

9.—REPORT OF EXPLORATIONS MADE IN MISSOURI AND ARKANSAS DURING
1889, WITH AN ACCOUNT OF THE FISHES OBSERVED IN
EACH OF THE RIVER BASINS EXAMINED.

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In July and August, 1889, the writer spent six weeks exploring the streams of the Ozark region of Missouri and Arkansas in the interest of the U. S. Fish Commission. The work was performed under the direction of Dr. David S. Jordan, and I received, throughout, the very efficient assistance of Mr. Louis Rettger and Mr. Frank M. Drew, students in the University of Indiana.

The region examined lies chiefly in southern Missouri and in western Arkansas. The surface of the country is much broken, although none of its hills reach any great height. The rock in place is chiefly limestone, containing much chert and flint. The flint breaks up into angular pieces which cover the bottom of the streams, affording lurking places to small fishes, but very destructive to the nets.

The Ozark region abounds in springs. The streams are clear and cold even in the heat of summer. The temperature rarely exceeds 76° Fah., and some streams are found as cold as 57° Fah.

Vegetation is not very abundant in the streams, being much less profuse than in the streams of western North Carolina and Virginia. The bottoms of the streams are rocky, gravelly, or sandy, with very little mud. Nearly all of those in Missouri are well filled with fishes, but there are fewer individuals than in streams seined by the writer in Iowa, Indiana, and the Carolinas. The greatest number of fishes was found near Mammoth Springs, but fishes were scarce in the Mazarn and especially so in the Caddo and in the forks of the Saline.

In collecting in these latter streams we were much disappointed. The fact that the country is thinly settled, and but a comparatively small amount of the timber has been cut, led us to believe that the fishes had been very little disturbed by man. We were informed by settlers to the west of Hot Springs that in the past few years many fishes in these streams have been destroyed by dynamite. The two summers previous to our visit many fishes were seen dead and dying along the Mazarn, Caddo, and the Saline. Dr. John C. Branner, director of the Geological Survey of Arkansas, informed the writer that large numbers of fishes were found dead along the forks of the Saline

in the summer of 1888. Whether this wholesale destruction is due to the use of dynamite I do not know. This is the explanation given by those living in the country, and those interested in preserving this valuable source of food.

We also heard elsewhere many complaints regarding the use of dynamite in capturing fishes, especially about Newburg, Mo., at Neosho, and at Cabool. At Neosho, we were informed by the superintendent of the United States Fish Hatchery that just before our visit several arrests had been made, and that heavy fines had been imposed upon a few persons for taking fishes by illegal methods. The Ozark streams are so abundantly supplied with springs that most of the small brooks never go dry in the summer, and the water in them is always cool. All streams seen by us seemed well adapted for fishes, but before good results can be obtained from stocking them by the United States or the State Commission, the wholesale use of dynamite in slaughtering the native fishes must be stopped.

In the present paper are given lists of the species taken in each stream together with such notes as seem useful. The species new to science are three, while a few others seem to present some varietal differences. I have also added to the paper the record of a few collections made in the same region in former years.

In the summer of 1886, Prof. R. E. Call, of Des Moines, Iowa, collected fishes in Dent and the neighboring counties in Missouri. In 1888, the writer collected a few fishes in Spadra Creek near Clarksville, Ark. The writer has been especially indebted to the assistance of Mr. Rettger and Mr. Drew while in the field, and he is also under obligations to Dr. D. S. Jordan and Dr. C. H. Gilbert for help in doubtful identifications, and for many valuable suggestions.

The new species described are as follows:

Zygonectes macdonaldi. Jones Creek and Osage Fork of the Gasconade.

Etheostoma juliaë. James River.

Notropis ozarcanus. North Fork of the White River.

I have also described two new subspecies:

Notropis telescopus arcansanus. Mammoth Spring.

Notropis atherinoïdes caddonis. Little Red and Caddo Rivers.

ITINERARY.

July 17.—The party met at St. Louis and took the train to Rolla.

July 18.—Collected in the Little Dry Fork of the Meramec River.

July 19.—Collected in Meramec Spring outlet, and in the Big Dry Fork of the Meramec River.

July 20.—Collected in Little Piney River near Newburg, Mo., and in the Meramec River near St. James, Mo.

July 22.—Collected in the Gasconade and Little Piney near Arlington, Mo.

July 23.—Went to Dixon, Mo.

July 24.—Collected in Jones Creek and the Marais River. Went to Marshfield, Mo.

July 25, 26.—Collected in the Osage Fork of the Gasconade and in the river near Marshfield, Mo.

July 27.—Went to Neosho, Mo.

July 29.—At Neosho.

July 30.—Collected in Hickory Creek and Shoal Creek, and went to Springfield, Mo., same evening.

July 31.—Collected in the James River and the Sac River near Springfield, Mo.

August 1, 2.—Went to Mansfield. Collected in the Lock Fork of the Gasconade and in Bryant's Creek. Went to Cabool, Mo.

August 3.—Collected in Big Piney, and the North Fork of the White near Cabool; went to Mammoth Spring, Ark.

- August 4.*—The rain of the previous day and the two previous nights had swollen the streams so that fieldwork was impossible.
- August 5.*—Collected in Spring Branch near Mammoth Spring, Ark.
- August 6.*—Collected in Myatt and English Creeks, near Mammoth Spring, Ark.
- August 7.*—Collected in Spring River and in Warm Fork of Spring River, near Mammoth Spring, Ark.
- August 8.*—Went to Hot Springs, Ark.
- August 9-11.*—Packed collections, mended nets, and prepared to go west with team.
- August 12-16.*—Spent in traveling and collecting west of Hot Springs.
- On this trip we collected in Mazarn and Myers Creeks, in the Caddo and two tributaries, in the South Fork of Ouachita River near Mount Ida, and in the Ouachita River near Crystal Springs.
- August 18.*—Collected in the West and Middle Forks of the Saline, about 25 miles west of Hot Springs, Ark.
- August 19.*—Went to Judsonia, Ark.
- August 20.*—Collected in a small tributary of the Little Red River, near Judsonia, Ark.
- August 21.*—Returned to Bloomington, Ind.

The streams examined may be classified as follows:

A.—Missouri River Basin.

I.—Meramec River:

1. Meramec River, St. James, Mo.
2. Meramec Spring, 5 miles southeast of St. James.
3. Big Dry Fork, near St. James.
4. Little Dry Fork, near Rolla.

II.—Gasconade River:

1. Gasconade River, at Arlington, Mo.
2. Gasconade River, 5 miles above Arlington.
3. Little Piney River at Newburg and Arlington.
4. Osage Fork of the Gasconade River, 6 miles southeast of Marshfield.
5. Lock Fork of the Gasconade at Mansfield.
6. Big Piney River at Cabool.
7. Jones Creek near Dixon.

III.—Osage River:

1. Marais River near Dixon, Mo.
2. Niangua River near Marshfield.
3. Sac River near Springfield, Mo.

B.—Arkansas River Basin.

IV.—Neosho River:

1. Shoal Creek near Neosho, Mo.
2. Hickory Creek near Neosho.
3. Spring Branch of Hickory Creek.

V.—Spadra Creek, Clarksville, Ark.

C.—White River Basin.

VI.—White River in Missouri:

1. James River near Springfield.
2. Bryant's Creek near Mansfield.
3. North Fork of White River, south of Cabool.

VII.—Tributaries of White River about Mammoth Spring, Arkansas:

1. Mammoth Spring.
2. Spring River at Mammoth Spring.
3. Warm Fork of Spring River.
4. English Creek, west of Mammoth Spring.
5. Myatt Creek, 6½ miles southwest of Mammoth Spring.

VIII.—Little Red River:

1. Little Red River at Judsonia, Ark.

D.—Washita River Basin.

IX.—Washita or Ouachita River:

1. Washita River at Crystal Springs, Ark.
2. Caddo River at Caddo Gap and Black Springs.
3. South Fork of the Ouachita at Mount Ida.
4. Mazarn Creek near Myers, Ark.
5. Myers Creek near Myers.
6. West Fork of Saline River, 24 miles west of Hot Springs.

A.—BASIN OF THE MISSOURI RIVER.

I.—THE MERAMEC RIVER.

The *Meramec River* rises near the southern border of Dent County, Mo. Its course is northeasterly, and it empties into the Mississippi River about 40 miles south of the Missouri River. The Meramec, together with many of its southern and western tributaries, have their origin in a considerably elevated portion of the Ozark Mountains, and in a cherty limestone region which is well supplied with springs.

We visited the Meramec River near St. James, Mo. At this point it is a beautiful stream of clear water flowing over a bottom of shingle and sand. The water was quite low on account of dry weather. In places the river was less than 40 feet wide and less than 4 feet deep. The river shows evidence of being a torrent in times of high water, and containing many times the volume of water it had during our visit.

The Meramec Spring is about 5 miles south and east of St. James. It is one of the largest springs in Missouri. The water flows from a large fissure at the foot of a cliff, and forms a stream larger than the Meramec River itself at the time of our visit. The spring is about 1 mile from the river; its outlet contains much vegetation, and its bottom for the most part is muddy. The left side of the Meramec River, below the mouth of the spring outlet, has a muddy bottom, and contains much vegetation. The temperature of the water at the spring was 56° Fah. About 100 rods below the spring the temperature was 57° Fah. More than fifty years ago a dam was thrown across the spring outlet, near the spring, and a portion of the water was used to run the machinery of an ironworks having sufficient capacity to furnish employment for about one hundred men. The motor used was a large breast-wheel. The water from the spring is very clear.

The Big Dry Fork of the Meramec River was visited between St. James and the Meramec Spring, and the Little Dry Fork near Rolla, Mo. In these two streams the currents are sluggish, and the bottom is more or less muddy, with occasional stretches of sand and gravel. At the time we were there the streams were not much more than a series of deep holes, with little running water between them. The temperature of Big Dry Fork was 85° Fah.; of Little Dry Fork, 79° Fah.

