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Fishes Collected in Oklahoma and Arkansas in 1927*

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I. INTRODUCTION

This is the third report of the current fish survey of Oklahoma. It treats the collections obtained during the summer of 1927, when the field party from the Museum of Zoology of the University of Oklahoma, again led by A. I. Ortenburger, visited southeastern Oklahoma, western Arkansas, and northeastern Oklahoma. The streams which were seined lie in the Red River, Ouachita and Arkansas drainage systems.

One new species, *Notropis greenei*, was obtained in both Oklahoma and Arkansas; we have it also from Missouri. This species was listed several times from Missouri and Arkansas by Meek, who first confused it with *N. boops* and later referred it to *N. xaenocephalus*.

Although only this one undescribed species was obtained in the 1927 survey, a number of other discoveries, of interest from zoogeographical and systematic standpoints, were made. Twenty-one of the species obtained in Oklahoma have not previously been attributed to that state: a considerable addition to the list of slightly more than one hundred already recorded. These new records testify to the extreme richness of the fish fauna of eastern Oklahoma. The abundance of species there is further indicated by the fact that most of the species, about twenty-five in number, reported from Oklahoma by earlier collectors but not yet obtained during the course of the present survey, were also obtained in that part of the State. It is particularly urgent that further explorations be made in the same region.

The fauna now known from eastern Oklahoma comprises a mixture of (1) northern types, notably *Catostomus, Hypentelium, Nocomis, Semotilus, Chrosomus* and *Cottus,* which were found to inhabit the cool upland creeks in the northeastern part of the state; (2) of a few southern upland species, like *Notropis greenei, N. zonatus, N. percobromus, Schilbeodes eleutherus, Hadropterus ouachitae, H. macrocephalus, Ulocentra stigmaea, U. histrio* and *Poecilichthys punctulatus,* taken in the same or similar waters, and (3) of a larger number of Mississippi lowland forms, such as

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Polyodon, Amia, Lepisosteus, Amphiodon, Dorosoma, Megastomatobus, Ictiobus, Ictalurus, Gambusia, Aphredoderus, Hololepis, Aplites, Chaenobryttus, Apomotis, Pomoxis, Aplodinotus, and many others, which penetrate into Oklahoma along the main river channels. This westward extension of the lowland fauna is greater than was earlier supposed to be the case; thus we now know as inhabitants of Oklahoma two-thirds of the twenty-five species which Meek listed (1896: 349) as found in the St. Francis of eastern Arkansas but not in western Arkansas and eastern Indian Territory. We consider it justified, furthermore, to expect that renewed exploration will add materially to the list of Oklahoma fishes.

Fewer additions were obtained for the Arkansas state list, because the fishes of that state have been more thoroughly studied (by Girard, Jordan and Gilbert, Meek, and Fowler). In fact these additions comprise but two little shiners, *Notropis ortenburgeri* and *Notropis volucellus buchanani,* and one darter, somewhat doubtfully identified as *Hadropterus macrocephalus.* We are able, however, to indicate two other darters as inhabitants of Arkansas. Meek's specimens of *"Etheostoma uranidea"* from Spring River at Black Rock, Arkansas, prove on reëxamination at the National Museum to be typical of *Poecilichthys variatus* (Kirtland), a species until now reported only from a few localities in the Ohio River basin. This discovery adds another confirmation to a conclusion at which Jordan and Gilbert (1886: 24) arrived in their study of the Southwestern fish fauna: "Our species of small fishes, especially the *Etheostomatinae,* are probably much less local in their distribution than has usually been assumed. Many of the species hitherto regarded as rare or local have been shown to have a very wide distribution in the west and south, and what is true of these species will very likely be found true of all those now known from only a few localities." The other new Arkansas record, that of *Poecilichthys punctulatus,* is based on material in the Field Museum.

Material was obtained in 1927 of three of the species which were described as new in our two previous reports. One of these, *Notropis ortenburgeri,* hitherto known only from the single type, was taken in quantity sufficient to indicate the usual range of variation in its characters and to accord it a definite distribution. A second form, *Notropis cornutus isolepis,* was obtained again, of typical character, in the Ouachita system of Arkansas, which it shares with the Red River drainage; its cognate, *N. c. chrysocephalus,* was obtained for the first time in Oklahoma (in the Arkansas River basin); these findings therefore uphold the distinction which we have drawn up between the ranges of these two subspecies. Still another of our species, *Notropis girardi,* the Arkansas basin representative of *N. sabinae* and *N. bairdi,* was taken this summer, at a point which extends the range of the species almost to the Arkansas line.

Advance notice is given in this report of several nomenclatorial and taxonomic findings in *Ictiobus, Erimyzon, Moxostoma,* and *Hybognathus.*

The obtaining of topotypical material of *Notropis lutrensis* and *Notropis whipplii* has yielded the opportunity of revising the

range of the typical subspecies of each of these species. Both are confined to southwestern streams, and differ from their northern representatives, *Notropis lutrensis forbesi* and *Notropis whipplii spilopterus*, which we are now able to distinguish, in having one more ray in the anal fin, and in other respects. The relationships of these subspecies to one another and of the species themselves appears rather complex, and therefore promising as a field of inquiry.

A beginning is made toward the reorganization of the classification of the forms of the *Notropis umbratilis* group.

Notropis percobromus is provisionally recognized as a species distinct from *N. rubellus* (of which *rubrifrons* is now indicated as a synonym). A contribution is made to the synonymy of *Notropis lutrensis, Notropis zonatus, Phenacobius mirabilis, Campostoma anomalum, Dionda episcopa,* and the subspecies of *Poecilichthys coeruleus*. The population of rainbow darters which was sampled in northeastern Oklahoma proves distinctly intermediate between *P. c. pulchellus*, the form now known as *lepidus*, and *spectabilis*, between the ranges of which this Oklahoma race intervenes. We may therefore follow Gilbert (1889: 609) in recognizing *pulchellus*, as well as *spectabilis*, as a subspecies of *Poecilichthys coeruleus*.

We have also derived from the present study additional and virtually conclusive evidence of the intergradation of *Notropis volucellus buchanani* and typical *volucellus*. In this case the region of intergradation proves to be very intricate, because *volucellus* ranges southwestward across the range of *buchanani*. There it seems to occur chiefly in the upland waters, whereas *buchanani* is the form of the major rivers and adjacent creek mouths. Intermediate races, as a consequence, occur in more or less mosaic fashion over the area roughly shared by both forms.

A number of additional hybrid fishes are included among the collection obtained in 1927. They are two sunfishes, *Helioperca incisor*×*Xenotis megalotis breviceps*, and a large number of bass, *Micropterus dolomieu* × *M. pesudaplites*. These hybrids all came from the headwaters of West Cache Creek in the Wichita Mountains, a habitat seemingly very conducive to hybridization. The bass population of this locality in fact consists almost entirely of hybrids: the species lines have here been almost completely broken down.

Another interpretation of general interest which has been made in the study of the 1927 collections is that several distinct types of young exist in what appears to be a single species of fish, *Dorosoma cepedianum*.

A phenomenon unexpectedly discovered in working over the material obtained in 1927 is that of a single specimen of one genus and species having a single character abnormal, but like that of a related genus. One of our half-grown examples of *Minytrema melanops* has the air-bladder almost completely constricted off into three chambers, instead of only two; this anomaly is doubly interesting, in that the teratological air-bladder is like the normal one of *Moxostoma, Placopharynx* and *Lagochila*. This odd example of *Minytrema* recalls a half-grown specimen of *Moxostoma*, from

Michigan, which exhibited no lateral line, and in this respect agreed with *Minytrema* and *Erimyzon*. Still another instance of a fish exhibiting a character proper to a related genus is that of one of our examples of *Hypargyrus velox*, which has the nuptial tubercles arranged as in *Hyborhynchus notatus*.

In intensive fish survey work it is often desirable to identify the very young fry which are collected. In studying these early stages of Michigan fishes, the senior writer has found that the arrangement of the pigmentation often offers a means of identification at stages too young to exhibit the differential characters of the adults. We find the same situation to hold true for Southwestern fishes, and therefore include descriptions of the pigmentation of a number of the young fishes, particularly suckers and minnows, which were collected on the 1927 expedition in Oklahoma and Arkansas.

Another set of little-used characters which we are finding of value in our work with fresh-water fishes lies in the structure and arrangement of the nuptial tubercles or pearl organs. We offer, in this paper, descriptions of these structures in a number of Oklahoma species of *Cyprinidae*.

II. DESCRIPTION OF COLLECTING STATIONS OCCUPIED IN 1927

We give here a brief running account of the localities where fishes were collected in the 1927 survey. The stations are grouped into five main areas, as follows: (A) Red River system in Oklahoma; (B) Red River system in Arkansas; (C) Ouachita River system in Arkansas; (D) Arkansas River system in Arkansas, and (E) Arkansas River system in Oklahoma. These groupings are used as paragraph headings in listing the localities for each species.

A. Red River System in Oklahoma

Station 1:—West Cache Creek (tributary to Red River), Comanche County, 9 miles northwest of Cache; June 6, 1927. This stream was very clear, and flowed over alternating gravel beds and granite rock. The temperature varied greatly with the depth: in the pool where most of the collecting was done the range in temperature was from 86° F at the surface to 68° at a depth of 28 feet. The pH was 8.1. These figures refer to Forty Foot Hole near Camp Boulder in the Wichita National Forest and Game Preserve. (Plate I, Fig. 1). The stream was fed almost entirely by small springs; in the shallow parts there was a swift current. The banks were mainly solid granite.

Station 2:—"Three Fish Creek" (feeder of Kiamichi River), Le Flore County, 8 miles west of the Arkansas line; June 18, 1927. Plate VI. This was a tiny spring-fed stream, typical of several flowing from the base of Kiamichi Mountain into Kiamichi River. The temperature was 71° and the pH less than 6.8. The bottom was composed entirely of boulders or rock, and was at least partly covered wih decaying vegetation, mainly oak leaves. The creek consisted of alternating pools from 6 to 10 feet in length and longer, shallower, rapidly flowing parts. These pools were not deep, only

about 8 inches to a foot in depth. For the greater part of its length the stream was well shaded with numerous trees and shrubs.

Station 3:—Flood pool of Kiamichi River, Le Flore County, 8 miles west of the Arkansas line; June 18, 1927. Plate VII. This was a small cut-off pool about 75 feet long, averaging 3 feet in depth and 5 feet in width. The temperature was 76° and the pH less than 6.8. The water was dark brown, fairly clear, bitter, and practically stagnant. The banks were low, steep, and muddy; there was much overhanging vegetation which almost met above the pool, making it very densely shaded. Near the bank in the water were *Nymphaea* and sedges. The bottom was mud and boulders covered with much decaying vegetation, mainly leaves and branches.

Station 4:—Kiamichi River, Le Flore County, 8 miles west of the Arkansas line; June 18, 1927. The river at this point was about 35 feet in width, and at 3 p. m. the temperature was 81° and the pH 6.8. The low banks were either steep mud or gently sloping sand and gravel. In either case they were covered with overhanging trees and shrubs. The bottom was bouldery and the average depth of the slightly muddy water was about 4 feet. Some of the larger boulders emerged from the water. The current was fairly swift, with much more rapidly flowing riffles at intervals. *Nymphaea* and sedges were growing in the water, mostly near the banks.

Station 5:—Flood pool of Kiamichi River, Le Flore County, 8 miles west of the Arkansas line; June 20, 1927. The temperature of this back-water pool was 75° at 9 a. m., the pH less than 6.8. The pool was connected to the main river channel by a narrow neck about 4 feet wide. The pool was about 100 feet long and on the average 20 feet wide. The bottom was entirely bouldery in some places and mixed with boulders and sand in others. One bank was almost vertical mud and the other sloping sand. Both banks were well shaded with overhanging trees. The water was muddy, with no current; the average depth was 2½ feet.

Station 6:—Kiamichi River, Le Flore County, 7 miles west of the Arkansas line; June 22, 1927. The temperature of the river on this day was 78° and the pH 6.8. The fish taken from this station were in one of the deeper, slowly flowing parts of the river between two riffles. The average depth at this point was about 4 feet and the width of the river 60 feet. The bottom was made up of boulders of various sizes and the banks were very steep mud and rock, with many overhanging trees and shrubs.

Station 7:—Tributary of Kiamichi River, Le Flore County, 8 miles west of the Arkansas line; June 24, 1927. The temperature of this small spring-fed stream was 74° and the pH less than 6.8. The water was clear and very shallow with a rock and sand bottom. As usual there were holes varying from 1½ to 4 feet in depth alternating with shallow, rapidly flowing water of the riffles. The banks were steep, mainly mud and sand, well covered with grass and shrubs; some sedges were growing in the water at the edge of small pools. The bottoms of the pools were covered with considerable decaying vegetation, mostly the leaves of overhanging trees.

Station 8:—Tributary of Kiamichi River, Le Flore County, 7 miles west of the Arkansas line; June 24, 1927. The temperature of this fairly clear small spring-fed stream was 66° at 8 a. m. and 76° at 2 p. m., with a pH of less than 6.8. The stream followed the northern base of Kiamichi Mountain for some distance, and its banks were steep and muddy and covered to a considerable degree with moss as well as shrubs. There were present in the

stream numerous gravel and sand bars, but these were usually covered with decaying logs and leaves. In general the bottom was alternately rock and sand and wherever the current was not swift, due to the increase in depth of the stream, the bottom was covered with much decaying vegetation.

Station 9:—Backwater of Kiamichi River, Le Flore County, 8 miles west of the Arkansas line; June 23, 1927. The temperature of this water was 83° and the pH was 6.8. This was a semi-stagnant body of water about 20 feet in width, 150 feet in length, with an average depth of about 2 feet. It was fed by a spring at the upper end, and found its outlet in the Kiamichi River. The water was distinctly brown in color and quite bitter to the taste. The bottom was composed of mud and large algae-covered boulders. *Nymphaea* was quite common along the banks.

Station 10:—Big Cedar Creek (flowing into Kiamichi River), Le Flore County, 11 miles west of the Arkansas line; June 24, 1927. The temperature of the water was 72° and the pH less than 6.8. This was one of the largest spring-fed mountain streams emptying into the Kiamichi River in this vicinity. Its usual width was 10 to 16 feet and the current was on the whole very swift and the water slightly muddy. The rapidity of the current increased toward the headwaters on Spring Mountain. Near the mouth of the creek the average depth was 1 to 3 feet and the bottom was a mixture of rocks and gravel rather than entirely boulders, as it was farther upstream. The banks near its mouth were nearly vertical rock and mud, and willows extended as far as 20 feet out into the stream in its wider parts. *Nymphaea* was found commonly in the quieter parts of the creek near Kiamichi River.

Station 11:—Tributary of Kiamichi River, Le Flore County, 10 miles west of the Arkansas line; June 25, 1927. The temperature of this small spring-fed tributary was 76° and the pH less than 6.8. The stream had an average width of 10 feet and an average depth of 2 feet. As is true of other streams of this type in this vicinity, there were alternate pools and rocky riffles. The current was moderate and the water clear. The bottom of the stream was rock or rock and gravel. The banks were rocky and sparsely covered with grass. The pool bottoms were covered to a considerable extent with decaying small logs and leaves.

Station 12:—Kiamichi River, Le Flore County, 9 miles west of the Arkansas line; June 25, 1927. The temperature was 86° and the pH 6.9. The collection was made from the river proper at the lower end of a long swift riffle. The average width at this point was 50 feet and the depth less than 3½ feet. *Nymphaea*, sedges, and williws were common as emergent vegetation. The banks were of steep mud, overhung by shrubs and trees.

Station 13:—Kiamichi River, Le Flore County, 8 miles west of the Arkansas line; June 26, 1927. Plate VIII. The temperature was 82° at 3 p. m., and the pH 7.0. The collection was made in the riffles between two large pools of the river. The average width of the river was 40 feet and the average depth not more than 1½ feet. The water was clear and the current swift. The bottom was composed entirely of boulders of various sizes, many of them large enough to emerge from the water and all of them covered with a growth of algae. Sedges and willows were plentiful, growing out into the riffle and in some parts almost meeting in the center. The mossy banks were steep rock and mud with an overgrowth of trees.

Station 14:—Kiamichi River, Le Flore County, 8 miles west of the Ar-

kansas line; June 27, 1927. Plate IX. The water in a pool at a bend of the river showed a temperature of 83° at 2 p. m., and a pH of 6.8. This was a large quiet pool about 150 feet wide by 300 feet long, with an average depth of 5 feet. Just above this point the river divided, and most of the water flowed on the other side of the island. The water was fairly clear and there was practically no current. The bottom was composed of boulders well covered wth algae; the emergent vegetation consisted of some *Nymphaea* and sedges along the sides of the pool. The banks were low, on one side muddy, on the other composed of boulders and gravel. Holly was a common tree on the gravel-boulder bank. *Amyda* and *Chelydra* were numerous in the pool.

B. Red River System in Arkansas

Station 15:—Tributary of Mountain Fork (of Little River), Polk County, 4 miles east of the Oklahoma line; June 29, 1927. Plate X, Fig. 16. The temperature was 77°, and the pH 6.8. This small stream in all probability was the headwater of Mountain Fork River. The water was slightly muddy, and the current slow. The bottom was solid rock, more or less covered with vegetation. In some places, on sandy-mud bars, sedges and grasses were growing. The banks were largely covered with witch-hazel.

Station 16:—Tributary of Mountain Fork, Polk County, 8 miles east of the Oklahoma line; June 29, 1927. The temperature of this branch of the headwaters of Mountain Fork River was 78° at 11 a. m., with a pH of 6.8. The water was fairly clear, and the current moderately swift. The bottom was solid shale, with many boulders of various sizes in the stream. There were many short, very swift riffles. The width was about 30 feet and the average depth was 1½ feet. The banks were mainly shale.

