
66. *Etheostoma phoxocephalum* Nelson. Many fine specimens were taken on grassy bottom in Eel River at Logansport, immediately above the wagon bridge. They were found nowhere else.
67. *Etheostoma aspro* (Cope & Jordan). *Black-sided Darter*. None were seen in the lakes, but they are common in all the streams. On some specimens from Eel River, at Logansport, the lateral spots flow together and form a solid dark band.
68. *Etheostoma evides* (Jordan & Copeland). This beautiful darter was not taken by me, but numerous specimens were secured by Prof. B. W. Evermann in Eel River, below the lower dam at Logansport. Scales 55.
69. *Etheostoma camurum* (Cope). *Blue-breasted Darter*. Scarce. In Eel River only at points between South Whitley and North Manchester. Head, 4; depth, $4\frac{1}{2}$. D. XI, 13; A. II, 8. Largest specimen taken, 2 inches long.
70. *Etheostoma flabellare* Rafinesque. Found nowhere except in Eel River between South Whitley and North Manchester.
71. *Etheostoma cœruleum* Storer. *Rainbow Darter*. Everywhere common in the streams. None were taken in the lakes.
72. *Etheostoma cœruleum spectabile* (Agassiz). Taken in Little Weasaw Creek only.
73. *Etheostoma eos* (Jordan & Copeland). Specimens were taken from each of the lakes. Most abundant in Round Lake. None from the streams. The largest specimen seen was $2\frac{1}{2}$ inches long; head, 4; depth, $4\frac{1}{2}$. D. VIII to X, 7 to 11; A. II, 7 or 8. Some of the larger specimens have two or three small black spots arranged vertically on base of caudal fin.
74. *Etheostoma microperca* Jordan & Gilbert. Numerous specimens were caught in Blue Lake, and a few in Round Lake. Found nowhere else.
75. *Perca flavescens* (Mitchill). *Ringed Perch*; *Yellow Perch*. Common in all the lakes. Found nowhere in the streams except in the upper courses of Eel and Blue rivers.
76. *Cottus bairdi* Girard. *Miller's Thumb*; *Muffle-jaw*. Common on cold, rocky bottom throughout Eel River and its larger tributaries. Also found in Weasaw Creek.

TIPPECANOE RIVER SYSTEM.

The waters of this system were examined at the following places:

1. *Loon Lake*.—This beautiful sheet of water is 9 miles northwest of Columbia City and lies partly in the counties of Whitley and Noble. It has a length northwest and southeast of $1\frac{1}{2}$ miles and a width of half a mile, and it has a maximum depth of 102 feet. The bottom is mostly sandy, its shores are low but clean, somewhat marshy at the north and south ends, and covered with water weeds. The water is very clear. It receives the waters of Old Lake and New Lake, small bodies of water lying about half a mile to the southwest of it. The outlet of Loon Lake contributes to the head waters of the Tippecanoe River. This lake was examined June 14.

2. *Big Lake* lies 2 miles to the east of Loon Lake and wholly within Noble County. It is nearly circular and somewhat larger than Loon Lake. It receives its waters from Crooked and Crane lakes, which lie immediately to the east of it. The outlet of Big Lake joins that of Loon Lake. Investigations on this lake were made June 15.

3. *Crooked Lake* is a narrow body of water having a length of about $1\frac{3}{4}$ miles; its east end is not more than one-fourth mile west of Cedar and Shriner lakes, which were described under the Eel River system. The specimens seen from this lake were in the hands of fishermen.

Loon Lake is a summer resort for fishermen. There is a hotel, a clubhouse, and a number of private cottages. The lake has a pleasure steamboat plying its waters. Big Lake has also several cottages. These lakes are well stocked with indigenous game and food fishes.

FISHES OF THE TIPPECANOE RIVER SYSTEM.