1. *Ammocetes branchialis* (Linnæus).

One larval specimen was taken from among the weeds in the Meramec River a short distance below the mouth of the Meramec Spring outlet.

2. *Ameiurus natalis* (Le Sueur).

Anal rays, 24 to 25; base of anal, 3½ in the length of the body. Three specimens from Little Dry Fork.

3. *Noturus exilis* Nelson.

Anal rays, 15 to 17; head, $4\frac{1}{2}$ in length of body; depth, 7. Dorsal, anal, and caudal fins each with a narrow, dusky border. Little Dry Fork; common.

4. *Catostomus nigricans* (Le Sueur).

Meramec River, scarce; Meramec Spring, Big Dry Fork, not common.

5. *Catostomus teres* (Mitchill).

Abundant in the Meramec Spring outlet. A few specimens were taken from the Meramec River and the Little Dry Fork.

6. *Minytrema melanops* (Rafinesque).

Dorsal rays, 12; scales, 45 to 46; depth, $4\frac{1}{2}$; Meramec Spring outlet; common.

7. *Moxostoma duquesnei* (Le Sueur).

Scales 46 to 48 in specimens from Meramec Spring Outlet. Meramec Spring, very abundant; less common in the Meramec River and the Little and Big Dry Forks.

8. *Campostoma anomalum* (Rafinesque).

Tubercles on the head and body, on some specimens from the Meramec Spring. Very abundant in Meramec River and Spring; scarce in Big and Little Dry Forks.

9. *Chrosomus erythrogaster* Rafinesque.

Males from Spring Outlet with much red on sides and belly. Abundant in Meramec Spring Outlet; one specimen from the Big Dry. This species abounds in clear, cool water.

10. *Hybognathus nubila* (Forbes).

Below eye, at base of pectoral, ventral, anal, and caudal fins faint red on males. All specimens have a dark lateral band; no black spot at base of caudal fin. Scales 35 to 38. Origin of first dorsal ray slightly nearer tip of snout than base of the caudal. Very common in the Meramec River; scarce in the Little Dry Fork.

11. *Pimephales notatus* (Rafinesque).

Meramec River and Big Dry Fork; scarce.

12. *Notropis cayuga* Meek.

Mouth small, its gape nearly horizontal; snout blunt, its length $3\frac{1}{2}$ in length of head. Eye rather large, its diameter $2\frac{1}{4}$ to 3 in head. Head $4\frac{1}{4}$ in length of body; depth $4\frac{1}{2}$ to $4\frac{3}{4}$. Back slightly elevated. Dorsal fin slightly nearer tip of snout than base of caudal fin. Thirteen scales before dorsal, 37 scales in the lateral line. Color, olivaceous, paler below. Sides with a dusky band, consisting of small dark dots; the band extending on snout of the upper lip only. Meramec River, scarce.

13. *Notropis boops* Gilbert.

(*Notropis scabriceps* Jordan & Gilbert, Proc. U. S. Nat. Mus., 1885, 3; not of Cope.)

Scales in the lateral line 35 to 36. Head $4\frac{1}{2}$; depth $4\frac{1}{2}$ to $4\frac{3}{4}$. Eye very large, its diameter $2\frac{1}{2}$ in head. Teeth 1—4—4—1: tips hooked, no evident grinding surface, edges crenate. Big Dry Fork, abundant; Meramec River and Little Dry Fork, scarce.

14. *Notropis whipplei* (Girard).

Big Dry Fork, not common.

15. *Notropis megalops* (Rafinesque).

Scales on the anterior part of body little if any smaller than those on rest of body. This is true of all specimens taken by us in the Missouri and Arkansas. Thirteen to 17 scales in front of dorsal fin. Sides silvery, with a darkish plumbeous band, less conspicuous than in *N. zonatus*. The young of this species and of *N. zonatus* appear very much alike.

16. *Notropis zonatus* (Agassiz).

Head 4 in the length of the body, depth $4\frac{1}{2}$ to $5\frac{1}{2}$. Sides with a dark plumbeous band, above which is usually a more narrow silver band; upper part of body dusky; a dark vertebral line; a dark band on shoulder from upper edge of opercle to base of pectoral fin. Lower part of body and the lower fins on males with some red. The position of the dorsal fin is variable; in some specimens it is midway between tip of snout and base of caudal fin; in others the middle of the fin is midway between base of caudal fin and tip of snout. It is usually further forward on the larger and deeper specimens.

This species is very abundant in southern Missouri. It prefers cool, clear water, and is usually taken with *N. megalops*. Its colors are brighter when taken from streams with clear, cool water. It is one of the largest, handsomest, and most graceful of the species of *Notropis*. Meramec River and Spring Outlet, abundant.

17. *Notropis umbratilis cyanocephalus* (Copeland).

First dorsal ray midway between the eye and caudal fin. Body deep, compressed. Color pale greenish in life, with more or less pinkish on the sides. All specimens taken were less than $2\frac{1}{2}$ inches in length. A dark vertebral line and a dark spot at base of dorsal in front. Big and Little Dry Forks, abundant.

According to the studies of Dr. Gilbert, *Notropis ardens*, *cyanocephalus*, *atripes*, *lythyrurus*, *matutinus*, and *nigripinnis* are indistinguishable as species from *N. umbratilis*.

18. *Notropis rubrifrons* (Cope).

Head $4\frac{1}{3}$ to $4\frac{1}{2}$ in the length of the body; depth 5 to $5\frac{1}{2}$; scales 40 to 42 in the lateral line. Eye small, scarcely equal to length of snout, its diameter $3\frac{1}{2}$ in length of head in specimens $2\frac{1}{2}$ inches in length. A broad, high plumbeous band on sides overlaid with silvery; lateral line decurved, usually forming lower boundary of the plumbeous band. Some red on the lower parts of the body on some specimens. Anal rays 9 or 10, usually 10. Meramec River and Little Dry Fork, common; Big Dry Fork, scarce.

19. *Notropis lutrensis* (Baird and Girard).

Big Dry Fork.

20. *Hybopsis amblops* (Rafinesque).

Big Dry Fork, scarce.

21. *Hybopsis kentuckiensis* (Rafinesque).

Meramec River, Big and Little Dry Forks, common.

22. *Semotilus atromaculatus* (Mitchill).

Meramec Spring and Little Dry Fork, not common; Big Dry Fork, scarce.

23. *Notemigonus chrysoleucus* (Mitchill).

Little Dry Fork, one specimen.

24. [*Salmo irideus* Gibbons.

This species is not native to the Ozark region. It has been introduced into the streams in Missouri by the Missouri State fish commission. Several specimens were taken by us in the Meramec Spring Outlet.]

25. *Fundulus catenatus* (Storer).

Usually with few crimson spots on opercles and sides of the body. The lateral stripes are much broken in some specimens. A few faint dark vertebral bars are quite conspicuous on the posterior portion of the body. The dorsal fin is larger in adult males than in females. Meramec River, common; Big Dry, scarce.

26. *Zygonectes notatus* (Rafinesque).
Big Dry Fork, one specimen.
27. *Lucius vermiculatus* (Le Sueur).
Branchiostegals, 11 to 13. Lateral line, 105. Meramec Spring Outlet, common; Meramec River, scarce. Taken among weeds. Specimens all small.
28. *Labidesthes sicculus* Cope.
Big Dry, one specimen.
29. *Ambloplites rupestris* (Rafinesque).
Meramec River, one specimen. Taken by hook and line.
I was informed that the Meramec River at the mouth of the Spring Outlet used to be an excellent place to catch Black Bass (*M. salmoides* and *M. dolomieu*), "Crop-pies" (*A. rupestris*), and other species of sun-fish, with hook and line. About 6 miles below the Spring Outlet a dam was built across the Meramec River. Since then there has been a noted scarcity of the game fishes at this point. The dam was built about four years ago. No fishway has been erected at the dam.
30. *Lepomis cyanellus* Rafinesque.
Big and Little Dry Forks, scarce.
31. *Lepomis pallidus* (Mitchill).
Big and Little Dry Forks, scarce.
32. *Micropterus dolomieu* Lacépède.
Meramec Springs, Meramec River, and Big Dry Fork, not abundant.
33. *Micropterus salmoides* (Lacépède).
Meramec River, one specimen taken.
34. *Etheostoma nigrum* Rafinesque.
Scales in the lateral line, 52 to 54. Dorsal spines, 10 in one specimen; soft rays, 12. Meramec River and Big Dry Fork, scarce.
35. *Etheostoma blennioides* Rafinesque.
Depth 5 to 5½, more slender than eastern forms. Meramec River, Big Dry Fork, and Little Dry Fork, scarce.
36. *Etheostoma cœruleum* Storer.
One specimen from Little Dry Fork has the dorsal XII—13, others with IX—XI spines in the dorsal. Scales, 43 to 48. Several specimens taken are of the *spectabile* form. The markings on some of the larger females are irregular, giving them a marbled appearance. Meramec River and Little Dry Fork, not common.
37. *Etheostoma zonale* (Cope).
Meramec River, one specimen; scales in lateral line 49.
38. *Cottus bairdi* Girard.
Dorsal spines, 6 to 8; soft rays, 17 to 18. Color, variable. Some specimens very dark, with no markings; others reticulated with dark; others plain olive; dark bars present on a few specimens. Meramec Spring, abundant; Meramec River, common; Little Dry Fork, scarce.

II.—THE GASCONADE RIVER BASIN.