Station 17:—Tributary of Mountain Fork, Polk County, 3 miles south of Mena; June 29, 1927. The temperature of this small, slowly flowing muddy creek was 86° at 2 p. m., and the pH 7.0. The bottom of the stream was composed of boulders and gravel and the banks were steep mud with a sparse growth of sedges.

Station 18:—Tributary of Mountain Fork, Polk County, 5 miles southwest of Mena; June 29, 1927. The temperature of this stream at 3 p. m., was 86° and the pH 7.0. This was a slow-flowing, slightly muddy stream with an average width of 35 feet. The bottom was composed of rock and the banks, of steep mud, were thickly covered with witch-hazel bushes.

Station 19:—Mountain Fork River, Polk County, 3 miles southwest of Potter; June 29, 1927. The temperature was 81° at 3 p. m., and the pH 6.9. This was a wide stream, varying from 75 to 175 feet with an average depth of 2½ feet. The water was clear and the current fairly swift. The bottom was composed of boulders and gravel. The nature of the banks of the stream varied greatly, as in some places they were composed of rock, in others of gravel, in still others of sand.

Station 20:—Rolling Fork (tributary of Little River), Polk County, 1 mile west of Wickes; June 30, 1927. The temperature of this swift stream was 76° at 8 a. m. and the pH less than 6.8. The average width of the creek was 30 feet and the average depth, 2½ feet. The water was very clear, flowing rapidly over a bottom composed mainly of gravel, but with a few boulders present. For the greater part of the length the banks were steep

and muddy, but in several places they were composed of very gently sloping large gravel beds. Where the banks were muddy, sedges were numerous in the water under the overhanging witch-hazel bushes.

Station 21:—Cossatot River (tributary to Little River), Sevier County, 7 miles northeast of De Queen; June 30, 1927. The temperature of this large stream was 85° at 4 p. m., and the pH less than 6.8. The river was approximately 250 feet wide, with an average depth of 5 feet and a very slow current. At long intervals the stream narrowed to a width of 50 to 75 feet and the current in those places was very much more rapid. The water was slightly muddy, flowing over a bottom composed mainly of gravel. Sedges and *Nymphaea* were common in the shallower parts of the stream.

Station 22:—Saline River (tributary of Little River), Sevier County, 6 miles west of Dierks; July 1, 1927. The temperature was 82° at 7 a. m., and the pH 6.8. This stream was composed of alternate riffles and deep pools; it averaged 90 feet in width and 4 to 5 feet in depth. Sedges and *Nymphaea* were common along the bank.

C. *Ouachita River System in Arkansas*

Station 23:—Fallen Fork (tributary to Little Missouri River), Pike County, 1 mile west of Newhope; July 1, 1927. The temperature was 74° at 9 a. m. and the pH 6.9. Ths small creek was composed of pools about 20 feet wide, with very shallow riffles between. The bottom was gravel and the banks mud 2 or 3 feet high. These banks were commonly overhung with moss and ferns.

Station 24:—Little Missouri River, Pike County, 3 miles east of Newhope; July 1, 1927. Plate XI. The temperature of this swift stream was 80°. The water averaged 80 feet in width and 3 feet in depth. There were falls about 4 feet in height just above the place of seining. The bottom of the stream was alternate gravel and solid rock and the banks mainly steep mud, or in some places rock.

Station 25:—Self Creek (Little Missouri River basin), Pike County, 1 mile west of Daisy; July 1, 1927. The temperature of this small, swift stream was 80° at 11 a. m., and the pH 6.8. The width of the creek was very variable, from 15 feet as a minimum to 150 as a maximum. The depth averaged 4 feet. The water flowed quite swiftly in the narrower parts and was fairly clear. The bottom was mainly composed of gravel with a few boulders, and the banks were in the main steep and overhung with witch hazel and birch.

Station 26:—Akle Creek (flowing through Caddo Creek into Little Missouri River), Pike County, Arkansas, 1 mile south of Glenwood; July 1, 1927. The temperature of this small tributary of Caddo River was 82° at 1 p. m., with a pH of 7.6. The water was clear and the current of moderate swiftness. The bottom was composed of boulders and gravel and the average depth in the parts seined was 2 feet. The banks of the stream were steep mud, covered to a considerable degree with grass.

Station 27:—Caddo Creek, Pike County, ½ mile south of Glenwood; July 1, 1927. The temperature of this stream was 88° at 2 p. m., and the pH 8.4. This stream averaged 100 feet in width and three feet in depth. The water was clear with a very swift current. All of the fish were taken from pools along the edges where there was practically no current. The bottom was composed largely of gravel and small boulders and there were many

backwater pools covered with thick scum. There was practically no vegetation in the stream.

Station 28:—Lick Creek (feeder of Caddo Creek), Montgomery County, 7 miles northwest of Norman (equals Womble); July 1, 1927. The temperature of this small, swift stream was 76° at 4:30 p. m., and the pH 7.4. The water was exceptionally clear. The width was about 25 feet and the average depth about 1 foot. Many small, deep pools were found along the bank, some of these 6 to 8 feet deep. The bottom was clean gravel and there was no vegetation in the water. *Magnolia tripetala* L. was common along the banks.

Station 29:—Tributary of the Ouachita River, Polk County, 1 mile west of Board Camp; July 1, 1927. The temperature of this small creek was 76° and the pH 6.9. This stream was typical of the region with alternating wide pools and riffles. These pools were 50 to 75 feet wide, and the riffles from 10 to 15 feet. The water was clear. The bottom of the pools was gravel, while that of the riffles was principally rock ledges. The banks were steep mud, covered in some places with moss.

Station 30:—Tributary of Ouachita River, Polk County, 4 miles west of Board Camp; July 2, 1927. The temperature of this stream was 78° at 10 a. m., and the pH was 7.1. This small creek averaged 15 feet in width and 1 foot in depth. The water was fairly clear, the current slow, and the bottom was composed of sand and gravel. The banks were principally steep gravel and sand.

Station 31:—Tributary of Ouachita River, Polk County, 6 miles north of Mena; July 7, 1927. The temperature of this small stream was 88° at 11 a. m., and the pH 6.8. This was a typical small tributary of the Ouachita, with alternating riffles and pools, the latter 1½ feet deep. The bottom was of rock and sand as were also the sloping banks. The current was very slow, with practically no vegetation in the stream.

D. Arkansas River System in Arkansas

Station 32:—Fourche la Fave River, Scott County, 11 miles south of Waldron; July 3, 1927. Plate X, Fig. 15. The temperature was 80° at 7 a. m., and the pH 6.8. This large river varied in width from 100 to 300 feet and in depth from 1 to 2 feet in the riffles, to 6 or 8 feet in the wide pools. The water was slightly muddy and the current moderate. The bottom of this stream was composed mainly of boulders of various sizes. The fishes were all taken from the large pools where the current was slow. In the riffles the common emergent plant was *Dianthera americana* L. The banks on both sides were low, steep, and usually of mud or sand.

Station 33:—Tributary of Fourche la Fave River, Scott County, 9 miles south of Waldron; July 3, 1927. The temperature of this small, slightly muddy creek was 84° at 8:30 a. m., and the pH 6.8. This stream had practically no current, the water flowing very slowly over a bottom of sand and mud, with a considerable growth of *Nymphaea* along the banks. The banks were of steep mud covered with shrubs and grass.

Station 34:—Poteau River, Scott County, ½ mile north of Waldron; July 3, 1927. The temperature was 84° at 10 a. m., and the pH 6.8. Near Waldron this was a small stream about 3 feet deep, varying in width from 20 to 100 feet. The bottom was mainly muddy with a few boulders; the banks were steep slopes of mud and gravel, thickly covered with willows (*Salix*

discolor) and other trees. In the stream, particularly in the more rapidly flowing parts, *Dianthera americana* L. was common; the small islands in the stream were grassy. The water was slightly muddy and the current very slow.

Station 35:—Petit Jean River, Scott County, 11 miles northwest of Waldron; July 3, 1927. The temperature of this stream, which was about 30 feet wide, was 80° at 11 a. m., and the pH 6.8. The stream was slightly muddy with a very slow current and the fish were taken at a depth of about 3 feet. The bottom was composed of mud and gravel; the banks of mud, usually steep and about 8 feet high. The stream was composed of pools about 30 feet wide and a few hundred feet long, with rocky riffles which were of course narrower and swifter. The typical common plant of the riffles was *Dianthera americana* L.

Station 36:—Little Petit Jean River, Scott County, 13 miles northwest of Waldron; July 3, 1927. This stream was small and the water fairly clear with a slow current. The temperature was 82° at noon and the pH 6.9. The bottom was composed of either gravel or rocks; the bank were usually steep and about 5 feet high, of mud, but in some places of gently sloping gravel. As in the Petit Jean, *Dianthera americana* L. was a common water plant.

Station 37:—Lee Creek, Crawford County, 3 miles northwest of Van Buren; July 5, 1927. The temperature of this wide stream (150 to 250 feet) was 88° at noon, with a pH of 8.0. The stream was "up" and hence the water was muddy and the current rapid. Under ordinary conditions the stream has a slow current and fairly clear water. It furnishes the water for the city of Van Buren. The banks were steep and high, averaging more than 15 feet and composed of sandy loam or mud, largely covered with willows near the water. The bottom of the stream was sandy mud with many large boulders.

E. Arkansas River System in Oklahoma

Station 38:—North Canadian River, Hughes County, 7 miles south of Weleetka; June 14, 1927. The temperature of this stream averaged 73° and the pH 8.0. The banks were typical of the North Canadian River—gently sloping mud or sand, with willows scattered along them. The bottom of the stream where the collections were made was composed entirely of soft mud with neither emergent nor submergent vegetation. Most of the fishes were seined at a depth of 3 or 4 feet in flooded pools which slope to a maximum depth of 10 feet.

Station 39:—Brazil Creek (tributary of Poteau River), Latimer County, 3 miles north of Red Oak; June 14, 1927. The temperature of this stream was 70° at 4 p. m., and the pH 6.9. The stream was composed of alternating pools and riffles, the former with very muddy bottoms and the latter with bottoms of clean gravel. The shores of the stream were either steep mud or gravel. The depth varied from less than 1 foot in the riffles to a maximum of 5 feet in the deeper parts of the pools. In the rapidly flowing parts of the stream no vegetation was noticeable. However, *Nymphaea* was common in the pools and in the many cut-offs.

Station 40:—Pool at the side of a railroad fill (during flood connected with Gaines Creek of South Canadian River). Pittsburg County, ½ mile north of Bache; June 14, 1927. This was a small, very muddy pond about 15 by 30 feet, with willows along one side. The banks were very low and

muddy or grassy. The bottom was covered with decaying vegetation, and sedges were very common, growing in the water. The maximum depth was 18 inches.

Station 41:—Black Fork (of Poteau River), Le Flore County, 6 miles south of Heavener; June 20, 1927. The temperature of Black Fork was found to be 81°, and the pH 6.8. The collection was made from a backwash of the river on a sharp turn, where the swiftly flowing water created a slow swirl. The banks were sharply sloping mud and the bottom of the backwash was deeply covered with decaying leaves. The maximum depth at this place was 5 feet. *Nymphaea* and sedges were growing in small numbers.

Station 42:—Tributary of Black Fork, Le Flore County, 6 miles south of Heavener; June 20, 1927. The temperature of this small stream was 78° and the pH less than 6.8. Most of the stream was composed of successive riffles with occasional pools between. The average depth was 3 feet; the bottom was composed principally of gravel, but in some places of rock. Some decaying vegetation was present in the stream. The banks were mainly mud, but in some places were clean sand.

Station 43:—Poteau River, Le Flore County, 4 miles south and 5 miles west of Fort Smith; July 4, 1927. The temperature was found to be 90° at the surface at 3 p. m., and the pH 7.5. The Poteau here was a fairly large stream, averaging 150 feet in width. The current of the muddy water was moderate. The banks were 10 to 15 feet in height, nearly perpendicular, and overhung with bushes and trees. All of the fishes were taken within 5 miles of the original Fort Smith.

Station 44:—Arkansas River, Le Flore County, Oklahoma, 5½ miles southwest of Fort Smith; July 4, 1927. The temperature at the surface was 86° at 5 p. m., and the pH 7.9. This large river averaging in width from ½ to more than 1 mile, was "up" slightly at the time and the water was very muddy and the current quite swift. The entire bed was composed of sand and mud, and the banks proper were from 15 to 25 feet high and of particularly clean yellow sand. On top of these banks was a row of cottonwoods and some willows. Behind these trees Bermuda grass covered the sand. As it was practically impossible to seine the main stream at the time it was visited all of the fishes were taken in cut-off pools (mainly covering old cotton fields). All of the fishes were collected within 5 miles of the old Fort Smith.

Station 45:—Little Skin Bayou, Sequoyah County, 1 mile west of Muldrow; July 6, 1927. This was a small creek not over 15 feet wide nor more than 2 feet deep. At long intervals there were pools which reached a depth of 4 feet. The bottom was of clean rock and the water very clear. There was some decaying driftwood in the stream. The banks were about 6 feet high, of steep rock and mud with sand on top.

Station 46:—Big Skin Bayou Creek, Sequoyah County, 9 miles east of Sallisaw; July 6, 1927. The temperature of this stream was 78° at 9 a. m., and the pH 7.0. There was a moderate current in this small muddy creek. The stream was about 30 feet wide at this point. The bottom was sandy with a few boulders; the banks were sloping sandy mud, thickly covered with willows. Most of the fishes were taken from a depth of about 2½ feet. *Dianthera americana* L. was common along the banks.

Station 47:—Little Sallisaw Creek, Sequoyah County, 3 miles east of Sallisaw; July 6, 1927. The temperature of this stream was 82° at 10 a. m.,

and the pH 6.8. This was a slow muddy creek averaging 30 feet in width and 3 feet in depth. The bottom was composed of sandy mud; the sloping banks of mud 6 to 8 feet high were covered with willow and witch hazel.

Station 48:—Sallisaw Creek, Adair County, ½ mile south of Bunch; July 7, 1927. Sallisaw Creek was an unusually clear stream, which was from 15 to 50 feet wide and from 2 to 6 feet deep, with many deeper holes. The temperature at 2 p. m., was 82° and the pH 7.5. Commonly one bank of this stream was low and composed of gravel while the other was a high bluff (from 20 to 50 feet) of metamorphosed limestone. The bottom of the creek was composed of a mixture of small, sharp stones and rounded gravel. The stream consisted of alternating riffles and long, deep pools.

Station 49:—Flood pool of Sallisaw Creek, Adair County, ½ mile south of Bunch; July 7, 1927. This was a small cut-off flood pool of the creek.

Station 50:—Barren Fork (of Illinios River), Adair County, near Baron; July 7, 1927. The temperature of this very clear stream was 68° at 11 a. m., and the pH 6.9. The bottom was made up of small rocks and gravel and the banks for the most part were about 4 feet high and composed mainly of gravel. The stream was free of emergent or submergent vegetation.

Station 51:—Illinois River, Adair County, 4 miles northwest of Watts; July 9, 1927. Plate XII. The temperature of this river was 75° at 11 a. m., and the pH 7.5. This was a large and very swift stream 100 to 200 feet wide and from 2 to 5 feet deep. Many holes were to be found from 6 to 8 feet in depth. The water was quite clear, but had a milky gray-blue color. As in most of the streams in eastern Oklahoma, there were deeper parts several hundred feet long which alternated with riffles 1, 2, or 3 feet in depth. Usually one bank of the river was a rocky bluff from 20 to 30 feet in height, commonly deeply undercut by the stream. The opposite side was then a wide stretch of very clean white gravel. Many flood pools were left along the stream, and there were also many small springs emptying into it. One spring typical of the region, near our camp, had a constant temperature of 61° and a pH of 6.9, thus differing considerably from the main stream.

Station 52:—Bouyer Branch (of Illinois River), Adair County, 6 miles northwest of Watts; July 9, 1927. This was a small, spring-fed creek with very clear, cool water flowing swiftly over a bottom composed entirely of gravel. There was some decaying vegetation, and a considerable quantity of algae along the bottom. The low sloping banks were either of gravel or mud.

Station 53:—Flint Creek, (tributary of Illinois River), Delaware County, near Flint, 8 miles west of the Arkansas line; July 10, 1927. Plate XIII, Fig. 19. The temperature of this swift and very clear stream was 75° at 1 p. m., and the pH 7.5. The width varied from 20 to 30 feet, and the depth was about 1½ feet. The bottom was composed mainly of gravel and rocks, and the banks were of sloping gravel, mud or sand.

Station 54:—Spavinaw Creek (tributary of Neosho River),[1] Delaware County, 7 miles south of Jay; July 10, 1927. Plate XIII, Fig. 20. This was a very clear, rapid stream, the temperature of which was 75° at 1 p. m., and the pH 7.3. Its width varied from 60 to 200 feet and its depth from 1 to 7

[1]The old name as given on Government maps; this stream is called the Grand River locally and on practically all state maps.

or more feet. The banks were unlike on the two sides, one being a low wide stretch of gravel and the other a rock bank from 6 to 12 feet in height. The bottom of the stream was composed of gravel and rocks and was covered to a considerable extent with algae.

Station 55:—Elk River (tributary of Neosho River), Delaware County, 7 miles north of Grove; July 11, 1927. The temperature of this large, swiftly flowing stream was 72° at 4 p. m., and the pH 7.5. The figures here given may not be typical since the river was rapidly rising as we made camp, and soon reached a near-flood stage. The water, although usually clear, was at this time quite muddy. The river was from 150 to 200 feet in width and had an average depth of about 4 feet, although in many places the water was much deeper than this. The south side of the river at this place was a bluff from 50 to 100 feet in height; the opposite bank was low and composed of gravel and mud.

Station 55a:—Same locality, but collected by Mr. Woodson in August.