1. *Lepisosteus osseus* (Linnaeus). *Common Gar-pike*. Common in all the lakes.
2. *Ameiurus nebulosus* (Le Sueur). Very abundant, especially in Loon Lake.
3. *Pimephales notatus* (Rafinesque). *Loon Lake and Big Lake*. Very common.
4. *Notropis cayuga* Meek. *Loon Lake*. Scarce.
5. *Notropis heterodon* Cope. *Loon Lake*. More abundant than *N. cayuga*.
6. *Coregonus artedi sisco* (Jordan). *Cisco*. Common in Crooked Lake; also found in the west end of Big Lake, but scarce.
7. *Zygonectes notatus* (Rafinesque). *Top Minnow*. Abundant in Loon and Big lakes. None from Crooked Lake.
8. *Lucius vermiculatus* (Le Sueur). *Grass Pike*. Many specimens from Loon and Big lakes. No doubt it inhabits Crooked Lake also.
9. *Labidesthes sicculus* Cope. *Brook Silverside; Smelt*. Common in Loon Lake. A single specimen from Big Lake.
10. *Pomoxis sparoides* (Lacépède). *Calico Bass*. From Crooked Lake only.
11. *Chænobryttus gulosus* (Cuvier & Valenciennes). *Warmouth*. A few specimens from Loon and Big lakes only.
12. *Lepomis pallidus* (Mitchill). *Blue-gill; Blue Sunfish*. From all the waters examined. Abundant.
13. *Lepomis megalotis* (Rafinesque). *Long-cared Sunfish*. A few small specimens from Loon Lake only.
14. *Lepomis gibbosus* (Linnaeus). *Common Sunfish*. Common in Loon Lake. Not taken by me in the other lakes.
15. *Micropterus salmoides* (Lacépède). *Large-mouthed Black Bass*. Very abundant in all the lakes.
16. *Etheostoma caprodes* (Rafinesque). *Log Perch; Hogfish*. Many from Loon Lake, but none from Big or Crooked lakes.
17. *Perca flavescens* (Mitchill). *Ringed Perch; Yellow Perch*. Common in all these lakes.

LIST OF BATRACHIANS AND REPTILES OBSERVED IN EEL RIVER BASIN.

BATRACHIANS.

1. *Necturus maculatus* Rafinesque. *Mud Puppy; Water Dog*. Numerous specimens are taken in Eel and Blue rivers on the hook while fishing for suckers.
2. *Amblystoma opacum* (Gravenhorst). Not common. Found near Columbia City under logs in damp woods.
3. *Amblystoma microstoma* (Cope). *Small-mouthed Salamander*. About ponds near Columbia City.
4. *Bufo lentiginosus* Shaw. *Common Toad*.
5. *Acris gryllus crepitans* Baird. *Cricket Frog*. Common along the streams and about the lakes.
6. *Hyla versicolor* Le Conte. *Tree Frog*. At Columbia City.
7. *Rana virescens* Kalm. *Leopard Frog*. Very common along the lakes and streams.
8. *Rana clamata* Daudin. *Green Frog*. Also found along the water courses, but not so common as the former.
9. *Rana catesbiana* Shaw. *Bull Frog*. Common in sluggish waters in the lakes and streams.

REPTILES.

1. *Storeria occipitomaculata* (Storer). *Red-bellied Snake*. At Columbia City and Collamer.
2. *Eutainia faireyi* Baird & Girard. In the vicinity of Collamer.
3. *Eutainia proxima* (Say). Mr. Galbreath says it has been taken at Collamer.
4. *Eutainia sirtalis* (Linnæus). *Common Garter Snake*. Everywhere common.
5. *Tropidonotus sipedon* (Linnæus). *Water Snake*. Common along the streams. Largest taken was 35 inches long.
6. *Bascanion constrictor* (Linnæus). *Blue Racer*. A common snake.
7. *Ophibolus doliatus triangulus* (Boie). *Milk Snake; House Snake*. Seen at Columbia City.
8. *Sistrurus catenatus* (Rafinesque). *Prairie Rattlesnake*. Many were killed last summer in fields east of Columbia City.
9. *Amyda mutica* (Le Sueur). *Leather Turtle*. Several specimens from the middle course of Eel River.
10. *Aspidonectes spinifer* (Le Sueur). *Common Soft-shelled Turtle*. A few small specimens were seen in Eel River.
11. *Chelydra serpentina* (Linnæus). *Snapping Turtle*. In Eel and Blue rivers.
12. *Aromochelys odoratus* (Latreille). *Musk Turtle*. Taken in Eel River.
13. *Malaclemmys geographicus* (Le Sueur). *Map Turtle*. Several small specimens from Eel River.
14. *Chrysemys marginata* (Agassiz). *Western Painted Turtle*. Taken in all the lakes and streams. The most common turtle.
15. *Chelopus guttatus* (Schneider). *Speckled Tortoise*. Found in Eel River.

COLUMBIA CITY, Indiana, August 14, 1893.