The headwaters of the *Gasconade* are farther west and south than those of the Meramec River. The river flows in a northeasterly direction and empties into the Missouri River about 30 miles below the mouth of the Osage River. We visited the Gasconade

at Arlington, Mo., and at a point 5 miles higher. Here it is a clear stream flowing for the most part over a gravelly and sandy bottom. The river is about 125 yards wide and at times of low water easily forded. Vegetation in the river was scarce, and but few fishes were taken in each haul of the seine. The temperature was 80° Fah.

Little Piney River is an eastern tributary of the Gasconade. It is a clear stream of water flowing with a considerable current. The bottom is sandy and gravelly with scarcely any mud except near its mouth, which is at Arlington. In times of low water the stream between Arlington and Newburg, Mo., seldom exceeds 20 or 30 feet in width. The stream is largely fed by springs, and is said always to contain considerable running water. Our seining was done at Newburg and at Arlington, Mo. The supply of smaller fishes was quite large. Larger fishes are taken in small numbers in the larger holes. The temperature of Little Piney at Newburg was 76°; at Arlington, near its mouth, 79°.

The Osage Fork of the Gasconade.—This stream was visited about 6 miles southeast of Marshfield, Mo. It is a sluggish stream, some 50 feet wide in the broadest places. In the deeper places the bottom was muddy, elsewhere somewhat rocky. The water was not clear at the time of our visit, while the waters of the Niangua visited the previous day were very clear. The temperature was 97° Fah.

The Lock Fork of the Gasconade.—This stream was examined at Mansfield, Mo. It is nearly twice the size of the Osage Fork, its waters clearer, and the bottom with much less mud. Otherwise it is much like the Osage Fork. This stream is seined a great deal by the people living on its banks near Mansfield. Large cat-fish are said to be taken frequently. Not many fish were obtained by us. The temperature was 78° Fah.

Big Piney River was visited near Cabool, Mo. It is here a small stream, with a rather sluggish current and a stony bottom. Near Cabool the stream widens until it is about 60 to 100 feet wide and from 2 to 10 feet deep. Fish are apparently scarce in this stream. The scarcity is in some measure due to the presence of gristmills and sawmills, which discharge refuse substances into the stream, and to the use of dynamite. It is reported that dynamite is frequently used in this region. The temperature was 74° Fah.

Jones' Creek is a small stream near Dixon, Mo. It is little more than a small brook, seldom exceeding 30 feet in width. It has a rocky and gravelly bottom, with occasional stretches of sand. Temperature 76° Fah.

1. *Noturus exilis* Nelson.

Dorsal and caudal fins tipped with black. Common in Jones' Creek; a few specimens from Little Piney.

2. *Leptops olivaris* (Rafinesque).

A few specimens were seen in the market at Newburg, Mo. They were reported to be from the Gasconade.

3. *Ameiurus melas* (Rafinesque).

Two specimens from the Big Piney. Color, silvery; the distal half of each anal ray black, the rest of each ray the color of the body.

4. *Ameiurus nebulosus* (Le Sueur).

One specimen from the Osage Fork of the Gasconade. Anal rays, 22.

5. *Ictalurus punctatus* (Rafinesque).

A few specimens seen in the Newburg market, from the Gasconade.

6. *Catostomus nigricans* Le Sueur.

Found in all places except the Big Piney; common.

7. *Catostomus teres* Mitchill.

Big Piney; not common.

8. *Moxostoma duquesnei* Le Sueur.

Common in the Osage Fork and the Big Piney; not common in the Lock Fork; scarce in the Little Piney and Gasconade at Newburg and Arlington.

9. *Campostoma anomalum* (Rafinesque).

Abundant in Jones' Creek and Big Piney; scarce in the Osage and Lock Forks of the Gasconade.

10. *Chrosomus erythrogaster* Rafinesque.

Osage Fork, Big Piney, and Jones' Creek, common.

11. *Hybognathus nubilus* (Forbes).

Scarce in Little Piney; abundant in Jones' Creek, the Lock and Osage Forks of the Gasconade. A black spot at base of caudal fin.

12. *Pimephales notatus* (Rafinesque).

Osage and Lock Forks, abundant; Big Piney, common; Little Piney, scarce.

13. *Notropis cayuga* Meek.

This species is very scarce in southern Missouri. It is usually found in quiet and warm waters. Big Piney, Osage, and Lock Forks of the Gasconade.

14. *Notropis boops* Gilbert.

At the base of the caudal fin is a distinct <-shaped spot, the apex pointing towards the head of fish, the first dorsal ray nearer base of caudal than tip of the snout. Eye 3 in head, head 4 in length, depth $4\frac{1}{4}$. The specimens of this species from the Gasconade and Little Piney differ from those from the Big Dry, at Rolla, Mo., in having the <-shaped blotch at base of caudal, in the smaller eye, and the more posterior position of the dorsal fin. Abundant in the Little Piney and the Gasconade near the mouth of Little Piney; Jones' Creek, scarce.

15. *Notropis lutrensis* (Baird & Girard).

Two specimens from the Little Piney. Snout tuberculate; head, $3\frac{3}{4}$; depth, $3\frac{1}{4}$. First dorsal ray midway between snout and base of the caudal fin. Color, steel-bluish.

16. *Notropis whipplei* (Girard).

Abundant near the mouth of the Little Piney; scarce in the Osage Fork of the Gasconade.

17. *Notropis zonatus* (Agassiz).

Usually a scarlet red band across the middle of the dorsal fin in the males. Some specimens from the Big Piney are very slender, the depth being $5\frac{1}{2}$ in the length. The position of the dorsal fin is farther back in the more slender specimens. The clearer and cooler the water in which this minnow is found the brighter are its colors. Big Piney, Little Piney, Gasconade, Lock Fork, Osage Fork, and Jones' Creek; common.

18. *Notropis megalops* (Rafinesque).

Big Piney, common; Lock Fork of the Gasconade, common.

19. *Notropis umbratilis cyanocephalus* (Copeland).

Abundant from the Lock and Osage Fork of the Gasconade. The larger specimens are much compressed. Color, dark bluish, dark spot at base of dorsal in front.

The smaller specimens are less compressed, more slender, and the color much lighter. Longest specimen, 3 inches.

20. *Notropis rubrifrons* (Cope).

Very common in the Osage Fork, scarce in the Lock Fork, not common in the Little Piney. Anal rays 10, occasionally 9 or 11.

21. *Hybopsis kentuckiensis* (Rafinesque).

Abundant in all streams.

22. *Hybopsis dissimilis* (Kirtland).

Gasconade and Little Piney, scarce.

23. *Semotilus atromaculatus* (Mitchill).

Rather scarce in all streams.

24. *Dorosoma cepedianum* (Le Sueur).

One specimen from Little Piney, near its mouth.

25. *Fundulus catenatus* (Storer).

Scarce in Jones' Creek and the Gasconade; abundant in the Little Piney.

26. *Zygonectes macdonaldi*, sp. nov. (Plate XLII, fig. 1).

Closely allied to *Zygonectes sciadicus* (Cope), but with larger anal fin, more slender body, and rather stronger teeth. (A. 10 to 11 in *Z. sciadicus*.) Length of longest specimen, $2\frac{1}{2}$ inches; head, $3\frac{2}{3}$ in the length of the body; depth, $4\frac{1}{2}$ to 5; dorsal, 10 or 11; anal, 12 to 14. Origin of dorsal behind origin of the anal. Scales large, 34 to 36 (the small ones at base of caudal not counted), 12 in a vertical series. Body rather long and slender, not much compressed; top of head flat; back slightly arched. Teeth rather large in one series, each curved inwards. Ventrals very small, and situated midway between pectoral and anal fins. Dorsal fins small; anal larger. Caudal fin rather large, rounded. Color greenish in spirits, no distinct markings, darker on upper portion of the body; both jaws more or less edged with blackish.

Four specimens were taken from Jones' Creek and five from the Osage Fork of the Gasconade. Larger specimens, described further on, were obtained in the Neosho River. I take pleasure in naming this pretty fish for the United States Commissioner of Fisheries, Hon. Marshall McDonald.

27. *Labidesthes sicculus* Cope.

Abundant in Big Piney and the Osage Fork of the Gasconade. This species is found in greatest numbers in rather warm sluggish water.

28. *Lepomis cyanellus* (Rafinesque).

Not common; Jones' Creek, Gasconade, Big Piney, and Little Piney.

29. *Lepomis macrochirus* Rafinesque.

Lepomis nephelus Cope, Jour. Acad. Nat. Sci. Phila., 1868, 222.

Lepomis ischyryus Jordan & Gilbert, Syn. Fish N. A., 1883, 475.

Lepomis macrochirus Jordan & Gilbert, Syn. Fish. N. A., 1883 (probably *Lepomis macrochirus* of Rafinesque).

Head 2 in the length of the body; in specimens 4 inches in length; 3 in specimens $2\frac{3}{4}$ inches. Depth, $2\frac{1}{2}$. Scales, 45 to 51. D. X, 11 or 12. Dorsal spines in one specimen 9. Body more compressed than in *L. cyanellus*. Supplemental bone well developed. Mouth nearly as large as in *L. cyanellus*. Cheeks with 5 rows of scales. Color as in adult *L. pallidus*, but darker and much more mottled with distinct bronze spots, these on dorsal and anal fins. Usually a faint dark spot on last dorsal rays.

Three specimens from Osage Fork of the Gasconade, more abundant in Lock Fork of the Gasconade.