Station 56:—Little Cabin Creek (tributary of Neosho River), Craig County, 3 miles east of Vinita; July 15, 1927. As the stream was in flood and out of its banks at the time collections were made, no accurate description can be given. Normally it is a small stream probably averaging 30 feet in width and about 5 feet in depth. The bottom was mud as were also the banks, which were 10 to 15 feet high and quite steep.

Station 57:—Pryor Creek (another Neosho tributary), Rogers County, 1¼ mile northeast of Chelsea; July 15, 1927. This was a small creek about 15 feet in width and 1 to 2 feet in depth. The bottom was composed of sandy mud and the banks of sloping mud 10 to 15 feet in height. The stream was also out of its banks in flood stage when the fishes were taken.

Station 58:—Verdigris River, Rogers County, 5 miles west of Claremore; July 15, 1927. This river was from 200 to 300 feet in width with mud banks from 20 to 30 feet in height, at an angle of about 45 degrees. This condition was not at all typical, since the stream was "up" several feet.

Station 59:—Hominy Creek (tributary of Verdigris River), Osage County, 8 miles west of Skiatook; July 16, 1927. The pH of this clear stream was 8.2, and its width from 16 to 50 feet, with shale or sand and mud banks. The water was from 6 inches to 3 feet in depth, clear but with a noticeable film of oil. All vegetation in and near the stream had been killed. Oil was also plainly visible upon all dead tree trunks along the banks. The water was distinctly salty to the taste. Along the stream as far as examined bubbles of natural gas were seen emerging from the clean sand bottom.

Station 60:—South Canadian River, just south of Norman; October 20, 1927.

III. SYSTEMATIC ACCOUNT OF THE SPECIES

In the list which follows we give under each species the localities at which it was taken in 1927, listing the stations as in the preceding section. We add such distributional, ecological or systematic notes as appear to be of interest or significance.

POLYODONTIDAE

1. **Polyodon spathula** (Walbaum)

(Paddlefish; spoon-bill cat)

Arkansas River system in Oklahoma.—Sta. 43, Poteau River, 6½ miles from Fort Smith (9 large young).

This is the second record of this peculiar chondrostean from Oklahoma, and the first for the young of the species: the only other specimen we obtained (Ortenburger and Hubbs, 1926: 124) was an adult from the Red River basin.

LEPISOSTEIDAE

2. **Lepisosteus platostomus** Rafinesque

(Short-nose or duck-bill gar)

Arkansas River system in Oklahoma.—Sta. 43, Poteau River, 6½ miles from Fort Smith (series of young to half-grown); Sta. 58, Verdigris River, Rogers County (several young to half-grown).

This gar has not been listed heretofore from Oklahoma. Our records do not confirm Meek's supposition (1896: 342) that this species is much less abundant than *osseus* in the Fort Smith region.

3. **Lepisosteus osseus** (Linnaeus)

(Long-nosed gar; billfish)

Red River system in Oklahoma.—Sta. 14, Kiamichi River, Le Flore County (one small adult).

Arkansas River system in Oklahoma.—Sta. 55, Elk River, Neosho County (one young); Sta. 58, Verdigris River, Rogers County (one small adult).

AMIIDAE

4. **Amia calva** (Linnaeus)

(Dogfish; bowfin)

Arkansas River system in Oklahoma.—Sta. 43, Poteau River, 6½ miles from Fort Smith (one half-grown).

This is the first time that *Amia* has been recorded for Oklahoma.

CLUPEIDAE

5. **Dorosoma cepedianum** (Le Sueur)

(Gizzard shad; hickory shad)

Arkansas River system in Arkansas.—Sta. 34, Poteau River, near Waldron (two half-grown).

Arkansas River system in Oklahoma.—Sta. 38, North Canadian River, Hughes County (two macrocephalic young); Sta. 43, Poteau River, 6½ miles

from Fort Smith (series of small to large young, all normal, except for a single macrocephalic one); Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (many young, small to large, of which all of the smaller but three are macrocephalic); Sta. 51, Illinois River, northwest of Watts (three adults); Sta. 58, Verdigris River, Rogers County (series, large young to half-grown).

The vertebrae number 49 to 51; anal rays, 30 to 36; gill-rakers on first arch, more than 300 at a length of 65 mm.

The smaller young taken in the Canadian and Arkansas rivers, with few exceptions (as noted above), present a decidedly abnormal, macrocephalic appearance: their heads are not only much longer than in other, seemingly normal, young, but also much thicker and more swollen; the eyes likewise are much larger; the tail region, in contrast, is almost abortive, being much shorter as well as slenderer than is usually the case. So different are these two types of young, that at first it seemed probable that they must belong to distinct species, especially since intermediate types were not then found. Yet each type grades perfectly into larger young and half-grown fishes which present a fully uniform appearance, and between which no significant differences can be found, either in the size of head, eye or tail, or in the number of vertebrae, fin-rays, scutes or gill-rakers. If our interpretation is correct the macrocephalic young are distinct teratological products, yet capable of developing into normal adults. This unexpected phenomenon has been further analyzed and reported on in detail (Hubbs and Whitlock, 1929).

CATOSTOMIDAE

6. **Megastomatobus cyprinella** (Cuvier and Valenciennes)

(Big-mouth or red-mouth buffalo)

Arkansas River system in Oklahoma.—Sta. 43 and 44, Poteau and Arkansas rivers about 6 miles southwest of Fort Smith; Sta. 58, Verdigris River, Rogers County. (A series of rather large young from each station).

These records are the first for the Arkansas drainage of Oklahoma, as the previous state reports (Meek, 1896: 342, and Ortenburger and Hubbs, 1926: 125) have been for the Red River system.

7. **Ictiobus niger** (Rafinesque)

(Mongrel or black buffalo)

Arkansas River system in Oklahoma.—At each of the stations where the preceding and the following species were obtained, from one to several young of this form were secured.

This is the species currently but erroneously known as *Ictiobus urus*. The nomenclature and the characters of the young as well as the adult, will be treated in a forthcoming paper by Hubbs, on the catostomid fishes.

8. **Ictiobus bubalus** (Rafinesque)

(Small-mouth or razor-back Buffalo)

Arkansas River system in Oklahoma.—Of this species, not before reported for Oklahoma, we have large series of young from each of the three stations listed for the two previous species.

9. **Catostomus commersonnii commersonnii** (Lacépède)

(Common or white sucker)

Arkansas River system in Oklahoma.—Sta. 50, Barren Fork of Illinois River, Adair County (three young); Sta. 55, Elk River, tributary to Neosho River, Delaware County (one young).

This species is new to the Oklahoma list, although it has been recorded before from farther upstream in the same river systems in adjoining states: from the Illinois basin in Arkansas, by Meek (1894: 86), and from the Neosho basin in Missouri, by Meek (1891: 126) and by Evermann and Kendall (1895: 470).

We refer this Ozark population to the typical Eastern subspecies rather than to the Great Plains representative *C. c. sucklii*, because the Ozark fauna as a whole shows northern and eastern relationships, and because our specimens (although unfortunately none longer than 38 mm. to caudal) have only two rows of papillae on the upper lip.

10. **Hypentelium nigricans** (Rafinesque)

(Black or hog sucker)

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, Pike County (3 young); Sta. 27, Caddo Creek, Pike County (one yearling); Sta. 28, Lick Creek, a tributary to Caddo Creek, Montgomery County (4, young and yearling).

Arkansas River system in Oklahoma.—Sta. 55, Elk River, tributary to Neosho River, Delaware County (a small series of young to adults).

11. **Erimyzon oblongus claviformis** (Girard)

(Chub sucker)

Red River system in Oklahoma.—Sta. 3, 7, 8, 9, and 13, Kiamichi River and tributaries, Le Flore County (young and a few half-grown).

Red River system in Arkansas.—Sta. 15, Mountain Fork of Little River, Polk County (2 adults); Sta. 17, tributary of Mountain Fork, 3 miles south of Mena (1 young); Sta. 20, Rolling Fork of Little River, Polk County (4 half-grown).

Ouachita River system in Arkansas.—Sta. 23, Fallen Creek of Little Missouri River (small series, young to adult); Sta. 24, Little Missouri River, 3 miles east of Newhope (4 young); Sta. 30, tributary of Ouachita River, 4 miles west of Board Camp, Polk County (3 young); Sta. 31, tributary of Ouachita River, 6 miles north of Mena (2 young).

Arkansas River system in Arkansas.—Sta. 34, Poteau River, near Waldron (1 young); Sta. 35, Petit Jean River, Scott County (1 young).

Apparently all our material of *Erimyzon* is referable to this subspecies, the status of which will be discussed later by Hubbs.

12. **Minytrema melanops** (Rafinesque)

(Spotted sucker)

Red River system in Oklahoma.—Sta. 5, 8, 9, 13, and 14, Kiamichi River and tributary, Le Flore County (one adult each at Sta. 9 and 14; young only at other stations).

Arkansas River system in Arkansas.—Sta. 33, tributary to Fourche la Fave River, 9 miles south of Waldron (2 half-grown).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek, Latimer County (1 half-grown).

One of the two specimens taken at Sta. 33 shows a surprising anomaly of the air-bladder. This example, although almost exactly like the other and certainly referable to *Minytrema melanops*, has this organ divided into three almost completely separated chambers, as it normally is in *Moxostoma*.

The young of the year, 12 to 20 mm. long to caudal, differ radically from the young of *Moxostoma erythrurum* and *M. duquesnii* of like size in being much more attenuate, and in having a smaller head, as well as in having but two divisions in the air-bladder. Many sharp differences also appear in the arrangement of the melanophores. In *Minytrema* the myocommata are not all marked off by lines of color cells; the axial septum is accompanied by a very fine but black streak of more or less connected dashes; the sides are nearly clear, but the back is stippled with black; the largest punctulations range in a single even series, which is very conspicuous, from the occiput to the origin of the dorsal; this row is continued backward, still quite distinctly, on each side of the dorsal fin andof the dermal keel which precedes the caudal; a similar row skirts each side of the anal fin and is continued backward to the caudal, largely separate from its fellow; there is also a row of melanophores along each side of the preanal fold. In the very young of *Moxostoma*, the myocommata and the axial septum are both marked off, rather faintly, sometimes even indistinctly, by minute dots in a single row; the sides as well as the back are stippled; the melanophores are less specialized along the predorsal line than in *Minytrema*, and form a line which is less even, and which branches before the dorsal fin; this row is not distinctly continued along or behind the dorsal; there is some dark pigment, but this is not definitely arranged, along and behind the anal fin. When *Moxostoma duquesnii* attains a length of about 20 mm., the scale pockets become margined with dusky, and very soon thereafter the coarse dark blotches of the back and then of the sides become evident. Young of *Moxostoma erythrurum* of these sizes are usually much paler, and less definitely marked.

13. **Moxostoma duquesnii** (Le Sueur)

(Black mullet; fine-scaled redhorse)

Red River system in Arkansas.—Sta. 16, headwater tributary of Mountain Fork (of Little River), Polk County (10 young).

Ouachita River system in Arkansas.—Sta. 27, Caddo Creek, near Glenwood (series of young and several yearlings); Sta. 29, tributary of Ouachita River, 1 mile west of Board Camp, Polk County (small series of yearlings).

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, Scott County (1 young).

Arkansas River system in Oklahoma.—Sta. 51, Illinois River, Adair County (4 young); Sta. 54, Spavinaw Creek, Neosho system (series of young); Sta. 55, Elk River, Delaware County (large series of young and three half-grown).

This species, long confounded with *M. "aureolum"* (equals *erythrurum)* will be validated by Hubbs in a later paper. It has proved of considerable interest to find that it ranges from the upper Ohio drainage as far to the southward as Arkansas and Oklahoma.

14. **Moxostoma erythrurum** (Rafinesque)

(Golden mullet; common redhorse)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, Comanche County (3, young to adult); Sta. 12, Kiamichi River, Le Flore County (3, young to adult).

Red River system in Arkansas.— Sta. 20, Rolling Fork (of Little River), Polk County (1 young, 4 yearlings); Sta. 22, Saline River, tributary to Little River, Sevier County (10 young to half-grown).

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, Pike County (1 young); Sta. 25, Self Creek, tributary to the Little Missouri, Pike County (2 yearlings); Sta. 26, Akle Creek, a branch of Caddo Creek, Pike County (7 yearlings and 1 adult); Sta. 27, Caddo Creek, near Glenwood (several young and yearlings).

Arkansas River system in Arkansas.—Sta. 33, tributary to Fourche la Fave River, 9 miles south of Waldron (1 half-grown); Sta. 34, Poteau River, near Waldron (11, young to yearlings); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (1 young, 4 yearlings); Sta. 36, Little Petit Jean River, 13 miles northwest of Waldron (6 yearlings).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek, Latimer County, a tributary to Poteau River (2 young); Sta. 51, Illinois River, Adair County (1 young); Sta. 54, Spavinaw Creek, Delaware County, a tributary of Neosho River (2 young); Sta. 55, Elk River, Delaware County, another branch of Neosho River (large series of young).

This mullet is obviously one of the commonest fishes in eastern Oklahoma and in Arkansas.

In our yearling specimens the pectoral fin varies enormously in size, as its length is contained from 1.3 to 2.2 times in the interval between pectoral and pelvic insertions. Those individuals with the shorter pectorals do not otherwise possess the characters assigned to *Placopharynx carinatus* (which has been recorded from

the same waters). Most of the yearling to adult specimens showed when in formaldehyde at least a trace of red on the lower fins.

CYPRINIDAE

15. **Cyprinus carpio** (Linnaeus)

(Carp)

Arkansas River system in Oklahoma.—Sta. 43, Poteau River, and Sta. 44, Arkansas River, each about 6 miles southwest of Fort Smith (series of young to half-grown); Sta. 58, Verdigris River, Rogers County (series, large young).

The carp in Oklahoma apparently exist in several interbreeding strains: some are deep-bodied; a few are "mirror carp" and some are intermediate between the scaled and mirror type; one mirror carp has the main right barbel bifurcated and the lesser left barbel rudimentary.

16. **Nocomis biguttatus** (Kirtland)

(Western river chub)

Arkansas River system in Oklahoma.—Sta. 48, Sallisaw Creek, near Bunch (a small series, young to adults); Sta. 51, Illinois River, 4 miles northwest of Watts (9 young); Sta. 53, Flint Creek, Delaware County, a tributary of Illinois River (1 half-grown); Sta. 54, Spavinaw Creek, Delaware County, a branch of Neosho River (7 young to adults); Sta. 55, Elk River, Delaware County, tributary of Neosho River (several young).

There has been but one record of the river chub from Oklahoma, namely Sallisaw Creek (Meek, 1896: 84). The species has, however, been reported from other tributaries of the Arkansas, where it finds its southwestern limit, by Meek (*l. c.*, and 1891: 126) and by Evermann and Kendall (195: 471). These authors of course used the name for the species then accepted, *Hybopsis kentuckiensis*. Its nomenclature and status, as now accepted, is discussed by Hubbs (1926: 27-29).

As farther north, the vertical fins, particularly the caudal, are bright red in the young, and the caudal spot is at that stage round and jet-black; and the light wedge behind the eye in adults, particularly males, is vermilion in life. The breeding males in Oklahoma apparently attain a larger size than in the north: our three postnuptial males are 117 to 170 mm. long, whereas the largest we have seen from the Great Lakes region is only 141 mm. long, and the species there rarely attains a size that large. In the largest males from both regions the preorbital has become expanded to half the width of the postorbital region. The nuptial tubercles in the Oklahoma males extend from just before the nostrils to just behind the occiput; the frontal region is not swollen.

17. **Hybopsis storerianus** (Kirtland)

(Silver chub)

Arkansas River system in Arkansas.—Sta. 37, Lee Creek (tributary to the Arkansas), 3 miles northwest of Van Buren (1 young).

Arkansas River system in Oklahoma.—Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (2 half-grown).

These examples are topotypic of *Gobio vernalis* Girard (1856: 189 and 1858: 249), as were also those taken in the same region by Jordan and Gilbert (1886: 8) and by Meek (1896: 343). A cotype of *G. vernalis* is in the Museum of Comparative Zoology.

18. **Hybopsis amblops** (Rafinesque)

(Big-eye chub)

Arkansas River system in Oklahoma.—Sta. 48, Sallisaw Creek, near Bunch (5 adults); Sta. 55, Elk River, Delaware County, a tributary to Neosho River (small series, young to adult).

An example of this species was collected by Carl H. Eigenmann at Sarcoxie, Missouri.

For several years, this species has been called *Erinemus hyalinus*. It has been assumed that the name *Hybopsis gracilis* Agassiz was either based on a *Notropis*, or was unidentifiable. A careful reading of Agassiz's description, however, indicates that he had the present species. That he did is made virtually certain by the discovery at Harvard of a color sketch of Agassiz's specimen, made when fresh, and clearly representing the same species described later by Cope as *hyalinus*.

The very young of this species, from Sta. 55, in length 20 to 23 mm., show a fairly characteristic pigmentation. The lateral band is already prominent, several chromatophores wide, and is bent downward on the sides of the snout but is not continued around the front of the muzzle; the band is broadened and intensified toward its posterior end, and is followed immediately by a scarcely distinct caudal spot, which is faintly continued backward across the middle of the caudal fin. On the top of the head there is a frontal patch of enlarged chromatophores on each side, and a heart-shaped dusky occipital patch, which is usually paler inside, at the top (front) of the heart design. The predorsal streak is scarcely developed; the postdorsal streak usually shows as a fine double line; the blackened base of the anal fin is continued backward as a fine doubled streak to the caudal.

19. **Semotilus atromaculatus atromaculatus** (Mitchill)

(Creek chub; horned dace)

Ouachita River system in Arkansas.—Sta. 23, Fallen Fork (of Little Missouri River), near Newhope (small series, young to adults).