30. *Lepomis pallidus* (Mitchill).
Little Piney, Big Piney, Gasconade, and Osage Fork.
31. *Lepomis megalotis* Rafinesque.
Osage Fork of the Gasconade, one specimen.
32. *Micropterus dolomieu* Lacépède.
Gasconade, Little Piney, and Osage Fork, rather common.
33. *Micropterus salmoides* (Lacépède).
Scarce in the Pineys and the Osage Fork; common in the Lock Fork of the Gasconade.
34. *Etheostoma nigrum* Rafinesque.
Lock Fork of the Gasconade, one specimen.
35. *Etheostoma blennioides* Rafinesque.
Lock Fork, Osage Fork, Little Piney, and Gasconade, scarce.
36. *Etheostoma uranidea* Jordan & Gilbert.
Gasconade and Little Piney, two specimens.
37. *Etheostoma caprodes* Rafinesque.
Osage Fork and Lock Fork of the Gasconade, scarce.
38. *Etheostoma aspro* (Cope & Jordan).
Gasconade and Little Piney, not common.
39. *Etheostoma cymatotænia* Gilbert & Meek.
Cheeks and opercles scaly, scales 71 in one specimen from Osage Fork. D. XII, 12.
One specimen from Little Piney and one from the Osage Fork.
40. *Etheostoma flabellare* Rafinesque.
Jones Creek, Little Piney, and Osage Fork.
41. *Etheostoma punctulatum* (Agassiz).
Jones Creek, Big Piney, Osage Fork, and Lock Fork, scarce.
42. *Etheostoma cœruleum* Storer.
Found in all streams, but much less common than the following. The color is much mottled on some female specimens. Dorsal spines 10 to 11.
- 42b. *Etheostoma cœruleum spectabile* (Agassiz).
Found in all streams, but in much larger numbers than *E. cœruleum*. Dorsal spines 9 to 11. This and the preceding form grade into each other.
43. *Etheostoma microperca* Jordan & Gilbert.
One specimen from Jones' Creek; not different from specimens from Indiana.
44. *Cottus bairdi* Girard.
Common in the Big Piney; less common in the Little Piney; scarce in the Osage and Lock Forks, and in Jones' Creek.

III.—THE OSAGE RIVER.

The tributaries of this river visited were the Marais, the Niangua and the Sac.

The *Marais River* near Dixon, Mo., is a rather small stream which empties into the Osage near its mouth. It was visited in time of low water and was found to consist of long deep holes with little running water between them. The bottoms of the

deep holes were muddy, the spaces between them rocky and gravelly. A small bayou near the river was also seined. It yielded only *Notemigonus* and *Ameiurus* in abundance. The river is fed by a few small streams only. The waters were muddy in consequence of the rain preceding and during our visit. The temperature was 77° Fah.

The *Niangua River* near Marshfield, Mo., is a stream of very clear water flowing over a sandy and gravelly bottom. When we visited it the water was low, and in many places the stream was not more than 20 feet wide. The Niangua is fed by numerous quite large springs found all along its course. This stream is quite remarkable for the bright colors of its minnows and darters. A great number of *Etheostoma caeruleum spectabile* were taken from a sort of bayou with a sandy and muddy bottom. The temperature of the Niangua was 76° Fah. The Pomme de Terre River rises near Marshfield, Mo. It is some 10 miles distant. We were told that during the summer it runs nearly dry, and that it was in this condition when we were there. Owing to these facts we did not visit it.

The *Sac River* near Springfield is not large, and the water is not very clear. The bottom has mud, some sand and gravel, and the current is rather sluggish. It is much smaller than the James, and according to the people of Springfield it bears no comparison to the James for fishing purposes, although the James is said to be quite depleted of its game fishes. The temperature of the Sac was 79° Fah.

1. *Noturus exilis* (Nelson).
The Niangua. Scarce.
2. *Ameiurus melas* (Rafinesque).
One specimen from the Marais. Common in the small bayou near the Marais.
3. *Ictiobus cyprinella* (Cuvier & Valenciennes).
One specimen from the Marais.
4. *Ictiobus bubalus* (Rafinesque).
One specimen from the Marais.
5. *Catostomus teres* (Mitchill).
Common in the Niangua and the Marais.
6. *Catostomus nigricans* Le Sueur.
Common in the Niangua and the Marais; not common in the Sac.
7. *Moxostoma macrolepidotum duquesnei* (Le Sueur).
Niangua and the Marais; not common.
8. *Campostoma anomalum* (Rafinesque).
Very common in the Niangua and the Sac. Three specimens from the Marais.
9. *Chrosomus erythrogaster* Rafinesque.
Abundant in all three streams.
10. *Hybognathus nubila* (Forbes).
Very abundant in all three streams.
11. *Pimephales notatus* (Rafinesque).
Common in the Niangua and Sac, more abundant in the Marais.
12. *Notropis cayuga* Meek.
Six specimens from the Niangua.
13. *Notropis deliciosus* (Girard).
One specimen from the Sac River.

14. *Notropis lutrensis* (Baird & Girard).
Eight specimens from the Marais.
15. *Notropis zonatus* (Agassiz).
Abundant in all three streams. The specimens taken from the Niangua were more brightly colored than any other specimens of the same species taken during the summer.
16. *Notropis umbratilis* (Girard).
The typical form of this species is common in the Marais and the Sac. The scales vary from 40 to 48. A few specimens are much compressed, others less so. All be-long, however, to the same species. The black spot at front of dorsal is not large.
17. *Notropis rubrifrons* (Cope).
One specimen from the Sac.
18. *Hybopsis kentuckiensis* (Rafinesque).
Abundant in all streams.
19. *Semotilus atromaculatus* (Mitchill).
Common in the Niangua. One specimen from the Marais and three from the Sac.
20. *Notemigonus chrysoleucus* Mitchill.
This species was abundant in a small bayou a short distance from the Marais. It was not found in any of the streams.
21. *Labidesthes sicculus* Cope.
Marais, Niangua; scarce.
22. *Lepomis cyanellus* Rafinesque.
Few specimens from the Niangua and the Marais.
23. *Lepomis humilis* (Girard).
Five specimens from the Marais.
24. *Micropterus dolomieu* Lacépède.
Two specimens from the Marais.
25. *Etheostoma nigrum* Rafinesque.
Abundant in the Niangua; three specimens from the Marais.
26. *Etheostoma blennioides* Rafinesque.
Marais and Sac, scarce.
27. *Etheostoma flabellare* Rafinesque.
Niangua and Marais, scarce.
28. *Etheostoma punctulatum* (Agassiz).
Niangua, common.
29. *Etheostoma nianguæ* Gilbert & Meek.
Dorsal spines 12, scales 78. In one specimen the lateral line is incomplete on one side. Niangua River, three specimens taken.
30. *Etheostoma cymatotænia* Gilbert & Meek.
Marais, two specimens.
31. *Etheostoma cœruleum* Storer.
Few specimens of this form taken from each stream.
Var. *spectabile* Agassiz was very abundant in all streams, especially so in the Niangua. The largest number was taken from still water with sandy and muddy bottom.
32. *Cottus bairdi* Girard.
Niangua, common; Marais and Sac, scarce.

B.—BASIN OF ARKANSAS RIVER.

IV.—THE NEOSHO RIVER.

The *Neosho River*, in southeastern Kansas and southwestern Missouri, is a tributary of the Arkansas. *Shoal Creek*, the stream examined, is a rather large creek, near the town of Neosho. It has a depth of more than 6 feet, except in occasional shallow places where the water flows rapidly over a gravelly bottom. In the rapidly flowing places the water is quite clear, but opaque in the deeper places. The bottom is rather muddy in the deeper places. The width of the stream varies from 100 to 150 feet. The temperature is 76° Fah.

Hickory Creek, a small tributary of Shoal Creek, has a temperature of 74°. The temperature of a spring branch of Hickory Creek was 66½°.

The U. S. Fish Commission has built a fish hatchery at Neosho. At the time of our visit no hatching had been done. Several ponds had been made and the building was nearly finished. The hatchery is supplied with water from a beautiful, but not large spring.

1. *Noturus exilis* Nelson.

A few specimens taken from the spring branch.

2. *Catostomus teres* (Mitchill).

Common.

3. *Catostomus nigricans* Le Sueur.

Apparently scarce.

4. *Moxostoma duquesnei* (Le Sueur).

Common.

5. *Campostoma anomalum* (Rafinesque).

Common.

6. *Hybognathus nubila* (Forbes).

Abundant.

7. *Pimephales notatus* (Rafinesque).

Abundant.

8. *Notropis galacturus* (Cope).

Not common.

9. *Notropis megalops* (Rafinesque).

Very common.

10. *Notropis zonatus* (Agassiz).

Abundant.

11. *Notropis rubrifrons* (Cope).

Common.

12. *Hybopsis kentuckiensis* (Rafinesque).

Common.

13. *Hybopsis amblops* (Rafinesque).

A few specimens taken.

14. *Semotilus atromaculatus* (Mitchill).

One specimen taken.

15. *Zygonectes macdonaldi* Meek.

Numerous specimens of this species are in the aquarium of the United States Fish Commission at Washington, having been sent in from the hatchery at Neosho. These are larger than the original types, and show the following characters:

Form of *Zygonectes notatus*; the tail rather deeper. Head $3\frac{1}{2}$ in length; depth $4\frac{1}{2}$. Scales 38—13 or 14. D. 10 to 12. A. 14 or 15. Eye $3\frac{2}{3}$ in head, slightly longer than snout. Mouth large, the chin projecting; outer series of teeth very strong, hooked; lower jaw equal to eye. Pectoral small, $1\frac{1}{2}$ in head. Caudal broad; anal large, higher and longer than dorsal. Color in life, olivaceous, with a very faint broad lateral shade of darker; scales centrally bluish, their edges yellow. Adult with the caudal broadly edged with scarlet above and below; more or less red on upper part of dorsal and lower part of anal; faint olivaceous spots on bases of dorsal, anal, and caudal. No cross bars in either sex; no dark spots on scales or below eye.

16. *Labidesthes sicculus* Cope.

One specimen taken.

17. *Lepomis megalotis* (Rafinesque).

Very abundant.

18. *Micropterus dolomieu* Lacépède.

Two specimens taken.

19. *Etheostoma copelandi* (Jordan).

Scarce; three specimens taken. Dorsal XI or XII—10; scales 48 to 52.

20. *Etheostoma flabellare* (Rafinesque).

Two specimens taken.

21. *Etheostoma cœruleum spectabile* (Agassiz).

Very abundant.

22. *Cottus bairdi* Girard.

Common.

V.—SPADRA CREEK.

In July, 1888, the writer made a small collection of fishes in Spadra Creek, a small tributary of the Arkansas River, from the north, near Clarksville, Ark. Spadra Creek is not large, has a rocky and gravelly bottom, except near its mouth. It contains clear water, which flows with considerable current. The following are the species obtained:

1. *Ictalurus punctatus* (Rafinesque).

Few specimens taken.

2. *Ictiobus velifer* (Rafinesque).

One specimen taken.

3. *Moxostoma duquesnei* (Le Sueur).

Common.

4. *Erimyzon sucetta* (Lacépède).

One specimen.

5. *Campostoma anomalum* (Rafinesque).

Common.

6. *Pimephales notatus* (Rafinesque).

Common. These specimens are like those found in the streams in Missouri.

7. *Notropis boops* (Gilbert).

Two small specimens taken.

8. *Notropis whipplei* (Girard).
Scarce.
9. *Notropis megalops* (Rafinesque).
Not common.
10. *Notemigonus chrysoleucus* (Mitchill).
One specimen.
11. *Zygonectes notatus* (Rafinesque).
Common.
12. *Dorosoma cepedianum* (Le Sueur).
One specimen.
13. *Labidesthes sicculus* (Cope).
One specimen.
14. *Lepomis megalotis* (Rafinesque).
Common.
15. *Lepomis humilis* (Girard).
Common.
17. *Etheostoma caprodes* Rafinesque.
One specimen.
18. *Etheostoma blennioides* Rafinesque.
One specimen.
19. *Aplodinotus grunniens* (Rafinesque).
One specimen.

C.—BASIN OF WHITE RIVER.

VI.—THE WHITE RIVER IN MISSOURI.

That portion of northern Arkansas and southern Missouri, which is drained by the White River and its tributaries, is considerably broken and mountainous, although none of its hills are of great height. The streams are fed by many springs, and except in rainy seasons their waters are very clear. Their bottoms are for the most part rocky and gravelly.

The *James River*, near Springfield, where visited, flows through a prairie region, although there is considerable timber along the borders of the stream. The river at this place is a beautiful stream of clear water, flowing over a rocky and gravelly bottom, except in a few places, where the water was deep and the current sluggish. The stream is from 40 to 75 feet wide. At the time of our visit its temperature was 76° Fah. The water was then quite low.

Bryant's Creek heads not far from Mansfield, Mo. It is fed by springs and its waters are very cold. The country south of Mansfield is heavily timbered and much broken, and the stream flows with a very swift current over a rocky bottom. The species of fishes in Bryant's Creek were not many, but rich in individuals. *Chrosomus erythrogaster* was by far the most abundant species. The temperature was 58° Fah.

The North Fork of the White, south of Cabool, flows through the most broken region in southern Missouri visited by us. The country is also heavily timbered and as yet sparsely settled. The stream has a rocky bottom and flows with a considerable current. One bank or the other is usually bordered by cliffs. *Hybopsis amblops*, taken

only in small numbers elsewhere, was here found to be by far the most abundant minnow. The temperature was 74° Fah.

1. *Noturus exilis* Nelson.
One specimen from the James.
2. *Catostomus nigricans* Le Sueur.
James and North Fork of the White, not common.
3. *Erimyzon sucetta* (Lacépède).
North Fork of the White, common.
4. *Moxostoma duquesnei* (Le Sueur).
James, common; North Fork of the White, one specimen.
5. *Campostoma anomalum* (Rafinesque).
James, common; North Fork of the White and Bryant's Creek, abundant.
6. *Chrosomus erythrogaster* Rafinesque.
Bryant's Creek, abundant. The specimens have yellow on the sides instead of red.
7. *Hybognathus nubila* (Forbes).
James River and North Fork of the White, abundant; Bryant's, scarce. Females gravid.
8. *Pimephales notatus* (Rafinesque).
James River and North Fork of the White, common.
9. *Notropis ozarcanus*, sp. nov.

Ten specimens from the North Fork of the White. Longest specimen $2\frac{1}{4}$ inches in length. Allied to *Notropis spectrunculus*. Body very slender, not much compressed, back very slightly arched. Mouth slightly oblique, small, end of maxillary scarcely reaching front of orbit. Eye large, its diameter 3 in the length of the head; preorbital bone large, slightly longer than deep. Head $4\frac{1}{2}$ in the length of the body, depth $6\frac{1}{2}$. Dorsal rays 7. Anal rays 8. Thirty-six scales in the lateral line. First dorsal ray midway between tip of snout and base of caudal fin. Pectoral fins short, their tips reaching three-fifths the distance to base of ventrals. Teeth 4 — 4, their tips hooked, grinding surface narrow, and with its edges slightly crenate. Color olivaceous, the sides punctulated with dark dots, forming a faint lateral band. Lips very thin; intestinal canal not longer than the body.

This species resembles *Notropis spectrunculus*, from which it differs in being more slender, in having a smaller and narrower head, a less blunt snout, and a narrower interorbital space.

10. *Notropis lutrensis* (Baird & Girard).
James River, scarce.
11. *Notropis galacturus* (Cope).
James River, scarce.
12. *Notropis zonatus* (Agassiz).
James, Bryant's Creek, and North Fork, common.
13. *Notropis megalops* (Rafinesque).
Found with the above, common.
14. *Notropis rubrifrons* (Cope).
James River and Bryant's Creek, common.
15. *Notropis micropteryx* (Cope).
James River, scarce.

16. *Hybopsis kentuckiensis* (Rafinesque).
James, common ; North Fork of White, scarce.
17. *Hybopsis amblops* (Rafinesque).
James, common ; North Fork of the White, by far the most abundant minnow.
18. *Semotilus atromaculatus* (Mitchill).
Bryant's Creek, one specimen.
19. *Fundulus catenatus* (Storer).
James, common. In some specimens the stripes on the sides are somewhat broken. The caudal fin of one specimen is covered with black, in the others bordered with a dusky shade. Sides of head occasionally with orange spots.
20. *Zygonectes notatus* (Rafinesque).
James and North Fork of the White, scarce.
21. *Lucius vermiculatus* (Le Sueur).
North Fork of the White, common. Mr. Bartholomew, of Cabool, Mo., informed me that many large pickerel had been taken from this stream with the aid of dynamite. Probably these larger specimens are *Lucius reticulatus*.
22. *Ambloplites rupestris* (Rafinesque).
North Fork of the White River, James River, scarce.
23. *Lepomis cyanellus* (Rafinesque).
North Fork of the White River, scarce.
24. *Lepomis megalotis* (Rafinesque).
James and North Fork of the White, abundant.
25. *Micropterus dolomieu* Lacépède.
James and North Fork of the White, not common.
26. *Etheostoma blennioides* Rafinesque.
James and North Fork of the White, scarce.
27. *Etheostoma caprodes* Rafinesque.
James, scarce.
28. *Etheostoma juliae*, sp. nov. (Plate XLII, fig. 2).
James River, three specimens.

Length of longest specimen $2\frac{1}{4}$ inches. Head 4 in the length of the body, depth 4 to $4\frac{1}{2}$. Dorsal XI—11 or 12. Anal I, 7. Scales 8—58 to 60—8. Lateral line incomplete. Cheek and breast naked, opercles with few scales on upper part. Abdominal region scaled. Eye small, $4\frac{1}{2}$ in the length of the head. Branchiostegal membranes broadly united, with 6 rays. Teeth on vomer. Body deep, compressed, with the dorsal region elevated, the form being much as in *Etheostoma uranidea*. Mouth terminal, the lower jaw the shorter; snout pointed, upper lip thick; maxillary slightly protractile. Tip of maxillary reaching to front of pupil. Pectoral fins large, their length equal to the length of the head; ventrals small.

Color in life dusky olivaceous, greenish below. Caudal fin, soft dorsal, anal and ventral fins yellowish; pectoral fins dusky, with outer border pale yellowish. Spinous dorsal dusky, upper half with a yellowish tinge; a faint dark band on chin; a dark bar below eye; a black band across back in front of spinous dorsal, terminating at base of pectoral fins; a second and much fainter band on back between spinous and soft dorsal; a third faint band on back at middle of soft dorsal, and a fourth on caudal peduncle. Sides dotted with faint yellowish, this forming irregular stripes along rows of scales. On the posterior half of body are six faint dark vertical bars.

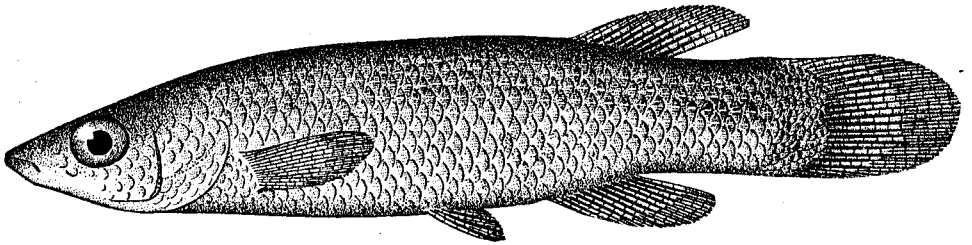


FIG. 1. ZYGONECTES MACDONALDI. (About twice natural size.)

(See page 122.)