Arkansas River system in Oklahoma.—Sta. 50, Barren Fork (of Illinois River), Adair County (1 young); Sta. 51, Illinois River, 4 miles northwest of Watts (10 young); Sta. 52, Bouyer Branch (of Illinois River), 6 miles northwest of Watts (15 young); Sta. 54, Spavinaw Creek, Delaware County, a tributary to the Neosho (1 young); Sta. 55, Elk River, in same county and system (5 young).

The creek chub appears to be generally distributed in northeastern Oklahoma. Our localities are not far from the type-station

of *Leucosomus incrassatus* Girard (1856: 190, and 1858: 252). Although this species is extremely variable, we can find no consistent characters by which to distinguish a southwestern subspecies.

20. **Notropis heterolepis atrocaudalis** Evermann

(Black-nose shiner of the Southwest)

Arkansas River system in Arkansas.—Sta. 34, Poteau River, near Waldron (11 young, 1 adult); Sta. 35, Petit Jean River, Scott County (1 young).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek, Latimer County, tributary to Poteau River (1 adult); Sta. 44, Arkansas River 5½ miles southwest of Fort Smith (1, half-grown).

This species is new for the Oklahoma state list, and has been recorded but once for Arkansas: Meek listed it (1896: 347) as *N. cayuga* from Old River, near Greenway, in the St. Francis system, and Forbes and Richardson in their *Fishes of Illinois* (1909 and 1920: 134) referred the same material to *N. cayuga atrocaudalis*.

We think that this may be a distinct species, especially since we have lately had seemingly typical material from as far north as Indiana, Wisconsin, and Minnesota. There is, however, fair evidence of intergradation in Ohio, Indiana, South Dakota, and Kansas.

Notropis h. atrocaudalis differs from *N. h. heterolepis* in having the lateral line nearly or quite complete in the adult, the dorsal fin inserted farther forward (nearer tip of snout than base of caudal), the fins larger and more falcate, the fin-rays more slender and weaker and the whole texture of the body softer and more transparent and the lateral band more solid in color. In those respects in which the type-description and figure do not well agree, the figure is correct. The types have been reëxamined.

The lateral band, as in related species, varies from pale dusky to black. The example from the Arkansas River, like most fishes taken from this silty stream, is extremely pale,—the lateral band is difficult to trace, although certainly present.

21. **Notropis deliciosus deliciosus** (Girard)

(Straw-colored minnow of Texas)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, Comanche County (a few young and a series of adults).

22. **Notropis volucellus volucellus** (Cope)

(Mimic shiner)

Arkansas River system in Oklahoma.—Sta. 55, Elk River, Delaware County, a tributary of the Neosho River (series of mature adults).

This is the first Oklahoma record for this subspecies.

Although taken in the same state as the types of *Notropis volucellus buchanani*, the specimens from the Elk River are distinctly nearer typical *volucellus* than subspecies *buchanani*. They are larger (as long as 43 mm. to caudal), very much more pigmented, in fact fully typical of *volucellus* in coloration (see Hubbs and

Greene, 1928: 378), thicker in the body and blunter in the head, of firmer flesh and are provided with stronger fin rays, and with shorter fins (the dorsal about two-thirds as long as its distance from the occiput) and with less elevated lateral line scales (about three instead of four times as high as long). They differ from extreme race of the *volucellus* type in averaging considerably deeper and in otherwise somewhat approaching *buchanani*.

The nuptial tubercles of the breeding males of this Oklahoma series of *N. v. volucellus* are arranged exactly as described for the Arkansas set referred to *N. v. buchanani*. This fact lends further testimony to the close connection of these types, so different superfically.

The occurrence of the northern form *volucellus* in the midst of the range of *buchanani* shows that the segregation of these subspecies is very imperfectly geographical. It seems probable that *volucellus* when occurring in the range of *buchanani* occupies upland streams, whereas *buchanani* is chiefly a form of the larger rivers and adjacent creek mouths. That the two forms nevertheless intergrade, is clearly indicated by the existence of numerous variously intermediate races. Two examples of such intermediate types are the ones we here record as *volucellus*, although it definitely approaches *buchanani*, and the one from Lee Creek, which we refer to *buchanani* because seemingly rather nearer that form than *volucellus*.

This status of *Notropis volucellus* and the distinctive features of its two subspecies, *volucellus* and *buchanani*, have recently been worked out and reported on by Hubbs and Greene (1928: 375-380).

The cotypes of *Cyprinella texana* Girard (1856: 198 and 1859: 55, pl. 31, fig. 9-12) from Rio Salado, Texas, represent two species, one of which may be provisionally retained as *Notropis texanus*, because it corresponds the better with Girard's account and figure. This species has 7 anal rays (6 in one); teeth 4, 1, or 2-1, or 2, 4 (4, 2 - 2, 4 in the specimen mentioned by Girard); scales 36, 15 before dorsal, not elevated along lateral line; lateral line slightly decurved; origin of dorsal over front of pelvics, a little nearer tip of snout than caudal base; length of depressed dorsal 1.3 to 1.5 in distance to occiput; mouth rather small, rising forward at about 45° to opposite middle of pupil; dorsal scale pocket finely margined with blackish; no distinct band on head; both lips blackish anteriorly; black specks on each scale along lateral line; a small but distinct caudal spot; head 3.8 to 4.3; depth 4.2 to 4.7. The other species, represented by two of the six cotypes in the National Museum, and by the single ones in the Academy of Natural Sciences of Philadelphia (see Meek, in Jordan, 1885: 124; and Fowler, 1910: 281) and the Museum of Comparative Zoölogy, on the contrary, represent a form of *Notropis volucellus*, intermediate between *buchanani* and *volucellus*.

23. Notropis volucellus buchanani (Meek)

(Ghost shiner)

Arkansas River system in Arkansas.—Sta. 37, Lee Creek (tributary to Arkansas River), northwest of Van Buren (7 nuptial males).

Arkansas River system in Oklahoma.—Sta. 43, Poteau River, 6½ miles southwest of Fort Smith (1 adult); Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (4 adults).

In the Field Museum there is a specimen of this subspecies, of the deep-bodied phase, labeled in Meek's handwriting—"*Notropis buchanani* Meek, Red River, Arthur, Texas."

The Oklahoma specimens listed above may be regarded as topotypic, since the type specimens were taken in a creek near Poteau (Meek, 1896: 342). Since they vary widely and evenly in robustness (the depth is contained 3.6 to 4.7 times in the standard length), it is evident that the relatively deep types belong to the same subspecies as the more slender specimens which are ordinarily met with, as for instance the Red River example which we recorded in our last report (Hubbs and Ortenburger, 1929: 29).

All of our seven Oklahoma specimens of *buchanani* are typical of that subspecies. They are mature adults only 27 to 34 mm. long, with thin angular bodies, rather watery-appearing flesh and extremely fragile fins of large size (the depressed dorsal is about half as long as its distance from tip of snout, and the pectoral reaches well toward or even beyond the pelvic insertion); the lateral line scales greatly elevated, anteriorly about four times as high as long, and the coloration a bare ghost-like remnant of that seen in subspecies *volucellus*. Without the extensive evidence now at our disposal, it would seem improbable in the extreme, that forms so unlike as *buchanani* and *volucellus* should intergrade.

This single series of *volucellus* which we have from Arkansas (and this is the first to be reported from that state), seems distinctly closer to *buchanani* than to *volucellus*, but clearly approaches the latter form. That this series should differ from typical *buchanani* is surprising, for it was obtained in Lee Creek, only a few miles from the stations at which extreme examples of that subspecies were obtained, and in the same stream system. In the minute size attained (the seven specimens are all mature males, although only 26 to 32 mm. long to caudal), the Arkansas series is typical of *buchanani*. In the form of the body they are distinctly and variously intermediate; the darker specimens are shaped the more like *volucellus*. The fins are smaller than in true *buchanani;* they are intermediate in length between those of the two subspecies, and the color is likewise definitely intermediate: the black spots along the lateral line, the black dash on the middle of the dorsal base and the dusky marks before caudal and dorsal fins and behind the occiput, and the black streak along and behind the anal, and also the dark margins to the dorsal scale pockets, are all rather distinctly shown. One of the specimens in fact almost agrees with true *volucellus* in coloration, for it also shows the lateral band fairly well,

from tip of snout to base of caudal, as well as the dusky streak along the trunk, above and parallel to the main band.

The nuptial tubercles in the Lee Creek specimens cover the entire head, and are somewhat enlarged between the nostrils and the occiput. They extend backward weakly on the nape to the dorsal fin, but are absent on the sides of the body, except in a single regular row, close-set, along the high base of the anterior lateral line scales. There are also none on any of the fins excepting the pectoral, where they are rather weakly developed along the inner side of the rays, in one series at the extreme base of the fin, then in two and sometimes in several rows toward the tips of the rays. The head tubercles are erect but those on the pectoral fin are weakly hooked forward.

24. **Notropis girardi** Hubbs and Ortenburger

(Girard minnow)

Arkansas River system in Oklahoma.—Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (10 small adults).

These specimens agree fully with the types of *girardi* in each one of the series of distinctive features which we pointed out in the original description (Hubbs and Ortenburger, 1929: 32). They extend the range of the species eastward almost to the Arkansas line, and make it seem certain that this Arkansas River representative of *bairdi* and *sabinae* will be found to occur in that state as well as across Oklahoma and into Kansas.

25. **Notropis boops** Gilbert

(Big-eye shiner)

Red River system in Oklahoma.—Sta. 4, Kiamichi River, Le Flore County (13 adults, including several mature females); Sta. 8, tributary to Kiamichi River (series of breeding adults); Sta. 9, Kiamichi River Le Flore County (5 mature adults); Sta. 10, Big Cedar Creek, a branch of Kiamichi River (1 half-grown, 12 breeding adults); Sta. 11, tributary to Kiamichi River (series of breeding adults); Sta. 12, Kiamichi River, Le Flore County (a series, half-grown to adult); Sta. 13, same stream (large series, adults).

Red River system in Arkansas.—Sta. 15, headwaters of Mountain Fork (of Little River), Polk County, (16 adults); Sta. 16, headwater feeder of Mountain Fork (10, half-grown to adult); Sta. 17, tributary of Mountain Fork, 3 miles south of Mena (18 half-grown); Sta. 18, tributary to Mountain Fork, southwest of Potter (1, half-grown); Sta 20, Rolling Fork (of Little River), near Wickes (small series, breeding adults); Sta. 21, Cossatot River, Sevier County (small series of adults, some breeding); Sta. 22, Saline River, Sevier County (9 adults).

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, 3 miles east of Newhope (2 young, 6 adults); Sta. 25, Self Creek (tributary to Little Missouri River), Pike County (small series, ripe and spent adults); Sta. 27, Caddo Creek, near Glenwood (11 young and a series of ripe and spent adults); Sta. 29, tributary of Ouachita River, 1 mile west of Board Camp, Polk County (small series, ripe females).

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, 11 miles south of Waldron (small series, breeding adults); Sta. 34, Poteau River, near Waldron (1 20-mm. young); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (3, half-grown and spent adults); Sta. 36, Little Petit Jean River, 13 miles northwest of Waldron (3 adults, ripe and spent).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek, Latimer County (4, half-grown to adults); Sta. 46, Big Skin Bayou, 9 miles east of Sallisaw (2 small adults); Sta. 48, Sallisaw Creek, near Bunch (9 breeding adults); Sta. 51, Illinois River, 4 miles northwest of Watts (10 ripe and spent adults); Sta. 55 Elk River (tributary to Neosho River), Delaware County (series, half-grown to adults).

Notropis boops is one of the commonest species in the upland streams of western Arkansas and eastern Oklahoma. It breeds there during July and the last of June.

The nuptial tubercles are numerous though minute over most of the body, usually about ten in number in the series along the margin of a scale, not counting the few which are often developed near the middle of its exposed surface. They become very weak toward the mid-ventral line and toward the caudal fin. The tubercles covering the entire head are generally rather fine, but are somewhat enlarged on the snout and chin. On the top of the head they tend to occur in clumps or rows. They are very weak on the dorsal, anal and pelvic fins, but well developed (though minute) on the inner edge of the pectoral, where several series line each ray. The tips are weakly hooked forward on the muzzle and on the occipital and nuchal regions and on the pectoral fin; elsewhere they are suberect, or bent slightly backward (especially on the broad interorbital region).

The breeding adults exhibit no marked sexual differences in color. In each sex there is a slight wash of orange over the body and fins. The dark pigment is variously developed: the lateral band varies from the pale gray to black.

The young about 15 mm. long (to caudal) are characteristically pigmented. The lateral band is represented by a narrow band of chromatophores, slightly widened posteriorly, extending from tip of snout to base of caudal, where it is separated from a distinct caudal spot. A row of similar punctulations lines each side of the anal fin; this pair of lines converge backward from each side of the anus to meet at the base of the caudal fin. Each side of the interorbital bears a small black crescent, and the parietal region is thickly punctate. The mid-occipital area bears a black dash, followed by a few isolated specks and then by a clear streak to the dorsal fin. This clear area is lined on each side by a pair of dark bands, followed on each side of the dorsal and thence backward to caudal by a pair of lines, each comprising a single row of puncticulations. The middle of the dorsal base is blackish. The scale pockets are narrowly margined with black on the back behind the dorsal, between the rows of spots.

26. Notropis ortenburgeri Hubbs

(Ortenburger shiner)

Red River system in Oklahoma.—Sta. 7, tributary to Kiamichi River, Le Flore County (small series of adults); Sta. 8, tributary to Kiamichi River, Le Flore County (small series, adults); Sta. 9, Kiamichi River, Le Flore County (6 mature females); Sta. 10, Big Cedar Creek, tributary to Kiamichi River (5 mature females); Sta. 13, Kiamichi River (1 small adult).

Red River system in Arkansas.—Sta. 15, headwaters of Mountain Fork, 4 miles east of the state line (10 adults).

Arkansas River system in Arkansas.—Sta. 34, Poteau River, near Waldron (1 young).

The rediscovery of this very distinct species was one of the most interesting results of the 1927 field season. It was previously known only from the single type specimen, taken in the Mountain Fork of Little River, in Oklahoma, and described by Hubbs in our first report (Ortenburger and Hubbs, 1926: 127).

The new material allows us to give a statement of habitat and range for this shiner. It inhabits more or less quiet waters, of acid reaction (pH 6.8 or less), in the upland streams of southeastern Oklahoma and western, especially southwestern Arkansas; it is commonest in the Red River system, but occurs also in the Arkansas system.

The mouth as seen from the front is horseshoe-shaped, for the curve by the symphysis is unusually broad; the premaxillary edge is slightly curved upward, as though in a faint smile. The teeth appear to be constantly 4-4 in number, although the principal anal rays number 9 or 10: a unique combination. The scales number 34 to 36 in the lateral line (to caudal base) and 13 to 16 before dorsal. The lateral line is more or less incomplete on the caudal peduncle. The fins are sharp and large (the length of the depressed dorsal is contained 1.2 to 1.35 times in the distance from dorsal to occiput). The eye is large, but usually smaller than in the type, ordinarily contained from 3.0 to 3.3 times in the head. The length of the head is contained 4.0 to 4.3 times in the standard length, and the depth of the body 4.0 to 5.0 times.

The nuptial tubercles are fine and numerous, apparently rounded, and generally distributed over the head, and nowhere particularly enlarged. They are scarcely developed on the body. On the pectoral fin the organs are extremely minute and thickly placed, as they line each ray in a band several tubercles wide.

There appears to be no sharp sexual difference in coloration, although there are two major color phases, one much darker than the ordinary one. In the dark phase the scale margins are widely marked with deep black on the back, and to some extent irregularly with brown on the sides of the body, where such markings are ordinarily not developed; the top of the head is blackish, but the nostrils and anterior orbital rim are pale; the lips are very black; the fins show considerable dark pigment; the peritoneum is silvery, thickly speckled with black.

The young of this species, represented by one specimen 23 mm.

long to the caudal (Sta. 34), shows some distinctive features of pigmentation. They are very pale, for most of the body is unpigmented (the scale margains are marked off only on the scales forming the mid-dorsal series and a part of those forming the next row below on each side). The mediodorsal streak is rather inconspicuous, for its constituent melanophores are few and scattered; it branches well before the dorsal, and toward the head loses the uniserial arrangement of color cells; behind the dorsal it is incipiently developed, and for a short distance only. The parietal blotch is large, heart-shaped and black; otherwise the top of the head is translucent whitish, except for a few punctulations on each side of the interorbital space, and others near the nostrils. The lips are blackish, as are also the sides of the preorbital, and there are just a few fine spots behind the eye. The lateral streak, a continuation of these head markings, is faint on the trunk but fairly conspicuous toward the scarcely separated and rather diffuse dusky caudal spot; it is a row one to three color cells wide. The axial streak, which curves above the band on the trunk, but runs into and finally below it toward the caudal, is faint anteriorly, but composed of a very regular line of fine but black dashes posteriorly. A row of large elongated melanophores skirts the anal fin on each side, and one or two rows, irregularly arranged, extend between anal and caudal.

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

(Red-fin minnow of the Southwest)

Arkansas River system in Arkansas.—Sta. 36, Little Petit Jean River, 13 miles northwest of Waldron (2 ripe adults); Sta. 37, Lee Creek, 3 miles northwest of Van Buren (small series of adults, mostly nuptial males and mature females).

Arkansas River system in Oklahoma.—Sta. 38, North Canadian River, 7 miles south of Weleetka (5 adults, the males nuptial); Sta. 39, Brazil Creek, Latimer County (1 nuptial male); Sta. 43, Poteau River, about 6½ miles southwest of Fort Smith (7 mature adults); Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (large series, half-grown to breeding adults); Sta. 45, Little Skin Bayou, near Muldrow (13 mature and spent adults); Sta. 46, Big Skin Bayou, 9 miles east of Sallisaw (6 mature adults); Sta. 47, Little Sallisaw Creek, 3 miles east of Sallisaw (10 nuptial and postnuptial males); Sta. 54, Spavinaw Creek, Neosho system, 7 miles south of Jay (1 ripe female); Sta. 55, Elk River, Neosho system, 7 miles north of Grove (3 half-grown); Sta. 57, Pryor Creek, Neosho system, near Chelsea (1 adult); Sta. 58, Verdigris River, 5 miles west of Claremore (postnuptial male; ripe female; Sta. 59, Hominy Creek, Verdigris system, 8 miles west of Skiatook (2 young and a small series of breeding adults); Sta. 60, South Canadian River, just south of Norman (67 young to small adults).

The absence of this species from any of our collections in the Red and Ouachita systems in Arkansas is remarkable. Meek (1894: 92, etc.) likewise listed it from neither of these drainage basins in Arkansas (except that he erroneously attributed Baird and Girard's Otter Creek record—the type locality—to that state). The species seems to avoid mountain brooks. It is noteworthy that the distribution of *lutrensis* and *whipplii* in Oklahoma and Arkansas is almost wholly complementary.

A recent examination of the types of *Leuciscus lutrensis* Baird and Girard and of several species described by Girard (1856) under the generic names *Moniana* and *Cyprinella,* at the National Museum, has helped to straighten out the involved synonymy of *Notropis lutrensis* and allied species. Jordan and Meek (1885:9), Jordan (1886: 123 and 126), Evermann and Kendall (1894: 101-102) and Fowler (1910: 279-280, pl. 17) have also published notes on reëxaminations of the types of these species.

The type of *Leuciscus lutrensis,* which was taken in southwestern Oklahoma rather than as generally supposed in Arkansas, has 9 anal rays and the teeth 4-4. It certainly represents the species ordinarily called *lutrensis,* although the head is a little heavier than usual.

The type of *Moniana gibbosa,* from the Rio Grande at Brownsville, Texas, is a typical nuptial male of *N. lutrensis;* it has 9 anal rays. The types of *Moniana couchi,* from China, Nuevo Leon, are also typical of *lutrensis;* three of these have 9 anal rays and one has 10; one has 4-4 teeth.

Cotypes of several of the accepted synonyms of *lutrensis* are yet preserved in the Museum of Comparative Zoology. Two types of *Moniana pulchella,* from Sugar Loaf Creek, near Fort Smith, show 4-4 and 4, 0 - 1, 4 teeth, and 9 anal rays. One type of *Moniana laetabilis* Girard, from Hurrah Creek of the Pecos basin, has 4-4 teeth and 9 anal rays. Two cotypes of *Cyprinella suavis* Girard, from near San Antonio, Texas, have 4-4 teeth (one examined) and 9 anal rays. One of *Moniana leonina* Girard, from a tributary of the Rio San Antonio, has 4-4 teeth, and the characteristic nuptial tubercles of *lutrensis.*

Series which appear to represent the types of *Moniana frigida* from Rio Sabinal, Rio Salado and Rio Medina are also referable to *Notropis lutrensis;* 4-4 teeth were counted in two of the first lot and one of the second; 9 anal rays were counted in two of the first lot and five of the second, and 8 in one and 9 in four of the third set. The scales are not more numerous than they usually are in *lutrensis*—33 were counted in one from the Sabinal, 35 in one from the Salado, and 35 and 36 in one each from the Medina. We refer *frigida* to the synonymy of *lutrensis,* although the types we examined must be regarded as paratypic, since Jordan and Evermann (1896: 271) virtually restricted the type locality to Rio Frio, and although Jordan counted 37 scales in a type of *frigida* and regarded *Notropis frigidus* as a valid species characterized by having more scales than *lutrensis* (in which he counted 34 or 35).

The type of *Leuciscus bubalinus* Baird and Girard, later called *Cyprinella bubalina* by Girard, is apparently lost, but we believe it certain that it does not represent a distinct species. It came from the same locality as the type of *L. lutrensis* (Otter Creek, southwestern Oklahoma, not Arkansas as generally stated), from a region from which we have much material of the *lutrensis* type, some looking like the types of *lutrenis* and others like the type of *bubalinus* but all obviously representing a single species. Only two examples

of many we have yet dissected from various parts of Oklahoma and Arkansas have a tooth in the lesser row (a character supposed to be diagnostic of *"Cyprinella" bubalina)*. Furthemore, the types of two of the nominal species of *"Cyprinella,"* which have been referred to the synonymy of *bubalinus,* have been examined and found referable to *lutrensis.* These are the types of *C. gunnisoni,* one of which dissected has no teeth in the lesser row and several have 9 anal rays; the types of *C. umbrosa,* of which two examined have 4-4 teeth and seven have 9 anal rays, and a type of *Cyprinella beckwithi,* preserved in the Museum of Comparative Zoology, collected from a "sluice of Arkansas River near Fort Makee" (Kansas), and having the teeth 4, 2-0, 4 (the inner teeth, especially one, very fragile), and 9 anal rays.

We therefore refer *bubalina* and its synonyms, as well as *frigida* (equals *leonina),* to *Notropis lutrensis.*

The types of *Moniana proserpina* and of *M. aurata* Girard, in the National and Harvard collections, are virtually identical. The species they represent, *Notropis proserpinus* (Girard), should apparently be regarded as valid, with the synonymy accredited to it by Jordan and Evermann (1896: 272). Certain of the Mexican representatives of *lutrensis,* however, as for example forms named *Moniana gracilis* and *M. rutila* by Girard, are more or less intermediate between *proserpinus* and *lutrensis.* The specific status of *proserpinus* is therefore still not clearly settled.

Notropis proserpinus differs from *N. lutrensis* in several ways. The anal rays number only 8, instead of usually 9; the snout is blunter, and the mouth lower and more horizontal; the color is darker, largely because of the more intense margining of the scale pockets; the form in the breeding male does not become so gibbous, except about the forehead and snout, which are especially swollen. The nuptial tubercles in *proserpinus* are arranged much as in *lutrensis*—a fine indication of intimate relationship. They are strong though rather numerous on the snout, and extend backward to the occiput; there are none on the side of the head; they are obsolescent on the body, except in an area over the anal base, where they are large and crowd the entire exposed surface of several scales; they are scarcely developed on any of the fins excepting the pectoral, where they form a villiform band, widening posteriorly, on each ray. The teeth, as in *lutrensis,* are 4-4, and the grinding surfaces are crenate.

Notropis lutrensis becomes rather aberrant toward the north, where according to Forbes and Richardson (1909 and 1920: 144) the teeth are not infrequently developed in the lesser row, and the anal rays number usually 8, rarely 7 or 9 (the type of *Cyprinella forbesi* Jordan, from Illinois, has 9 anal rays and the accessory tooth on one side only). Furthermore, the black bar on the chin apparently becomes faint toward the north (Jordan and Meek, 1885: 9). We provisionally recognize a northern subspecies, *Notropis lutrensis forbesi* (Jordan), but we have not now enough material to delimit its range.

The anal rays in sixteen specimens collected at seven stations

in Oklahoma and Arkansas in 1927 are 9 in twelve and 10 in four.

The colors of the breeding males in Oklahoma are like those described by Forbes and Richardson for Illinois examples, but even redder.

The young of the year, 13 or 14 mm. long to caudal, exhibit some distinctive color features, and already show the beginning of the modification in form characteristic of the species—their bodies are compressed, and one-fourth as deep as long. A lateral band, extending from the tip of the snout to the caudal, is diffuse forward but fairly distinct posteriorly; it is only a few chromatophores wide, and ends rather abruptly at a widened tip. The top of the head is rather evenly pigmented. The body is mostly pale, but becomes dark, owing to thickly set chromatophores, toward the mediodorsal line, where, however, there is no definite streak or band. A very black streak lines the anal on each side, and is continued backward, close to but distinct from its fellow, to the caudal. There is no spot at the base of the caudal fin. At an early age the dark shoulder bar and dark margining to the scale pockets become developed.

As noted in our last report, this species becomes mature at a very small size. At three of the 1927 stations, females as small as 24 mm. to caudal were ripe (a few still smaller were immature). Males may be mature at 30 mm., but at that size show a rather weak development of the tubercles and are still slender. The males reach an extreme length of 69 mm. to caudal.

The nuptial tubercles of *lutrensis* are highly characteristic. They are hooked forward and rather strong though isolated on the snout and top of head, and become weak backward behind the occiput, usually obsolete toward the dorsal fin. Microscopic tubercles are scattered between the large ones on the top of the head. The organs are obsolete on the sides and lower surfaces of the head, except on the chin, where they are few and weaker than on the snout. They are also obsolete over most of the body, except below the lateral line and behind the body cavity, where most of the scales carry a few rather strong pearl organs, hooked forward. These structures are scarcely evident on the dorsal fin and rather weak on the anal and paired fins; those on the anal and pelvic are scattered, developed on the rays basally in one row, which branches once or even twice distally, and are bent toward the base of the fin; those on the pectoral are thick-set, mostly in one row basally and two distally, and are suberect.

28. **Notropis whipplii whipplii** (Girard)

(Steel-color shiner of the Southwest)

Red River system in Arkansas.—Sta. 16, headwater tributary of Mountain Fork (of Little River), Polk County (12 mature adults); Sta. 22, Saline River (tributary to Little River), 6 miles west of Dierks (2 ripe females).

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, 3 miles east of Newhope (4 adults); Sta. 25, Self Creek, near Daisy, a tributary to Little Missouri River (small series, half-grown to adults); Sta. 27,

Caddo Creek, near Glenwood (6 ripe and spent females); Sta. 29, tributary of Ouachita River, 1 mile west of Board Camp (1 maturing female).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek, 3 miles north of Red Oak, Latimer County (tributary to Poteau River) (6 adults, the males very highly developed); Sta. 55, Elk River, Neosho system, 7 miles north of Grove (a small series of half-grown to adults).

Notropis whipplii is represented in Oklahoma and Arkansas (and eastward to western Kentucky) by the typical subspecies, because *Cyprinella whipplii* was described from a tributary of the Poteau River. The type, fairly well figured by Girard (1858), is an excessively modified male, as are several of our own specimens. In these the body is considerably deepened, the snout is produced as a sharply rounded point well beyond the mouth, the dorsal profile of the head is markedly concave and the dorsal fin is enormously enlarged (its depressed length may be more than half again as long as the head, and equal to the distance from origin of dorsal to eye.) This degree of sexual modification is never attained in the Great Lakes drainage and upper Mississippi basin (Ontario to Minnesota). In that region, furthermore, the anal rays are almost constantly 8, rarely 7 or 9, whereas in Oklahoma and Arkansas the anal rays are nearly always 9, rarely 8 or 10. These differences seem sufficient to warrant subspecific distinction, although intermediate types occur in Illinois, Indiana and central Kentucky. We therefore propose that the northern form be known as *Notropis whipplii spilopterus* (Cope).

The specimens from Elk River (Sta. 55), unfortunately all immature, are not fully typical. They appear a little thicker, and show more whitish on the base of the caudal lobes than do our other Oklahoma specimens. In these respects they approach *Notropis galacturus*. We do not refer them to that species because they are too deep (depth about one-fourth the standard length), have too large an eye (about as long as the snout) and have the white caudal marks not so distinct as in typical *galacturus* from Tennessee and Kentucky. These aberrant specimens have also 9 anal rays.

In two excessively modified males, 90 and 93 mm. long to caudal, from Sta. 39, the nuptial tubercles are well developed. They are largest on top of the head, where they are hooked weakly forward, have rounded bases, are irregularly arranged and show a slight tendency toward alignment into rows. They are thicker and smaller on preorbital, snout and edge of mandible, and are obsolete elsewhere on the head. Among the head tubercles are scattered microscopic pearl organs. The tubercles on the body are scattered over the whole scale surface in addition to the usual submarginal row. They are considerably enlarged on the nape, especially near the anterior angle of the exposed field, but elsewhere on the body are minute and numerous. They are even developed onto the belly, and upper surface of caudal peduncle. They show no distinct tendency toward enlargement over the anal base (in this respect disagreeing with some males of *N. w. spilopterus*, which strongly approach *lutrensis* in the arrangement of the tubercles). On the dorsal, anal, and pelvic fins the weak isolated organs are aligned in

loose files following the bifurcations of the rays; on the pectoral they are larger and more closely set, and aligned in one row per ray basally and two rows distally; these fin tubercles are not notably hooked or bent.

29. **Notropis cercostigma** (Cope)

(Black-tail shiner)

This species has not been collected during 1925 to 1927 expeditions in Oklahoma, but we list it here in order to attribute it more definitely to the state list. The specimens referred by Meek in 1896 (p. 343) to *N. venustus* are in part and probably all referable to *cercostigma*. Those taken from the Red River near Arthur have been reexamined; they have 37 or 38 rows of scales, and a very large spot at base of caudal.

30. **NOTROPIS GREENEI**, new species

(Wedge-spot shiner)

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, 11 miles south of Waldron (4 adults).

Arkansas River system in Oklahoma.—Sta. 55, Elk River, Neosho system, Delaware County (4 young and 5 adults).

The *holotype* is a breeding male, 42 mm. long to base of caudal fin, collected at Sta. 55; Cat. No. 80978, Museum of Zoology, University of Michigan. The paratypes consist of one half-grown 34 mm., one mature female 43 mm. and two breeding males, 42 mm. long, from the type-station, and of four nearly ripe adults from Sta. 32—males 50 and 60 mm. and females 56 and 66 mm. long. The paratypes are divided between the museums of zoology of the Universities of Oklahoma and Michigan. Another paratype, 49 mm. long, in the Michigan series, was collected by W. J. Clench in a rocky stream 6 miles south of Potosi,—a tributary to Big River in the Mississippi drainage side of eastern Missouri. Other paratypes, collected by Meek at Kinderhook, Arkansas, are in the Field Museum.

This is the species recorded by Meek (1891: 121) from the Gasconade system of Missouri under the name of *N. boops*. In his Arkansas reports it was in one instance confused with *boops* (1893: 242), and in another instance (1894: 77, 82, 85, and 92) distinguished from that species but wrongly identified with *N. xaenocephalus* (Jordan). In a later report (1896: 347), however, specimens of *Notropis nux* were recorded by Meek under the name of *xaenocephalus* (the specimens from Big Bay have been re-studied).

This species takes its place along side of a number of others characteristic of the Ozark Upland.

Notropis greenei is characterized by having the teeth 4, 2-2, 4, with a slight grinding concavity; anal rays usually 8; premaxillaries usually slightly, and mandible always decidedly included; the chin and lower lip whitish to merely dusky; the lateral band indistinct on head and trunk, and the caudal spot black and usually wedge-shaped. In many respects it is much like *N. xaenocephalus*, but dif-

fers in the poorer development of the lateral band, the whitish chin, etc. It is perhaps even closer to *N. amabilis*, but it is found to differ, on comparison with types of *Alburnus amabilis* in the Michigan and Harvard collections, in having the jaws not equal, the chin not blackish, the body thicker, the dorsal fin located not quite so far posteriorly and the anal rays usually 8 instead of 9.

The body is only moderately compressed anteriorly (the greatest width is about two-thirds the depth). The contours curve gently from the dorsal and pelvic fins to the mouth, which is about on a level with the lateral line. Behind these fins the contours extend nearly straight to the caudal base. The greatest depth of the body measures 4.8 times (4.6 to 5.1; 4.6 to 5.2[1]) in the standard length, and the least depth of the caudal peduncle enters 2.5 (2.6 to 2.8; 2.8 to 3.0) times in the head. The length of the head measures 3.9 (3.85 to 4.1; 3.7 to 4.2) times into the standard length. The head is rather pointed (rather blunter in the females), and the dorsal contour is slightly elevated over the orbit and more markedly so over the nostrils. The snout slightly but distinctly overhangs the premaxillaries in the males (but not always in the females); the lower jaw is always included. The gape is slightly curved and moderately oblique, as it rises anteriorly about to the horizontal from lower edge of pupil. The upper jaw extends backward to below front rim of eye, and enters 3.3 (3.2 to 3.5; 3.3 to 3.6) times in the head. The suborbital fold is lost on the snout behind the edge of the maxillary bone, but a distinct rostral lobe does not result, because the notch is not deep. The suborbital is narrower than the pupil. The width of the somewhat arched interorbital is about equal to the length of snout, or to the diameter of the eye, which enters 3.4 (3.2 to 3.4; 3.3 to 3.6) times into the head. The gill-rakers are short and fleshy, and only a few are developed on the first arch, near the angle. The teeth, 4, 2-2 4, are hooked, have narrow, somewhat concave grinding surfaces and scarcely crenate edges.

Scales, 5½ (or 5)—37 (35 to 38)—3½ (or 4); 2½ (or 3) to pelvic. The scales become more or less obsolescent below the pectoral base, but are well developed on the nape, where they number 21 (14 to 18) on the midline (to origin of dorsal). The scales have the exposed field rather deeper than long, with the edge evenly rounded; the radii (confined to this field) fairly strong, sometimes as many as 12, but often very few (1 to 3); the ridges rather fine but clear-cut and concentric with the margin. The focus is far basad, and the anterior field very narrow, with a nearly vertical margin, and with the ridges very close-set. The lateral line is complete, and gently decurved anteriorly, so that it is only half as far from the pelvic insertion as from the dorsal origin.