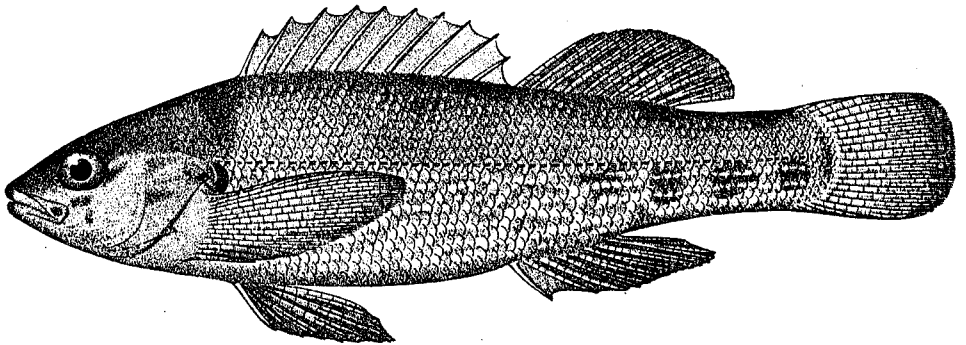


FIG. 2. ETHEOSTOMA JULIE. (Example 2½ inches long.)

(See page 130.)

This is one of the handsomest of the darters. I take pleasure in naming it for Julia Hughes Gilbert. (Mrs. Charles H. Gilbert.)

29. *Etheostoma zonale* (Cope).
James, not common. Scale 56 to 58.
30. *Etheostoma nigrum* (Rafinesque).
North Fork of White River; not common.
31. *Etheostoma cœruleum* (Storer).
James, not common. Scales 44-46. Bryant's Creek, not common. Scale 37-40.
Var. *spectabile* (Agassiz).
James, not common. Scales 44. Bryant's Creek, common. Dorsal IX or X—12 to 14. Scales 37 to 40, cheek naked, opercles with few scales. Color in some female specimens much as in *E. cœruleum*, but darker, mottled, and with the bars very indistinct. The stripes on the sides are less distinct, and the bars have a tendency to form quadrate spots on the sides.
32. *Etheostoma whipplei* (Girard).
North Fork of White River, scarce.
33. *Cottus bairdi* Girard.
James and Bryant's Creek, common.

VII.—MAMMOTH SPRING.

Spring River, a tributary of the Black which empties into the White, has its rise in *Mammoth Spring*, in North Eastern Arkansas. About one-third of a mile below the spring, *Spring River* receives a tributary known as the *Warm Fork*.

From $3\frac{1}{2}$ to $6\frac{1}{2}$ miles west of Mammoth Spring are *English* and *Myatt Creeks*. These creeks unite and empty into *Spring River* at some distance below Mammoth Spring. We collected in all of these streams, and also in a small creek flowing through the town of Mammoth Spring and emptying into *Spring River* opposite the mouth of *Warm Fork*.

Mammoth Spring is one of the largest springs in the United States. Its volume of water remains quite constant during the entire year, never diminishing more than one-sixth in its amount. We reached the town of Mammoth Spring on Saturday night. It began raining late Saturday evening and continued to rain most of the following day. On Sunday and Monday the water from the spring was very clear, on Tuesday and Wednesday quite opaque, and by Thursday evening it was noticeably much clearer again. We were told by several persons that it was unusual for the water in the spring to become clouded. A dam has been constructed a short distance below the spring. The distance between the wheel pits on either side of the dam is 107 feet. Between the wheel pits the water at the time of our visit was flowing over the dam at the depth of 1 foot. A large amount of the water was also used to supply the fish hatchery. The water in the spring flows from a large fissure at the foot of a low cliff. By the construction of the dam a small lake of about 17 acres is formed. The water in the lake at one point near the foot of the cliff is 170 feet deep.

The *Warm Fork* when first seen by us was somewhat muddy and swollen. Its current is quite swift, and by four days the water was low enough to permit collecting with fair success. The bottom of *Warm Fork*, except near its mouth, was rocky and gravelly. Its temperature above the spring was 75° Fah. Its volume of water was

much less than that flowing from the spring. Below the mouth of Warm Fork, Spring River flows with a very swift current over a very rocky bottom.

When the Kansas City and Memphis Railroad was built, a few years ago, to avoid the erection of a couple of bridges the Spring River was changed from its original bed for a short distance below Mammoth Spring. The portion of the river cut off forms a large bayou. The bottom of the bayou is very muddy and contains a large amount of grass and pond weeds.

We seined in this bayou, in Warm Fork near its mouth, in Spring River just below the dam, in a small branch which empties into the bayou, and in Spring Branch near its mouth. With the exception of those fishes taken from the Spring Branch, all were put together in one collection, and they are recorded in the following list as from Spring River.

Within the past year and one-half a "Fish Farm" has been established at Mammoth Spring. This place, from the nature of the soil, and from the abundant supply of cold water, is favorable for the hatching and rearing of fishes. Those interested in the first attempt to rear trout are pleased at the results of the experiment. The temperature of the water in Mammoth Spring was 59° Fah. The water in the bayou was much warmer, and evidently contains many large pickerel and black bass. Many young of these fishes were caught, and many large ones jumped over our nets. At my request Mr. A. Mizell, manager of the Fish Farm, furnished me with the following data, which I extract from a letter written at Mammoth Spring, Ark., March 7, 1890.

The spring is 170 feet deep, 190 feet in diameter, and flows fifty thousand cubic feet per minute, temperature from 59° to 62° the year round, and does not vary in depth perhaps two inches at any season, so that the flow of water is almost uniform.

The spring is seldom milky or muddy. This Fish Farm Company began the process of hatching trout February, 1889. At that time 200,000 brook-trout eggs, 7,000 English, and 25,000 California Rainbow trout eggs were placed in the hatchery, which has a capacity of at least 1,000,000 eggs. Of those put in, 85 per cent. were hatched, and up to thirty days old the "young fry" did well, after which, from the carelessness of those employed, the water beetle was permitted to get in among the young fish in almost endless numbers, yes, millions, which killed from 75,000 to 100,000 of the young in less than thirty days. The corroding of the copper-wire gauze in the nursery boxes caused some loss, as did the placing of a number of the fish when four months old in outside ponds, supplied with water not properly aerated, from a subterranean flume. On this account, at nine months old, there were only 25,000 brook, 2,000 English, and 10,000 California Rainbow trout. But in size and weight these have surpassed anything perhaps on record; at nine months old weighing from 8 to 10½ ounces, and at twelve months from 11 to 12 ounces, and numbers of them examined had a large quantity of spawn. One eleven inches long had 1,470 eggs. These fish have been too much crowded to attain their most rapid growth; doubtless would not but for the superiority of the water to trout growth. This rapid development is doubtless due to the water which runs through the thirteen small pools in which they are. It abounds with varieties of moss, and water cress, besides snails by the million. The materials of which the levees are constructed is limestone soil, clay, small stone, and gravel. This farm is yet in its infancy, and by greatly enlarging its area, and by profiting from the mistakes and neglects of one year past, it is believed that the results it will yield will be remunerative almost beyond a parallel.

Myatt Creek was reached at a point 6½ miles southwest of Mammoth Spring. It is a clear, swift stream, broken in many places into several channels. Where these channels are united, the stream is from three to four feet deep and about fifty feet wide. Some of the branches were converted into bayous, mud-bottomed and snag-strewn. In these quiet arms, sunfish and catfishes were quite common. The bottom of the main stream was either rocky or covered with small, angular fragments of

flinty conglomerate. The stream, at the time of our visit, was considerably swollen by recent rains, and was somewhat muddy. The temperature was 75° Fah.

English Creek was similar in its physical characteristics to Myatt Creek. It is smaller, the current more sluggish, the bottom quite muddy. It contains large patches of *Sagittaria* and *Myriophyllum*. This stream was also swollen by the rains. Temperature 71° Fah.

1. *Ameiurus melas* (Rafinesque).
Myatt Creek, common.
2. *Ameiurus nebulosus* Le Sueur.
Bayou of Spring River, common; English Creek, scarce.
3. *Catostomus teres* (Mitchill).
Spring River, common.
4. *Catostomus nigricans* Le Sueur.
Spring River, Myatt and English Creeks; common.
5. *Erimyzon sucetta* (Lacépède).
Spring River, Myatt, scarce.
6. *Moxostoma duquesnei* (Le Sueur).
Spring River, Myatt, English Creek, common.
7. *Campostoma anomalum* (Rafinesque).
Spring River and Myatt Creek, common.
8. *Chrosomus erythrogaster* Rafinesque.
Spring Branch, common.
9. *Hybognathus nubila* (Forbes).
Spring River, Myatt and English Creeks, common.
10. *Pimephales notatus* (Rafinesque).
Warm Fork, not common; Myatt Creek, scarce.
11. *Notropis lutrensis* Baird and Girard.
Warm Fork, scarce.
12. *Notropis galacturus* (Cope).
Spring River, Myatt and English Creeks, scarce.
13. *Notropis zonatus* (Agassiz).
Spring River, Myatt and English Creeks, common.
14. *Notropis megalops* (Rafinesque).
Spring River, Myatt and English Creeks, abundant.
15. *Notropis umbratilis* (Girard).
Spring River, scarce.
16. *Notropis telescopus arcansanus* var. nov.
Longest specimen $2\frac{1}{4}$ inches in length. Head $4\frac{1}{4}$ to $4\frac{1}{2}$ in the length of the body. Depth 5 to $5\frac{1}{3}$. Scales 5—35 to 38—3. Fourteen to 15 scales in a series between nape and dorsal fin. Anal rays 10 or 11. Eye very large, $2\frac{3}{4}$ in the length of the head. Snout pointed, its length $3\frac{2}{3}$ in the length of the head. First ray of dorsal fin midway between base of caudal and nostril, ventrals slightly in advance of the dorsal. Body long and slender. Sides with an indistinct plumbeous band overlaid by silvery. Color dusky olivaceous above, silvery below. I have compared specimens from Mammoth Spring region with *Notropis telescopus* from Big Creek, Tennessee, Watauga River, Tennessee, and from Middle Fork of the Holstein River, Glade Spring, Virginia.