Principal fin-rays: dorsal, 8; anal, 8 (rarely 9); caudal, 19; pelvic, 8 (rarely 7); pectoral, 16 (15 to 17). The fins are moderately sharp; the dorsal and anal are somewhat falcate, the paired fins scarcely so; the caudal is forked sufficiently so that its short-

[1]The two sets of measurements in parentheses are those of adult male and of adult female paratypes, respectively.

est ray is less than half the length of the longest. The dorsal fin is inserted over the middle of the pelvic base, slightly nearer tip of snout than base of caudal (sometimes as near caudal base as nostrils); its depressed length is contained 1.4 (1.35 to 1.6; 1.4 to 1.7) times in its distance from occiput. The caudal lobes are a little longer (to a little shorter) than the head. The pelvic fins stretch to the anus. The pectorals, measure 1.2 (1.15 to 1.3; 1.35 to 1.45) times into the head, extend to within a pupil's (to an orbit's) length from the pelvics.

The fine and thick-set nuptial tubercles are little specialized in this species. They cover the whole head, and are not enlarged on the snout; they are mostly erect, but bent backward on the interorbital space. They are generally developed on the body, but become obsolete toward the belly and toward the caudal fin. On the ridge of the back before the dorsal they are set over the surface of the scale, but elsewhere mostly line its margin in a single row of about 8 tubercles. These organs are present though weak on the dorsal, anal, and pelvic fins; here they are aligned basally into one row, which widely forks into two rows distally. On the pectoral rays the tubercles are minute, bent forward and thick-set, and form villiform bands distally.

In fresh specimens no marked sexual difference in coloration was evident. A silvery lateral band (better preserved in the specimens from Sta. 32), courses the side of the body, is as wide as the eye anteriorly but narrows to the width of the pupil on the caudal peduncle. It overlies and (until destroyed) hides the dark pigment beneath it. This pigment forms a definite dusky streak only behind the body cavity. Anteriorly the punctulations are relatively too few and scattered to form a band, but are considerably concentrated along the edge of the fine, whitish axial streak. The lateral line pores are bordered by dark dots as in *deliciosus*. There is no definite band on the head, although the sides and the front of the snout are dusky. The chin is pale, and the lower lip has too few melanophores to appear more than pale dusky. The margins of the scale pockets are rather sharply marked off with dusky above a pale streak which runs above the silvery band, and which is best developed posteriorly. A fine, blackish streak extends from occiput to dorsal fin, bordered with a diffusion of dark pigment, especially near the dorsal fin; the base of the dorsal fin is blackish, and a fine dusky streak extends from that fin toward but not quite to the caudal. The black pigment along anus and anal fin is concentrated in dashes extending upward and forward; the anal is connected with the caudal by a very fine double black line. The fins are all pale dusky, except for the deep black though somewhat disrupted caudal spot, which is typically wedge-shaped with the point forward. The peritoneum is gray, with black specks (varying from silvery with black puncticulations to uniform dark dusky).

The young apparently of this species, at 13 mm. length to caudal, show color features by which they may be separated from the young of related species. The belly is dusky, owing to the fact that the blackish peritoneum shows through the flesh. The

narrow lateral band is made up of black chromatophores, and is narrowed on the trunk to a very irregular file of these; it is rather diffuse, but not angled downward, on the snout; it ends distinctly in advance of a wedge-shaped black caudal spot, which is scarcely continued backward on the fin. The medio dorsal streak is faint, and comprises a single row of melanophores, which become enlarged toward a small black occipital spot; the streak forks distinctly in advance of the dorsal fin and skirts that fin in strengthened intensity on each side but is not distinctly continued behind the dorsal, where, however, certain scale pockets are especially darkened. The peritroct and the sides of the anal fin base are strongly blackened, and a distinctly doubled streak extends from the anal to the caudal.

This species is named for Mr. C. Willard Greene (a student of the senior writer), who is now engaged in making an ichthyological survey of Wisconsin.

31. **Notropis zonatus** (Agassiz)

(Agassiz shiner)

Arkansas River system in Oklahoma.—Sta. 48, Sallisaw Creek, near Bunch (a series, mostly young, but some postnuptial males and spent females); Sta. 50, Barren Fork (of Illinois River), near Baron (2 breeding males); Sta. 52, Bouyer Branch (of Illinois River), 6 miles northwest of Watts (9 young to adult); Sta. 53, Flint Creek, tributary to Illinois River, 8 miles west of state line (10 young to adult); Sta. 54, Spavinaw Creek (Neosho system), 7 miles south of Jay (16 young to adult); Sta. 55, Elk River, tributary to Neosho River, 7 miles north of Grove (large series, young t adults, mostly young, some adults breeding).

In the Michigan collection are specimens from a tributary of Big River, 4 miles south of Potosi; from 2 miles west of Shepard, and from Sarcoxie, all in Missouri—the first two sets collected by W. J. Clench and the last by Carl H. Eigenmann.

This Ozark Upland species has not been caught in Oklahoma before, although it appears to be common in the northeastern corner of the state, and has been taken by Meek in the same river systems in Arkansas (1894: 87) and Missouri (1891: 126).

We are indebted to Fowler for the suggestion that *Notropis pilsbryi,* described by him from Arkansas in 1904 (p. 245, fig.), is identical with *N. zonatus.* This suggestion we have confirmed, by examining the types of both *Notropis pilsbryi* Fowler and *Alburnus zonatus* Agassiz.

The young at a very early age assume the characteristic coloration of the species. The postnuptial males and the females show little difference in color. They are both olivaceous on the upper sides, and have a broad black vertical streak; a wide plumbeous shade on the middle sides, intensified on the upper edge, above which is a light and then a dark streak, both narrow and distinct forward but fading out backward; the lower sides and belly silvery, with a wash of reddish in the males; the lower fins apparently also reddish in that sex.

The breeding males (represented by a 58 mm. specimen from Sta. 52) are more intensely pigmented. The lateral band, wider on the trunk than the eye, is coal-black; it is indistinctly continued on the caudal to its end. The dark streak above the lateral band is also widened. The margins of the scale pockets are more deeply and finely penciled with dark than in the female. The mid-dorsal streak, wide and black, surrounds the base of the dorsal fin. The lower sides and fins are flushed with red, deeply so anteriorly.

The nuptial tubercles are few and scattered but not minute on the top of the head. They are not apparent elsewhere on the head or body. On the inner side of the pectoral rays the pearl organs are deciduous, scarcely hooked and in one row basally and two distally, and they have enlarged subquadrate bases in contact with one another; these bases are single-pointed toward the base of the ray, but bear several cusps medially.

32. **Notropis cornutus isolepis** Hubbs and Brown

(Common shiner, of the Red River system)

Ouachita river system in Arkansas.—Sta. 23, Fallen Fork (of Little Missouri River), 1 mile west of Newhope (1 young and 1 adult); Sta. 28, Lick Creek, tributary of Caddo Creek, Montgomery County (small series of young to breeding adults).

These additional specimens confirm the distinctness of the Red-Ouachita representative of the common shiner, which was described in our first report (Ortenburger and Hubbs, 1926: 127). They have 14, 15 or 16 predorsal scales.

In the Museum of Comparative Zoology there is a specimen of this subspecies from Natchez, Mississippi, with 12 predorsal scales, and one from Vichy Springs, Choctaw County, Alabama, with 14 predorsal scales.

The breeding males of *isolepis* are very conspicuously marked (our finest example, from Sta. 28, is 99 mm. long to caudal). The general color tone is dark. The stripes between the scale rows of the back are blackish brown, and zig-zag in the most highly developed males. The sides shine with a rose-silver luster, except on the blackened scale bases and on the large lateral blotches, which are almost as black as in *cerasinus*. The shoulder girdle is inky black from its upper edge to the pectoral; the opercles are blackish except for a rosy white margin; the cheeks are silvery except for a broad blackish suborbital bar (which is barely evident in non-breeding males). The top of the head is blackish. The fins apparently showed much red in life, particularly the caudal. The dorsal and anal rays are finely black-edged; the pectoral rays are margined within, except toward the border of the fin, by blackish—most intensely so on the outer ray; the pelvic rays are so marked only in "high" males and in them only near the middle of the fin; the outer pelvic ray is immaculate.

33. Notropis cornutus chrysocephalus (Rafinesque)

(Common shiner, of the Mississippi Valley)

Arkansas River system in Oklahoma.—Sta. 51, Illinois River, 4 miles northwest of Watts (a small series of young and 1 adult).

This Oklahoma record is the first for this subspecies. The one adult specimen obtained has 17 predorsal scales.

34. Notropis atherinoides Rafinesque.

(Lake shiner)

Red River system in Arkansas.—Sta. 21, Cossatot River, tributary to Little River, 7 miles northeast of De Queen (series of adults); Sta. 22, Saline River, tributary of Little River, 6 miles west of Dierks (small series of adults).

35. Notropis percobromus (Cope).

(Red shiner)

Arkansas River system in Oklahoma.—Sta. 48, Sallisaw Creek, near Bunch (4 breeding adults); Sta. 51, Illinois River, 2 miles northwest of Watts (8 young); Sta. 53, Flint Creek, tributary to Illinois River (7 half-grown, 1 adult); Sta. 54, Spavinaw Creek, Neosho system, 7 miles south of Jay (5 young); Sta. 55, Elk River, tributary to Neosho River, 7 miles north of Grove (a small series of half-grown to nuptial adults).

We provisionally identify with *Alburnellus percobromus* Cope several series of shiners, listed above, from northeastern Oklahoma. Similar specimens, obviously belonging to the same species, were collected in Silver Creek near Winfield, Kansas, by Jewell and Jobes, and in Sac River, Missouri, by Gilbert and Meek; these additional series are in the Michigan and Field Museum collections, respectively. These examples correspond fairly well with the type of *percobromus* as figured by Fowler (1910: pl. 21, fig. 50).

The species of this group have been sadly confused by ichthyologists. Woolman, for example, repeatedly identified *N. rubellus (N. rubrifrons* of authors) as *dilectus,* and Jordan and Evermann (1896: 294) state that *dilectus* represents *"rubrifrons"* southwestward. The original types of *dilectus,* however, are referable rather to *atherinoides.*

These two forms, *rubellus* and *percobromus,* agree with one another and differ from the intimately related *atherinoides* in characters which with experience seem real but which are difficult to express. These characters have already been pointed out (Forbes and Richardson, 1908 and 1920: 131 and 151-154; Hubbs, 1926: 38 and 45.). Wherever they occur, *rubellus* and *percobromus* are darker in color (the scale margins, the mid-dorsal band and the axial line and the streak accompanying the anal base are more intensely pigmented than in *atherinoides,* and the lateral line pores are definitely marked off by black dots as in *deliciosus).* The whole flesh appears more solid, less translucent. The body is less elliptical in outline, for it is relatively deeper anteriorly and more

attenuate posteriorly. The snout is larger, usually a little more instead of a little less than two-thirds as long as the postorbital part of the head, including opercular membrane. The mouth is also larger, usually a little more instead of a little less than one-third as long as the head. The sexual dimorphism is greater, for the breeding males have the nuptial tubercles much coarser (and consequently fewer), the paired fins more strikingly enlarged and the colors much brighter.

Notropis percobromus (as represented by the material listed above) differs from *rubellus* in having a deeper form, especially in the head and most particularly in the snout, which is very much less slender (the depth of the head, as in *atherinoides,* considerably exceeds, instead of being equal to or less than the combined length of snout and eye); in the larger eye, which as in *atherinoides* is nearly or quite as long as the snout (the eye, it must however be noted, becomes somewhat enlarged in *rubellus* toward the west and southwest), and in the redder color of the breeding fishes, especially of the females, which are bright and red as the males of *rubellus.*

From *N. micropteryx* (Cope), of the Tennessee system, which it closely resembles in general form and in tuberculation, *N. percobromus* differs in the deeper head and darker coloration. In these features *micropteryx* approaches *rubellus* and *atherinoides,* respectively.

The breeding males and females of *percobromus* in fact are very similarly colored, although the males are the more intensely pigmented. The top of the head and the whole muzzle are red, and a strong wash of the same color pervades the silvery sides of the head and lower half of the body. The plumbeous lateral band, black axial streak, and black vertebral line are conspicuous (in formaldehyde specimens). The lateral line is speckled with deep red as well as black. The bases of all fins are red, the pectoral axil most intensely so.

The pigmentation of the young of *percobromus* when about 18 to 22 mm. long (to caudal fin) is sufficient to distinguish them from the young of other minnows occurring in the same region. The general tone is very pale, for few melanophores occur on the sides, except near the midline. The most conspicuous color feature is the axial streak, which is indistinct only toward the head, and very clear-cut and black toward the caudal fin. The sprinkle of dots anticipating the lateral band occurs in single series over the streak near the head, in a loose band below the streak on the middle of the body and on both sides of the streak posteriorly. The band is widened into a subtriangular form at the caudal base. The snout and both lips are dotted with black. The heart-shaped black blotch over the brain grades backward into the dusky dorsal stripe, which is better developed before than behind that fin. Black punctulations are loosely sprinkled about the vertebral stripe. The anal-base streak is solid and black, wide forward and narrow posteriorly, continued backward behind the anal merely in a few isolated specks.

The nuptial tubercles, as in *rubellus,* extend over almost all the head and body, but become weak ventrally. They are fairly coarse (much larger and fewer than in *atherinoides)* and rather irregularly disposed. A few only line each scale margin. They are sharp cones, weakly hooked backward. The organs are strongest on the top of the head. They are rather weakly developed on the dorsal, anal, and pelvic fins, but rather strongly on the pectoral, where one row basally and two rows toward the tip of the fin line the inner side of each ray.

36. **Notropis fumeus.** (Evermann)

(Ribbon shiner)

Red River system in Arkansas.—Sta. 15, headwaters of Mountain Fork (of Little River), 4 miles east of state line (small series of adults); Sta. 16, headwater tributary of Mountain Fork, 8 miles east of state line (small series, half-grown to adults); Sta. 17, tributary of Mountain Fork, 3 miles south of Mena (small series, half-grown to adults); Sta. 18, tributary of Mountain Fork, southwest of Potter (series of half-grown to adults); Sta. 19, Mountain Fork, 3 miles southwest of Potter (series of half-grown to adults).

Ouachita River system in Arkansas.—Sta. 27, Caddo Creek, near Glenwood (1 ripe female).

We provisionally identify as *Notropis fumeus* Evermann the specimens listed above. They represent an extremely slim form (the depth usually about one-fifth the standard length), with the dorsal farther back than in *umbratilis* (nearer base of caudal than center of eye), the dorsal spot rather indistinct or even obsolete, the sexual dimorphism in form and coloration slight and the nuptial tubercles not enlarged on the muzzle. In many respects they closely agree with *Notropis lirus,* of the Alabama basin, from which they differ in the somewhat less solid lateral band, the smaller eye, more compressed head, and particularly in the minute size of the nuptial tubercles (in *lirus* the tubercles on the head have strongly enlarged bases, and there is a single huge tubercle at the tip of the chin).

On reëxamining the material recorded by Ortenburger and Hubbs (1926: 131) as *N. u. umbratilis,* we find all apparently correctly determined except those from Sta. P-17, all of which are the form we here call *N. fumeus,* and those from P-21, of which a part are that form and a part are typical *umbratilis.* We have not checked over all of the material recorded by earlier writers as *N. umbratilis,* but have found that Meek's specimens (1891: 138) from Myers, Arkansas, are entirely, and those from the Caddo are in part, the species here called *N. fumeus.*

Several specimens from the Arkansas system, taken in Brazil Creek, a tributary of the Poteau, at Sta. 39, like several included among the original types of *umbratilis,* are less extreme in body form than those discussed above, and have 11 or 12 anal rays rather than 10 or 11, as in typical *umbratilis* as well as the Red and Ouachita basin specimens identified with *fumeus,* with which they otherwise closely agree. Very likely these Arkansas and Red River

forms will prove distinct, in which case the former will require a new name.

A still more aberrant specimen is the one taken on the 1926 expedition in Coldwater Creek, Oklahoma (reported as *Notropis*, species by Hubbs and Ortenburger, 1929: 34). It has a deep compressed body, is pale and lacks the dorsal spot, is unusually small-eyed but large of mouth (upper jaw one-half longer than eye, somewhat more than one-third head). The dorsal fin of this individual is posteriorly inserted and the anal has 12 rays. The scales before the dorsal are less reduced than in *umbratilis* or the form we call *fumeus*, and the specimen may even represent a species of the *atherinoides* group.

More material will be required before a final identification can be made of these southwestern forms of the *umbratilis* series.

The nuptial tubercles are much weaker in the form we identify as *fumeus* than they are in typical *umbratilis*. Those on the chin are minute rather than enlarged. The tubercles, however, occur on the suborbital region and cheeks, where they are absent in *N. lirus*, *N. lythrurus* and *N. ardens*. On the fore part of the body several small organs parallel each scale margin. On the pectoral rays there are two rows basally, grading to a thick-set series, finally becoming obsolescent distally.

37. **Notropis umbratilis umbratilis** (Girard)

(Red-fin shiner of the Southwest)

Red River system in Oklahoma.—Sta. 4, Kiamichi River, Le Flore County (19 adult specimens, largely mature females); Sta. 5, same locality (8 adults); Sta. 8, tributary to Kiamichi River, Le Flore County (series of breeding adults); Sta. 9, Kiamichi River, Le Flore County (2 nuptial males); Sta. 10, Big Cedar Creek, tributary to Kiamichi River, Le Flore County (8 mature adults); Sta. 11, tributary to Kiamichi River, Le Flore County (9 breeding adults); Sta. 12, Kiamichi River, Le Flore County (series of half-grown to adults); Sta. 13, Kiamichi River, Le Flore County (series half-grown to adults, including nuptial males).

Red River system in Arkansas.—Sta. 20, Rolling Fork (of Little River), 1 mile west of Wickes (a series of adults, some breeding); Sta. 21, Cossatot River, tributary of Little River, 7 miles northeast of De Queen (4 adults); Sta. 22, Saline River, tributary to Little River, 6 miles west of Dierks (7 adults).