The color of the western form is darker, and the position of the dorsal fin is farther back than in the eastern forms examined. The eastern form apparently reaches a larger size.

Specimens of this species were taken by Jordan & Gilbert in the White River and its branches about Eureka Springs, Arkansas, in 1884, and in their list it was included with *Notropis boops* under the name of *Notropis scabriceps*. The true *scabriceps* is not found in Arkansas and *N. boops* is a distinct species.

17. *Notropis rubrifrons* (Cope).

Warm Fork, common; English Creek, scarce.

18. *Hybopsis kentuckiensis* (Rafinesque).

Spring River, Myatt and English Creeks, common.

19. *Hybopsis amblops* (Rafinesque).

One specimen from English Creek.

20. *Semotilus atromaculatus* (Mitchill).

Myatt Creek, Spring Branch, scarce.

21. *Salmo irideus* Gibbons. Rainbow Trout.

One specimen taken in Spring River, below the dam, escaped, no doubt, from the hatchery.

22. *Fundulus catenatus* (Storer).

Myatt Creek, abundant.

23. *Zygonectes notatus* (Rafinesque).

Spring River, Myatt and English Creeks, very common.

24. *Lucius vermiculatus* (Le Sueur).

Myatt, one specimen. Very abundant in a bayou of Spring River about three miles below Mammoth Spring.

25. *Lucius reticulatus* (Le Sueur).

English Creek, one specimen. Branchiostegal rays 14 and 15.

Bayou near Spring River, one specimen, 24 inches in length. Length of the head 7½ inches. From tip of snout to the eye 4 inches. Dorsal rays 14, anal rays 14, only long rays counted. Branchiostegals 15. Scales in the lateral line 110. Cheeks and opercles scaly. Sides reticulated, the reticulations forming rather indistinct and irregular lateral stripes. This large specimen differed in color from several smaller specimens taken at same time and in same place. The large specimen was taken in a trammel net which was stretched across the bayou near its mouth. The sportsmen owning the net informed us that it was not uncommon to take pickerel of this size from the bayou.

The specimen from English Creek was compared with the Eastern and Southern specimens of *L. reticulatus*, from which it presented no appreciably specific or varietal differences. I have also examined a specimen of this species from Spring Valley, Shannon County, Mo., taken by Prof. R. E. Call in 1888. In a paper published by Professor Call on "A Collection of Fishes from the Ozark Region," in the Proceedings of the Davenport Academy of Sciences in 1887, the following notes are made under the species *Esox vermiculatus*: "Sinking Creek, Spring Valley Creek, and Jack's Fork, Shannon County. This species, which is locally called mountain trout, and occasionally pike, is abundant in all the larger streams in the mountains of Missouri." I have also been told by Professor Call that some of the specimens taken were from 18 inches to 2 feet in length.

It is quite certain that the geographical range of this species is much wider than has been supposed. It has been taken in the streams east and south of the Alleghanies, from Maine to Alabama, and west to Ithaca, N. Y. We now record it for the first time from the Ozark Mountain region, where it is apparently quite common. It is difficult to capture the pickerel in the small meshed seines used by us in collecting, as it is a swift swimmer and either runs around our nets or jumps over them.

This species is easily distinguished from the preceding by its longer snout and the large number of branchiostegal rays. Of the five species of this genus this one is most fond of the cool, clear mountain streams.

26. *Labidesthes sicculus* Cope.

Myatt Creek; scarce.

27. *Ambloplites rupestris* (Rafinesque).

Spring River and English Creek, not common.

28. *Chaenobryttus gulosus* (Cuvier and Valenciennes).

Myatt Creek, two specimens taken.

29. *Lepomis cyanellus* (Rafinesque).

Spring River and English Creek, scarce; Myatt Creek, between Myatt and Mammoth Spring, common.

30. *Lepomis garmani* Forbes.

Length of longest specimen $5\frac{1}{2}$ inches. Head $2\frac{4}{5}$ to 3 in the length of body. Depth $1\frac{3}{4}$ to 2. Scales 8—35 to 38—10. Pharyngeal teeth not paved; teeth on vomer, none on the palatines; 5 rows of scales on the cheeks. Opercular flap small, without pale edge. Body deep, compressed, more robust than in *Lepomis megalotis*. Mouth small, very oblique, no distinct supplemental maxillary bone. Profile rather steep with an angle above eye. Lower jaw the longer, the chin very prominent.

Color dark greenish above, sides tinged with red above lateral line, while on the lower part of the body red becomes the predominating color; breast tinged with yellow. The red on sides appears as a nearly square blotch on each scale. No blue stripes on head. Young covered with bronze spots. This species was found very abundant in Spring River.

31. *Lepomis pallidus* (Mitchill).

Spring River, common; English and Myatt Creek, scarce.

32. *Lepomis megalotis* Rafinesque.

Spring River and English Creek, common; Myatt, abundant.

33. *Micropterus salmoides* (Lacépède).

Spring River, English, and Myatt Creeks; common.

34. *Micropterus dolomieu* Lacépède.

Spring River, scarce.

35. *Etheostoma blennioides* Rafinesque.

Spring River, English, and Myatt Creeks; scarce.

36. *Etheostoma zonale* (Cope).

Spring River, one specimen.

37. *Etheostoma cœruleum* Storer.

Spring River, a few specimens.

Var. *spectabile* (Agassiz).

These specimens resemble those from Bryant's Creek, except that they are less brightly colored. Scales in the lateral line 40 to 46. Dorsal fin IX to XI—12 to 13.

Opercles on a few specimens nearly scaleless. Spring River, Spring Branch, Myatt, and English Creeks; common.

38. *Cottus bairdi* Girard.

Spring River, abundant near the dam. Called "Cod" by the inhabitants of Mammoth Springs. The specimens of this species vary much in color; some are nearly black, while others are almost brick red; some are much mottled while others have the dark vertical bands prominent. Some specimens taken were more than 6 inches in length.

VIII.—LITTLE RED RIVER.

The *Little Red River* at Judsonia, Ark., reaches a considerable size, and at the time of our visit was much swollen by floods. The current is sluggish and the banks rather steep and muddy. The temperature was 79° Fah. The river was too high to admit of seining, and so the collecting was done in a small tributary near Judsonia. This stream has a sluggish current and muddy bottom. The Little Red River is a southern tributary of the White River.

1. *Erimyzon sucetta* Lacépède.

Not common; 44 scales in the lateral line.

2. *Hybognathus nuchalis* (Agassiz).

Common.

3. *Notropis whipplei* (Girard).

Scarce.

4. *Notropis megalops* (Rafinesque).

One specimen.

5. *Notropis umbratilis* (Girard).

Common.

6. *Notropis atherinoides caddonis* (new variety).

Length of longest specimen 3 inches. Head $4\frac{1}{3}$ to $4\frac{1}{2}$ in the length of the body. Depth $5\frac{1}{2}$. Scales 36 to 39 in the lateral line. Anal rays 11. Dorsal rays 8. Eye 3 in the head. Snout $3\frac{3}{4}$ in the head. Origin of first dorsal ray midway between the pupil and base of caudal fin. Eighteen or 19 scales before dorsal fin. Body slender. Eye large. Snout short. Color light olivaceous, with a faint plumbeous lateral band, overlaid by silvery lateral line decurved. This form differs from the ordinary *atherinoides* in having a comparatively larger eye and a shorter snout. It was found also in the Caddo River.

7. *Semotilus atromaculatus* (Mitchill).

Scarce.

8. *Zygonectes notatus* (Rafinesque).

Not common.

9. *Lucius reticulatus* (Le Sueur).

One specimen.

10. *Labidesthes sicculus* (Cope).

Not common.

11. *Aphredoderus sayanus* (Gilliams).

One specimen. Fifty scales in the lateral line.

12. *Elassoma zonatum* Jordan.

One small specimen. The species was originally described from Judsonia.

13. *Chænobryttus gulosus* (Cuv. & Val.).
One specimen.
14. *Lepomis cyanellus* Rafinesque.
One specimen.
15. *Etheostoma blennioides* Rafinesque.
One specimen.
16. *Etheostoma zonale* (Cope).
One small specimen.
17. *Etheostoma microperca* Jordan & Gilbert.
Two specimens. D. VIII-10. A. II-6. Scales 36.
18. *Etheostoma fusiforme* (Girard).
Scarce.

D.—BASIN OF THE WASHITA.

IX.—WASHITA RIVER.

The *Ouachita* or *Washita River* is one of the largest streams in southwestern Arkansas. It rises in the southern range of the Ozark Mountains, and empties into the Mississippi River. The head waters of the *Ouachita* and of its tributaries are swift-flowing streams of clear water. Their bottoms are rocky and gravelly.

The *Ouachita* was visited near Crystal Springs, Ark. Most of the seining was done at the ford. Above and below the ford the water was too deep for our nets. In the deep places large rocks were numerous, and the bottoms less gravelly than in the shallower water. The current of the *Ouachita* was less swift than in any of its tributaries.

The tributaries of the *Ouachita* examined are all much alike in physical characteristics. The *Caddo River* was the largest visited. The South Fork of the *Ouachita* next in size, *Mazarn* and *Myers Creeks* being rather small.

The *Caddo River* was seined at *Caddo Gap* and near *Black Springs*, and also in two small tributaries between these points. The *Caddo* is a beautiful stream, but evidently contains few fishes and few species. Near *Black Spring* the *Caddo* divides itself into several small streams. This affords excellent opportunities for collecting, but fishes were found in fewer numbers than in any other stream in which we collected during the summer. Temperature, 76° Fah.