Ouachita River system in Arkansas.—Sta. 23, Fallen Fork (of Little Missouri River), near Newhope (5 breeding adults); Sta. 24, Little Missouri River, 3 miles east of Newhope (1 ripe and 1 spent female); Sta. 25, Self Creek, tributary to Little Missouri River, near Daisy (6 half-grown adults); Sta. 29, tributary of Ouachita River, 1 mile west of Board Camp (9 breeding adults); Sta. 30, tributary of Ouachita River, 4 miles west of Board Camp (5 breeding adults); Sta. 31, tributary of Ouachita River, 6 miles north of Mena (a series of breeding adults).

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, 11 miles south of Waldron (1 half-grown and 1 adult female); Sta. 33, tributary of Fourche la Fave River, 9 miles south of Waldron (a series of small adults);

Sta. 34, Poteau River, near Waldron (3 ripe females); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (small series, adults); Sta. 36, Little Petit Jean River, 13 miles northwest of Waldron (a series of adults).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek, tributary to Poteau River, 3 miles north of Red Oak (small series, half-grown to adults); Sta. 45, Little Skin Bayou, near Muldrow (15 spent and mature adults); Sta. 46, Big Skin Bayou, 9 miles east of Sallisaw (1 nuptial male); Sta. 47, Little Sallisaw Creek, 3 miles east of Sallisaw (1 spent and 2 ripe females); Sta. 55, Elk River, tributary to Neosho River, 7 miles north of Grove (4, young to ripe and spent adults).

We have examined the types of *Alburnus umbratilis* Girard (1856: 193), in the National and Harvard museums; of *Luxilus lucidus* Girard (1856: 193), in the Museum of Comparative Zoology, and of *Minnilus nigripinnis* Gilbert, in the National Museum, and find them all indentifiable as *N. u. umbratilis*, excepting a few of the types of *umbratilis*, which look like the specimens from Sta. 39, mentioned under the account of *N. fumeus*.

Even within the race which we designate as typical *umbratilis* there is much variation. This is chiefly due to the differential degree of modification of the males. Some males mature at a small size (as small as 31 mm. to caudal fin) and with the appearance of the females (which may mature at a length of only 27 mm.), whereas others become considerably deepened, with the nape elevated, the body darkened (in extreme cases marked with obscure blackish bars), and the vertical fins variously darkened, sometimes jet black. The extreme types are apparently not developed at all localities, and at some stations even the small males are considerably modified. We do not find any reason for regarding these sexual variations as of subspecific significance.

The nuptial tubercles in typical *umbratilis* are most strongly developed on the chin and snout, but cover the entire head and in well developed males most of the body as well, but always become obsolescent toward the caudal peduncle and middle of belly. They are fine on the body, about ten on each scale, in a series near the scale margin. The tubercles are hooked forward. They are very fine and in several series along the inner edge of each pectoral ray: weaker on the pelvic and front of dorsal and anal fin.

38. **Phenacobius mirabilis** (Girard)

(Sucker-mouth minnow)

Arkansas River system in Arkansas.—Sta. 34, Poteau River near Waldron (small series, young to half-grown); Sta. 37, Lee Creek, 3 miles northwest of Van Buren (1 large young).

Arkansas River system in Oklahoma.—Sta. 44, Arkansas River 5½ miles southwest of Ft. Smith (3 half-grown); Sta. 59, Hominy Creek (Verdigris system), 8 miles west of Skiatook (1 half-grown).

The specimens from the Arkansas River near Fort Smith are topotypes of *Exoglossum mirabile* Girard. A comparison of these with specimens from Doniphan County, Kansas, taken near the type-locality of *Sarcidum scopiferum* Cope, discloses no significant

differences in number of scales, intensity of darkening of margins of scale pockets nor in any other character. We therefore follow Forbes and Richardson (1909 and 1920: 159) in regarding as identical these two species, held distinct by Jordan and Evermann (1896: 303). We append the scale counts (in lateral line from shoulder girdle to extreme base of caudal rays) of these topotypic specimens, as well as of examples from other localities. No notable geographic trend is evident.

Table I. Variation in number of scales in Phenacobius mirabilis.

	Scales in lateral line								
	41	42	43	44	45	46	47	48	49
Yuma County, Colorado	—	—	1	—	—	1	1	—	1
Erie, Colorado	1	1	—	—	—	—	—	—	—
Julesburg, Colorado	—	1	1	—	1	—	—	—	—
Doniphan County, Kansas	—	1	—	—	—	1	—	—	—
Rock Creek, Kansas	—	—	1	—	—	—	—	—	—
Neosho River, Kansas	—	—	—	1	—	—	—	—	—
Peace Creek, Kansas	—	—	—	—	—	—	1	—	—
Arkansas River, Kansas	—	—	—	—	1	—	—	—	—
Coldwater Creek, Oklahoma	—	—	—	—	—	1	—	—	—
Cimarron River, Oklahoma	—	—	—	4	—	1	—	—	—
Salt Fork, Arkansas River, Oklahoma	—	—	—	—	1	—	—	—	—
West Carrizzo Creek, Oklahoma	—	—	—	—	1	—	—	—	—
Hominy Creek, Oklahoma	—	—	1	—	—	—	—	—	—
Arbuckle Mountain Creek, Oklahoma	—	—	—	—	—	1	—	—	—
Arkansas River, near Ft. Smith	—	—	1	—	2	—	—	—	—
Poteau River, Arkansas	—	1	2	2	—	—	1	—	—
Lee Creek, Arkansas	—	—	—	1	—	—	—	—	—
West Fork, Clark River, Kentucky	—	—	1	1	—	—	—	—	—
Southern Illinois	—	—	1	2	1	—	2	—	—
Southern Indiana	—	5	4	3	1	3	—	1	1
Southern Ohio	—	—	—	—	2	—	2	1	—
Northern Ohio (near Findlay)	—	—	—	—	—	1	—	—	—
Total	1	9	13	14	10	9	7	2	2

39. **Notemigonus crysoleucas crysoleucas** (Mitchill)

(Golden shiner)

Arkansas River system in Oklahoma.—Sta. 38, North Canadian River, 7 miles south of Weleetka (12 yearlings to adults); Sta. 41, Black Fork (of Poteau River), 6 miles south of Heavener (1 yearling); Sta. 43, Poteau River, about 6½ miles southwest of Ft. Smith (7 large young); Sta. 44, Arkansas River, 5½ miles southwest of Ft. Smith (2 young to half-grown); Sta. 47, Little Sallisaw Creek, 3 miles east of Sallisaw (23 adults); Sta. 57, Pryor Creek, Rogers County, tributary of Neosho River (7 half-grown to adults); Sta. 58, Verdigris River, 5 miles west of Claremore (10 half-grown to adults); Sta. 59, Hominy Creek (Verdigris system), 8 miles west of Skiatook (1 half-grown).

These specimens like most of those already collected in Oklahoma, show a rather low number of anal rays. The counts are given in the appended table.

Table 2. Showing variations in number of anal rays in Notemigonus crysoleucas *from Oklahoma.*

	Number of principal anal rays			
	11	12	13	14
Station				
38	—	1	10	1
41	—	—	1	—
43	—	4	3	—
44	—	—	2	—
47	1	17	11	4
57	—	—	6	1
58	1	2	7	—
59	—	1	—	—
Total	2	25	40	6

The absence of this species from our collections in Arkansas is readily explained by its preference for sluggish water. It appears to tolerate a considerable range of alkalinity, for it was taken in waters in Oklahoma varying in hydrogen ion concentration from 6.8 to 8.2.

The largest specimen taken (at Sta. 58) is 105 mm. long to caudal.

40. **Chrosomus erythrogaster** Rafinesque

(Red-belly dace)

Arkansas River system in Oklahoma.—Sta. 48, Sallisaw Creek, near Bunch (1 spent male); Sta. 50, Barren Fork (of Illinois River), near Baron (large series, half-grown to adults); Sta. 51, Illinois River, 4 miles northwest of Watts (1 young); Sta. 52, Bouyer Branch (of Illinois River), 6 miles northwest of Watts (2 young); Sta. 55, Elk River, Neosho system, 7 miles north of Grove (1 young).

These are the first records for *Chrosomus* in Oklahoma. The species has, however, been reported from the Neosho basin in Missouri (Evermann and Kendall, 1895: 470).

We also have specimens collected by W. J. Clench two miles south of De Soto, Missouri.

The postnuptial male from Sta. 48 retained its life colors in formaldehyde. It was olivaceous, grading toward dusky near the black-gray vertebral streak; abruptly silvery below main lateral band, and (less brilliantly so) between the two dark bands on the posterior half of the length. The head on and below the mouth and below the silvery cheeks and opercle was red: the lower surface of the body, orange.

The nuptial tubercles, as shown by the breeding male in the lot from Sta. 50, are very characteristic. They are sharp and hook-

ed backward. Except for minute organs they are few in number on the head; there is, however, a thick patch on the opercle toward its margin, widest dorsally. Over the body a single sharp pearl organ is developed on each scale, near its apex. They become stronger on the caudal peduncle toward its lower surface, where the number of tubercles is usually two to five on each scale. The organs are obsolete on the lower sides of the trunk, except on the breast between the pectorals, where they are located one per scale, and before the pectorals, where they occur in ten very regular and characteristic comb-like series. On the pectoral fin the horny cones resemble those of the body except that they are hooked forward instead of backward; on this fin they are ranged on each ray in one series, which forks once toward the tip of the fin. On the dorsal fin the tubercles are weak; on the pelvic, obsolescent; on the anal, absent.

41. **Dionda nubila** (Forbes)

(Forbes minnow)

Arkansas River system in Oklahoma.—Sta. 48, Sallisaw Creek, near Bunch (2 half-grown and a series of adults); Sta. 51, Illinois River, 4 miles northwest of Watts (2 young); Sta. 52, Bouyer Branch (of Illinois River), 6 miles northwest of Watts (8 adults); Sta. 53, Flint Creek, a branch of Illinois River, 8 miles west of Arkansas line (8 mature and spent adults); Sta. 54, Spavinaw Creek, Neosho system, 7 miles south of Jay (small series, young to breeding adults); Sta. 55, Elk River, tributary to the Neosho, 7 miles north of Grove (series of adults, some mature).

Examples of this form were collected by W. J. Clench in Missouri—in a clear creek 2 miles west of Shepard, and in a small tributary of Big River, 4 and 6 miles, respectively, south of Potosi. Others were taken by Carl H. Eigenmann at Sarcoxie, Missouri. The species has been recorded once before from Oklahoma, by Meek (1894: 84); Meek's specimens, from the Sallisaw, have been reëxamined at the National Museum.

In breeding males the lateral band is almost jet black—so dark as to nearly obscure the black specks along the lateral line. Above the band is a light streak, then a dark one, as in *Notropis zonatus*. The area below the lateral band and on the lower side of the head is charged with pink. All the fins are orange about the bases, and this color is especially conspicuous in two patches on the caudal.

The nuptial tubercles are mostly small—moderate in size on top of head, weak on snout and chin—and cover most of the head and body, becoming obsolescent on the lower sides. On the body a considerable number occur along the edge of each scale. The organs are of moderate size on the inner side of pectoral, where they are in one row per ray basally and in two rows distally; they are very weak along the dorsal rays anteriorly and not apparent on the other fins. The tubercles on the head are suberect; on the body, somewhat hooked backward; on the pectoral fin, moderately hooked forward.

In Oklahoma, the females attain a length of 67 mm. to caudal.

An examination of type material at Washington has indicated that too many of Girard's nominal species of *Dionda* have been retained as valid by Jordan and Gilbert (1883: 155-157), Jordan (1885: 121), Evermann and Kendall (1894: 69-75 and 99) and Jordan and Evermann (1896: 214-216). Three of the nominal species, *plumbea, spadicea* and *grisea,* we refer to the synonymy of *Campostoma anomalum* (which see). The type of *Algoma amara* Girard (1856: 181), from near the mouth of the Rio Grande, appears referable to *Hybognathus nuchalis;* it has a relatively chubby body, elevated at the dorsal base (depth equal to length of head, contained 4.0 times in standard length); the eye moderate, distinctly shorter than snout (4.5 in head); the head somewhat gibbous (its width equal to length of head to posterior border of eye); the nape rather tumid; the dorsal fin pointed; the scale structure as in typical *nuchalis;* the suborbitals rather slender, but less so than in *hayi.* The type of *Algoma fluviatilis* seems to be lost; it is perhaps to be referred doubtfully to *H. nuchalis.* Of the *Dionda* series proper, types of *episcopa, texensis, argentosa, serena,* and *couchi* have been examined in the National Museum, and types of *D. texensis, argentosa, serena, couchi, chrysitis,* and *melanops* and of *Hybognathus punctifer* have been seen in the Museum of Comparative Zoology. We agree with Meek (1905: 48) in regarding all as representing a single species: all show at least a trace of a lateral band, of a caudal spot and of rather coarse punctulations, which tend to become concentrated over the lateral band and on special scales; in all the eye is rather large, and the snout short and decurved; the origin of the dorsal fin is about midway between base of caudal and nostril; the mouth is small, and rather more transverse than lateral; the scales are of moderate size (*D. "serena"* does not have larger scales than *episcopa,* for we count 37 in one and 38 in two types of the former and 37 in two of the later). We can now recognize only three species of *Dionda,* namely, *D. episcopa* Girard, *D. nubila* (Forbes) and *D. rasconis* (Jordan and Snyder).

42. **Hybognathus nuchalis** (Agassiz)

(Silver minnow)

Red River system in Arkansas.—Sta. 21, Cossatot River, tributary to Little River, 7 miles northwest of De Queen (1 half-grown).

Arkansas River system in Oklahoma.—Sta. 43, Poteau River, about 6½ miles southwest of Fort Smith (2 large young).

This form we now find is specifically distinct from *H. placitus* Girard, and often occurs with it at a single locality. As a whole it prefers the pools of small rivers, whereas *placitus* abounds in the shallows of plains streams with rather swift current.

The false assumption that these forms were only subspecifically distinct caused us to record the large-eyed form taken with *placitus* in the Red River system (Ortenburger and Hubbs, 1926: 132) as another species, *H. hayi* Jordan, whereas the specimens should have been referred to *H. nuchalis. Hybognathus hayi* appears to be a valid species, although known only from the few series

recorded by Hay and Jordan. Compared with *nuchalis* (equals *argyritis*) it has the eye larger, the suborbitals narrower, the snout sharper, the mandible almost terminal, the symphysial protuberance scarcely developed, the mandibular rami stronger, the teeth usually less compressed and close-set, and the intestines less extensively convoluted.

We have reëxamined practically all the Arkansas and Oklahoma material which was recorded by Jordan and Gilbert in 1886: 7, 11, 14, and 15, and by Meek in 1894: 76, 82, and 84, as *H. nuchalis*, and find that the identifications were correctly made. This is true even for Jordan and Gilbert's material from Lee Creek, Arkansas, where we secured *H. placitus*.

43. **Hybognathus placitus** (Girard)

(Plains silver minnow)

Arkansas River system in Arkansas.—Sta. 37, Lee Creek, 3 miles northwest of Van Buren (1 half-grown).

Arkansas River system in Oklahoma.—Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (a large series of half-grown to adults, many ripe); Sta. 60, South Canadian River, just south of Norman (22 half-grown).

As mentioned above, we have found *H. placitus* to be fully distinct specifically, rather than a subspecies of *H. nuchalis*. We have examined the types of *nuchalis, placitus, evansi,* and *argyritis,* as well as a vast amount of other material, and feel confident that the names *nuchalis* and *placitus* have been properly used, and that *argyritis* is a synonym of *nuchalis*, and *evansi* a synonym of *placitus*.

H. placitus differs from *H. nuchalis* in having the eye much smaller (typically less than one-sixth length of head), the head more turgid (its width greater than combined length of snout and eye), the body more nearly terete, less slabsided, and the silver less burnished.

In the Red River system *placitus* is represented by a form having the eye intermediate in size between that of more typical *placitus* and *nuchalis*, and the body averaging deeper and the fins larger and more falcate than in ordinary *placitus*. The Arkansas basin form is of course typical *placitus*. This is another instance of racial differentiation in the species inhabiting these two systems.

One of us (Hubbs) will soon prepare a paper dealing in more detail with the species of *Hybognathus*.

44. **Hypargyrus velox** (Girard)

(Bullhead minnow)

Ouachita River system in Arkansas.—Sta. 31, tributary to the Ouachita, 6 miles north of Mena (1 young).

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, 11 miles south of Waldron (2 half-grown).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek (a Poteau tributary), 3 miles north of Red Oak (1 breeding male); Sta. 44, Arkansas River, 5½ southwest of Fort Smith (3 half-grown to mature

adults); Sta. 55, Elk River, a Neosho tributary, 7 miles north of Grove (2 half-grown).

As indicated in our last report (Hubbs and Ortenburger, 1929: 35), this name should be used for the species ordinarily called *Ceratichthys vigilax*—which name properly replaces *Cochlognathus ornatus*.

The two adult males in the present collection both have a rather small eye, 4.5 in head; one from Sta. 44 has the tubercles as usual in two rows, but one from Sta. 39 has these organs in three rows, as in *Hyborhynchus;* the tubercles in this apparently abnormal specimen number 4 in the upper, 4 in the middle and 3 in the lower row, not counting a supernumerary one behind the left nostril and another on the middle of the upper lip.

The young of this species tend to resemble *Hyborhynchus* in having the mouth somewhat overhung by the snout. They can readily be distinguished, however, by the silvery peritoneum and by the more definite dark margining of the scale pockets.

45. **Hyborhynchus notatus** (Rafinesque)

(Blunt-nose minnow)

Red River system in Oklahoma.—Sta. 10, Big Cedar Creek, tributary to Kiamichi River, Le Flore County (1 half-grown); Sta. 12, Kiamichi River, Le Flore County (1 young, several adults); Sta. 13, Kiamichi River, near last station (1 adult).