The *South Fork of the Ouachita* was seined near *Mount Ida*. This stream afforded as favorable opportunities as did the *Caddo*, especially in the long deep holes. The strata of rock are nearly vertical, and lying across the stream, form by unequal wear a series of ridges and furrows in the shallower places. The stream varies in width from 40 to 70 feet, and the water is from 1 to 5 feet or more in depth. In the deeper holes were much pond weeds and grass, which made hiding places for black bass (*M. dolomieu*, *M. salmoides*) and pickerel (*Lucius vermiculatus*), which seemed rather common. More fishes were found in this stream than in the *Caddo*. The temperature was 74° Fah.

The *Mazarn* is a tributary of the *Ouachita*, and *Myers' Creek* flows into the *Mazarn*. These streams were examined near *Myers*. Neither is large, and neither contained many fishes.

The *West and Middle Forks of the Saline* are both about 24 miles east of *Hot Springs*.

These streams are not large, and their bottoms are too rocky to admit of very successful seining. The scarcity of fishes in these streams was very noticeable. The temperature of the Middle Fork was 76° Fah.; of the South Fork, 74° Fah. Dr. John C. Branner, geologist of Arkansas, informed the writer that large numbers of fishes were found dead along the Saline Forks the preceding summer. It is thought that they had been killed by dynamite.

1. *Noturus nocturnus* Jordan & Gilbert.

Ouachita and the Saline; only a few small specimens taken.

2. *Erimyzon sucetta* (Lacépède).

Caddo and Mazarn; scales in lateral line, 44.

3. *Catostomus nigricans* Le Sueur.

Common in all streams.

4. *Moxostoma duquesnei* (Le Sueur).

Common in all streams.

5. *Campostoma anomalum* (Rafinesque).

Not common; taken in all streams.

6. *Chrosomus erythrogaster* (Rafinesque).

One specimen from the South Fork of the Ouachita.

7. *Hybognathus nubilus* Forbes.

West and Middle Forks, Saline River, Hot Springs, Ark.

8. *Pimephales notatus* (Rafinesque).

The specimens of this species from the Ouachita Basin seem quite different from specimens taken elsewhere. The body is more slender and the top of the head is flatter. Head, $4\frac{3}{4}$ in the length of the body; depth, 5; scales in the lateral line, 44 to 46; sides with a distinct lateral band, more prominent on snout. Common in all streams.

9. *Notropis boops* Gilbert.

The most abundant minnow in all streams, especially in the colder ones like the Caddo.

10. *Notropis whipplei* (Girard).

Abundant in all streams.

11. *Notropis megalops* (Rafinesque).

Not common; Caddo, Mazarn, and the Saline.

12. *Notropis umbratilis* (Girard).

Not common; taken in all streams.

13. *Notropis atherinoides caddonis* Meek.

One specimen from the Caddo; Ouachita, Mazarn, and Myers' Creeks; scarce; head, $4\frac{1}{2}$; depth, 6; scales in lateral line, 39; 17 scales before dorsal fin; eye, $3\frac{1}{4}$ in head; snout, $3\frac{1}{2}$; dorsal inserted midway between pupil and base of caudal. Length of longest specimen, $2\frac{1}{2}$ inches.

14. *Hybopsis dissimilis* (Kirtland).

Two specimens from the Ouachita.

15. *Semotilus atromaculatus* (Mitchill).

Two specimens from the Caddo.

16. *Fundulus catenatus* (Storer).

Taken in all streams; common.

17. *Zygonectes notatus* (Rafinesque).
South Fork Ouachita, Mazarn, Saline, and Caddo Rivers.
18. *Lucius vermiculatus* (Le Sueur).
One specimen from Mazarn and one from South Fork of the Ouachita.
19. *Labidesthes sicculus* Cope.
All streams; very common.
20. *Aphredoderus sayanus* (Gilliams).
One specimen from the Caddo; scales 53.
21. *Ambloplites rupestris* (Rafinesque).
Ouachita and South Fork of the Ouachita; common.
22. *Chænobryttus gulosus* (Cuv. and Val.).
Caddo River, Caddo Gap, Ark., scarce.
23. *Lepomis cyanellus* (Rafinesque).
All streams except the Saline; not common.
24. *Lepomis pallidus* (Mitchill).
Caddo Creek; scarce.
25. *Lepomis megalotis* Rafinesque.
All streams; common.
26. *Micropterus salmoides* (Lacépède).
One specimen from the Ouachita, two from the Caddo.
27. *Micropterus dolomieu* Lacépède.
All streams; rather common.
28. *Etheostoma nigrum* Rafinesque.
One specimen from the Caddo.
29. *Etheostoma blennioides* Rafinesque.
Very abundant in the Ouachita; common in the other streams.
30. *Etheostoma copelandi* (Jordan).
Seven specimens from the Ouachita.
31. *Etheostoma caprodes* Rafinesque.
Three specimens from the Ouachita.
32. *Etheostoma phoxocephalum* Nelson.
Abundant in the Ouachita.
33. *Etheostoma zonale* (Cope).
Ouachita, abundant; South Fork of the Ouachita, Caddo, and Saline, scarce.
34. *Etheostoma whipplei* (Girard).
Common. Taken in all streams. Scales in the lateral line 50 to 60. Dorsal spines 9 to 12.
35. *Etheostoma chlorosoma* (Hay).
(*Boleosoma camurum* Forbes.) A few specimens from the Ouachita.
36. *Etheostoma stigmæum* (Jordan).
(*Pæcilichthys saxatilis* Hay, *vide* Gilbert.) Ouachita and South Fork of the Ouachita, scarce; Caddo River, Caddo Gap, Ark.; scarce.

APPENDIX.

COLLECTIONS OF MR. CALL IN SOUTHERN MISSOURI.

In June and July, 1886, Mr. Richard Ellsworth Call, of Des Moines, Iowa, made a collection of fishes in Dent, Texas, Reynolds, and Shannon Counties, in Missouri. A portion of this collection is in the Smithsonian Institution, Washington, D. C., a portion in the University of Indiana, and the rest in the University of Missouri.

A list of the species collected was published by Professor Call in the Proceedings of the Davenport Academy of Natural Sciences, 1887.

The following list is made up from this paper, and from an examination of a portion of the collection sent out by Mr. Call to the Museum of the Indiana University.

The collections were made in the Meramec River (M.); in tributaries of the Gasconade as follows: Piney (P.) and Big Creek (B.); and in tributaries of the Black River as follows: (W) West Fork, (J) Jack's Fork, (T.) Tom's Creek, (S) Sinking Creek, and in (Ba.) Barren Creek.

1. *Ictalurus punctatus* (Rafinesque). P.
2. *Catostomus teres* (Mitchill). J. T.
3. *Catostomus nigricans* Le Sueur. M. T.
4. *Moxostoma duquesnei* (Le Sueur). (*Moxostoma macrolepidotum* Call.) M; P. B.; W. J.
5. *Campostoma anomalum* (Rafinesque).

Taken in all streams.

6. *Chrosomus erythrogaster* Rafinesque. W. T.; S. Sp. J.
7. *Hybognathus nubila* (Forbes). (*Dionda nubila* Call, and *Hybognathus meeki* Call.) W. T. J. P.
8. *Hybognathus nuchalis* Agassiz. M; P.
9. *Notropis boops* Gilbert. (*Notropis deliciosus* Call; *Notropis scabriceps* Call.) M. P.; Sp. W.
10. *Notropis whipplei* (Girard). (*Notropis notatus* Call.) P. W. T. J. Sp. S. Ba.
11. *Notropis galacturus* (Cope). J. Sp.
12. *Notropis megalops* (Rafinesque).

Taken in all streams.

13. *Notropis zonatus* (Agassiz).

Found with the preceding species.

14. *Notropis telescopus arcansanus* (Meek). (*Notropis micropteryx* Call.)

I compared one specimen taken by Professor Call with those from Spring River, Mammoth Spring. All belong to the same species.

15. *Notropis umbratilis* (Girard). Sp.
16. *Semotilus atromaculatus* (Mitchill). M; B; W. T. B. Sp.
17. *Fundulus catenatus* (Storer).

Taken in all streams.

18. *Zygonectes notatus* (Rafinesque). W. J.
19. *Lucius vermiculatus* (Le Sueur). S. Sp. J.
20. *Lucius reticulatus* (Le Sueur).

One specimen in the Indiana University Museum, from Spring Valley creek.

21. *Ambloplites rupestris* (Rafinesque). W. Sp. J.

22. *Lepomis megalotis* (Rafinesque). J.

23. *Micropterus dolomieu* Lacépède.

 Taken from all streams.

24. *Etheostoma nigrum* Rafinesque. (*Boleosoma olmstedii ozarcanum* Call.) B; J.

25. *Etheostoma blennioides* Rafinesque. J. S. W.

26. *Etheostoma punctulatum* (Agassiz). B.

27. *Etheostoma ceruleum spectabile* Agassiz. W. Ba. S. Sp. B.

28. *Cottus bairdi* Girard.

 Abundant in all streams.

 The following is a list of species taken by Professor Call from (B) Bear and (H) Hinkson Creeks, tributaries of the Missouri River near Columbia, Mo.:

1. *Noturus exilis* Nelson. B. H.
2. *Catostomus teres* (Mitchill). B. H.
3. *Moxostoma duquesnei* (Le Sueur). H.
4. *Campostoma anomalum* (Rafinesque). B. H.
5. *Pimephales promelas* Rafinesque. B.
6. *Pimephales notatus* (Rafinesque). B.
7. *Notropis deliciosus* (Girard). B.
8. *Phenacobius mirabilis scopifer* Cope. B.
9. *Semotilus atromaculatus* (Mitchill). B.
10. *Pomoxis annularis* Rafinesque. B.
11. *Lepomis cyanellus* Rafinesque. B. H.
12. *Lepomis humilis* (Girard). B.
13. *Etheostoma nigrum* Rafinesque. B.

 COE COLLEGE, CEDAR RAPIDS, IOWA, *March* 19, 1890.