Red River system in Arkansas.—Sta. 16, headwater tributary of Mountain Fork (of Little River), 8 miles east of state line (1 young, 1 adult); Sta. 17, tributary of Mountain Fork, 3 miles south of Mena (9 half-grown); Sta. 18, tributary of Mountain Fork, southwest of Potter (1 half-grown); Sta. 20, Rolling Fork (of Little River), near Wickes (small series, half-grown to adult); Sta. 22, Saline River, branch of Little River, 6 miles west of Dierks (3 half-grown).

Ouachita River system in Arkansas.—Sta. 23, Fallen Fork (of Little Missouri River), near Newhope (6 adults); Sta. 24, Little Missouri River, 3 miles east of Newhope (4 young to half-grown); Sta. 25, Self Creek, tributary to Little Missouri River, near Daisy (5 half-grown to adults); Sta. 27, Caddo Creek, near Glenwood (large series, young to adult); Sta. 29, tributary of Ouachita River, 1 mile west of Board Camp (3 half-grown); Sta. 30, tributary of Ouachita River, 4 miles west of Board Camp (4 half-grown to adults).

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, 11 miles south of Waldron (5 half-grown); Sta. 33, tributary of Fourche la Fave River, 9 miles south of Waldron (small series, young to adult); Sta. 34, Poteau River, near Waldron (small series, young to adult); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (2 young, 13 adults); Sta. 36, Little Petit Jean River, 13 miles northwest of Waldron (small series of adults); Sta. 37, Lee Creek, 3 miles northwest of Van Buren (small series of adults).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek, a Poteau tributary, 3 miles north of Red Oak (small series of adults); Sta. 45, Little Skin Bayou, near Muldrow (4 adults); Sta. 46, Big Skin Bayou, 9 miles

east of Sallisaw (1 mature female); Sta. 48, Sallisaw Creek, near Bunch (4 adults); Sta. 51, Illinois River, 4 miles northwest of Watts (2 adults, 1 ripe); Sta. 53, Flint Creek, tributary of Illinois River, 8 miles west of state line (1 half-grown); Sta. 55, Elk River, tributary to Neosho River, 7 miles north of Grove (series, half-grown to adults); Sta. 56, Little Cabin Creek, tributary to Neosho River, 3 miles east of Vinita (1 young).

46. **Pimephales promelas confertus** (Girard)

(Black-head minnow of the Southwest)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles northwest of Cache (1 adult).

Arkansas River system in Oklahoma.—Sta. 38, North Canadian River, 7 miles south of Weleetka (9 adults); Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (series, young to adult); Sta. 58, Verdigris River, 5 miles west of Claremore (1 breeding male); Sta. 60, South Canadian River, just south of Norman (11 young to adults).

47. **Campostoma anomalum** (Rafinesque)

(Stone-roller minnow)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles northwest of Cache (large series, young to adults); Sta. 3, Kiamichi River, Le Flore County (5 young); Sta. 7, tributary of Kiamichi River, Le Flore County (2 young); Sta. 8, tributary of Kiamichi River (7 young); Sta. 9, Kiamichi River (9 young); Sta. 11, tributary to Kiamichi River (1 adult); Sta. 13, Kiamichi River (series, young to large adults).

Red River system in Arkansas.—Sta. 16, headwater tributary of Mountain Fork (of Little River), 8 miles east of state line (1 young); Sta. 20, Rolling Fork (of Little River), near Wickes (1 young and 1 adult); Sta. 22, Saline River, tributary to Little River, 6 miles west of Dierks (5 young and 2 adults).

Ouachita River system in Arkansas.—Sta. 23, Fallen Fork (of Little Missouri River), near Newhope (small series, young to adults); Sta. 24, Little Missouri River, 3 miles east of Newhope (series of young and 1 adult); Sta. 25, Self Creek, tributary to the Little Missouri, near Daisy (4 half-grown to adults); Sta. 26, Akle Creek, tributary to Caddo Creek, 1 mile south of Glenwood (1 adult); Sta. 27, Caddo Creek, near Glenwood (4 young to adults); Sta. 28, Lick Creek, tributary to Caddo Creek, Montgomery County (11 young); Sta. 30, tributary of Ouachita River, 4 miles west of Board Camp (7 young to adults); Sta. 31, tributary of Ouachita River, 6 miles north of Mena (2 young).

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, 11 miles south of Waldron (1 large young); Sta. 34, Poteau River, near Waldron (9 half-grown); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (4 young); Sta. 36, Little Petit Jean River, 13 miles northwest of Waldron (small series of young to adults); Sta. 37, Lee Creek, 3 miles northwest of Van Buren (1 half-grown).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek, a Poteau tributary, 3 miles north of Red Oak (1 half-grown); Sta. 41, Black Fork (of Poteau River), 6 miles south of Heavener (1 young); Sta. 42, tributary

of Black Fork, 6 miles south of Heavener (several young and 1 adult); Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (5 half-grown); Sta. 45, Little Skin Bayou, near Muldrow (1 young); Sta. 46, Big Skin Bayou, 9 miles east of Sallisaw (small series, young to adults); Sta. 48, Sallisaw Creek, near Bunch (small series, young to adults); Sta. 50, Barren Fork (of Illinois River), near Baron (7 young to adults); Sta. 51, Illinois River, 4 miles northwest of Watts (small series of young and 1 adult); Sta. 52, Bouyer Branch (of Illinois River), 6 miles northwest of Watts (series of young); Sta. 53, Flint Creek (a branch of the Illinois River), 8 miles west of state line (small series young to half-grown); Sta. 54, Spavinaw Creek, tributary to the Neosho, 7 miles south of Jay (series of young and 8 adults); Sta. 55, Elk River, tributary to the Neosho, 7 miles north of Grove (series, young to half-grown); Sta. 57, Pryor Creek, near Chelsea (a tributary of Neosho River) (3 half-grown).

Specimens of this species were collected in Missouri, by W. J. Clench, in creeks 2 miles west of Shepard, 2 miles south of DeSoto, and 4 miles south of Potosi.

Three species of *"Dionda"* described by Girard (1856: 178 and 1858: 228-230, pl. 52), under the names of *D. plumbea, D. spadicea* and *D. grisea,* have long been a puzzle to ichthyologists. They appear to differ from the other species of *Dionda* in having smaller scales, but no such species of that or any closely related genus has since been found. Jordan and Gilbert (1883: 155) and Jordan (1885: 121) doubtfully united the three species under the name of *Zophendum plumbeum.* Jordan and Evermann (1896: 216) take essentially the same view, but call the species *Hybognathus plumbea.* The fact that no species of *Hybognathus* or *Dionda* corresponding with the accounts of the three nominal species united under this name have been secured in the Oklahoma survey, which has covered the general region from which these nominal species were secured, has led us to reconsider the case. On examining Girard's three figures, we are struck by their resemblance to *Campostma anomalum.* This fact taken with the additional evidence that Girard lists no *Campostoma* from the same region (where, however, it is one of the most abundant and wide-spread of fishes), makes it possible definitely to refer *Dionda plumbea, Dionda spadicea* and *Dionda grisea* Girard, all to the synonymy of *Campostoma anomalum* Rafinesque The discovery of a type of *D. plumbea* and one of *D. grisea,* in the Museum of Comparative Zoology, each certainly an example of *C. anomalum,* clinches this view.

AMEIURIDAE

48. Ictalurus punctatus (Rafinesque)

(Channel cat)

Arkansas River system in Oklahoma.—Sta. 46, Big Skin Bayou, 9 miles east of Sallisaw (4 young); Sta. 58, Verdigris River, 5 miles west of Claremore (1 small adult).

Since this is a species of the river channels, its absence from our collections in the upland tributaries of the Red, Ouachita, and Arkansas rivers is easily explained.

49. Ameiurus melas catulus (Girard)

(Black bullhead of the Southwest)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles northwest of Cache (2, half-grown to adult); Sta. 7, tributary to Kiamichi River, Le Flore County (9 young and yearlings); Sta. 8, tributary to Kiamichi River (1 large young).

Arkansas River system in Oklahoma.—Sta. 38, North Canadian River, 7 miles south of Weleetka (3 young); Sta. 43, Poteau River, about 6½ miles southwest of Fort Smith (very large series of young and 3 adults); Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (a large series of young); Sta. 46, Big Skin Bayou, 9 miles east of Sallisaw (1 young); Sta. 47, Little Sallisaw Creek, 3 miles east of Sallisaw (1 young and 1 adult); Sta. 49, Sallisaw Creek, near Bunch (7 half-grown to adults); Sta. 57, Pryor Creek, near Chelsea (3 young to half-grown); Sta. 58, Verdigris River, 5 miles west of Claremore (large series of young to adult, mostly young).

The systematic status of this bullhead was discussed in our last report (Hubbs and Ortenburger, 1929: 39). The specimens from the Arkansas and Poteau rivers above Fort Smith are topotypes of the subspecies.

Most of our collections of this form have come from expected situations—weedy backwaters, overflow pools, etc. Its absence from our Arkansas collection is doubtless due to the fact that our collecting in that state was almost entirely in mountain streams.

In the larger streams this bullhead attains a considerable size. The largest specimen seen, from the Poteau River above Fort Smith, measures 232 mm. to the caudal fin.

50. Ameiurus natalis (Le Sueur)

(Yellow bullhead)

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, 3 miles east of Newhope (11 young).

Arkansas River system in Oklahoma.—Sta. 51, Illinois River, 4 miles northwest of Watts (1 young); Sta. 52, Bouyer Branch (of Illinois River), 6 miles northwest of Watts (1 young).

These records indicate that *Ameiurus natalis* in the Southwest as well as in the north inhabits cleaner and swifter water than *A. melas*.

51. **Noturus flavus** Rafinesque

(Yellow stone-cat)

Arkansas River system in Oklahoma.—Sta. 55, Elk River (Neosho system), 7 miles north of Grove (2 adults).

This is the only record of this species for Oklahoma, other than Jordan and Gilbert's (1886: 7).

52. Schilbeodes miurus (Jordan)

(Brindled stone-cat)

Arkansas River system in Arkansas.—Sta. 36, Little Petit Jean River, 13 miles northwest of Waldron (2 young).

These specimens have been compared with Indiana examples of *miurus* and *eleutherus* (both of which have been recorded from Oklahoma and Arkansas), and found to agree more satisfactorily with the former than with the latter.

ESOCIDAE

53. **Esox vermiculatus** (Le Sueur)

(Mud or grass pickerel)

Red River system in Oklahoma.—Sta. 7, tributary to Kiamichi River, Le Flore County (3, half-grown to adult); Sta. 8, tributary to Kiamichi River (5 young to adults); Sta. 9, Kiamichi River (2 half-grown and 1 adult); Sta. 10, Big Cedar Creek, tributary to Kiamichi River (1 young); Sta. 12, Kiamichi River (2 large young).

Red River system in Arkansas.—Sta. 17, tributary of Mountain Fork (of Little River), 3 miles south of Mena (1 small adult); Sta. 20, Rolling Fork (of Little River), near Wickes (1 half-grown).

Arkansas River system in Oklahoma.—Sta. 43, Poteau River, about 6½ miles southwest of Fort Smith (1 half-grown).

CYPRINODONTIDAE

54. **Fundulus catenatus** (Storer)

(Studfish)

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, 3 miles east of Newhope (12 young to adults); Sta. 25, Self Creek, near Daisy, tributary to the Little Missouri (4 half-grown); Sta. 27, Caddo Creek, near Glenwood (22 young to adults, some ripe, some spent); Sta. 28, Lick Creek, Montgomery County, tributary to Caddo Creek (small series, young to adults); Sta. 29, tributary of Ouachita River, 1 mile west of Board Camp (5 young to adults); Sta. 30, tributary to Ouachita River, 4 miles west of Board Camp (7 half-grown to adults).

Fundulus catenatus is apparently a common species in the Ouachita system. It is one of the forms common to the Tennessee and Ozark uplands.

This species is one of the gaudiest of all the American killifishes. A breeding male from Sta. 28 when received still retained its vivid colors, and was then described as follows. It is beautifully streaked with orange and blue. The blue lines are really the ground color, for the orange streaks represent the confluent spots on each scale. These spots become black on the back before the dorsal fin, and become isolated and less sharply distinguished from the ground color on the belly. Small orange spots occur on the bronzy cheeks, and blood-red ones on the opercles contrast with the blue ground color. Orange-red spots are profuse on the bluish gray dorsal and anal fins, toward their base and posterior edge. The dorsal is darker than the anal; both become lighter toward the margin. The pectoral fin is plain dusky; the pelvic fin is somewhat dusky, with bright red spots on its inner half. The caudal fin is dusky, darkest in an in-

distinct subterminal band; the membranes on the basal half of the fin shows some small dusky orange spots. Females are much duller, as indicated by one of us in 1926 (Hubbs, 1926a: 10).

55. **Fundulus sciadicus** (Cope)

(Orange-fin top minnow)

Arkansas River system in Oklahoma.—Sta. 54, Spavinaw Creek, 7 miles south of Jay, tributary of Neosho River (1 adult female).

This species has not before been reported from so far south as Oklahoma. It is characteristic of the Missouri River basin, but has been described from the Gasonade and Neosho systems in Missouri. under the name of *Zygonectes macdonaldi,* by Meek (1891: 122 and 126). Our example agrees satisfactorily with a specimen of *macdonaldi,* which, however, we do not distinguish from *F. sciadicus* (see Hubbs, 1926a: 10).

The adult female, from Sta. 54, when fresh had the body dusky greenish, and the fins orange.

56. **Fundulus notatus** (Rafinesque)

(Black-stripe topminnow)

Red River system in Oklahoma.—Sta. 8, tributary to Kiamichi River, Le Flore County (1 adult); Sta. 12, Kiamichi River, Le Flore County (several small adult females).

Red River system in Arkansas.—Sta. 21, Cossatot River, tributary to Little River, 7 miles north of De Queen (1 adult male).

Ouachita River system in Arkansas.—Sta. 23, Fallen Fork of Little Missouri River (1 adult female); Sta. 28, Lick Creek, tributary to Caddo Creek, Montgomery County (6 adults).

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, 11 miles south of Waldron (2 young); Sta. 33, tributary to Fourche la Fave River, 9 miles south of Waldron (1 young and 3 adults); Sta. 34, Poteau River, near Waldron (several young to adults); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (2 young).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek, tributary to Poteau River, Latimer County (3 adults); Sta. 46, Big Skin Bayou, 9 miles east of Sallisaw (4 adults); Sta. 47, Little Sallisaw Creek, 3 miles east of Sallisaw (1 adult); Sta. 51, Illinois River, 4 miles northwest of Watts (1 young and 7 adults); Sta. 55, Elk River, tributary to Neosho River, 7 miles north of Grove (several adults); Sta. 56, Little Cabin Creek (tributary to Neosho River), 3 miles east of Vinita (1 young); Sta. 57, Pryor Creek (tributary to the Neosho), near Chelsea (1 half-grown male and 1 adult female); Sta. 59, Hominy Creek, tributary of Verdigris River, 8 miles west of Skiatook (1 half-grown male).

The specks on the body vary from being diffuse or even indistinct to being sharp, round, and black. We are, however, unable to attach any racial importance to this variation, for it shows no clear-cut geographical relation, and is not always consistent at a single locality.

57. **Plancterus kansae** (Garman)

(Plains killifish)

Arkansas River system in Oklahoma.—Sta. 60, South Canadian River, just south of Norman (15 adults).

POECILIIDAE

58. **Gambusia patruelis** (Baird and Girard)

(Topminnow of the Mississippi Valley)

Arkansas River system in Oklahoma.—Sta. 38, North Canadian River, 7 miles south of Weleetka (1 pregnant female); Sta. 43, Poteau River, about 6½ miles southwest of Fort Smith (series, young to adult, many gravid); Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (series of young to adults, many gravid); Sta. 59, Hominy Creek, 8 miles west of Skiatook, tributary of Verdigris River (1 gravid female); Sta. 60, South Canadian River, just south of Norman (17 adults, mostly spent).

Among the specimens from stations 43, 44, and 60 are a number of males each showing the gonopodial characters which are diagnostic of the species (see Hubbs, 1926a: 25 and 38-41).

The absence of this species from our mountain-streams collections was to be expected.

APHREDODERIDAE

59. **Aphredoderus sayanus** (Gilliams)

(Pirate perch)

Ouachita River system in Arkansas.—Sta. 23, Fallen Fork (of Little Missouri River), near Newhope (1 adult).

PERCIDAE

60. **Hadropterus macrocephalus** (Cope)

(Mountain black-side darter)

Red River system in Arkansas.—Sta. 18, tributary to Mountain Fork of Little River, southwest of Potter (1 adult).

Arkansas River system in Arkansas.—Sta. 33, tributary to Fourche la Fave River, 9 miles south of Waldron (1 adult).

Arkansas River system in Oklahoma.—Sta. 41, Black Fork of Poteau River, 6 miles south of Heavener (1 young).

These specimens are provisionally identified as *H. macrocephalus*, a species hitherto recorded only from the western slope of the Allegheny Mountains. That species is said to be characterized by the almost complete lack of scales on the cheeks, whereas Oklahoma and Arkansas specimens have the cheeks well scaled. But the cheeks are also scaly in some specimens from the Tennessee basin.

Our specimens differ from *Hadropterus maculatus* (equals

aspro) in having the scales smaller (pores 76 to 86), the lateral blotches more numerous (9 to 16), the head slenderer, the snout more pointed and produced and the eye relatively smaller (1.4 in snout in adult), and the mouth larger (upper jaw nearly one-third as long as head). The one with 16 lateral spots is particularly extreme, in form as well as in color, and it may represent an undescribed species (it came from Sta. 18). The young example from Sta. 41 has the scales small as in the two adults, but the eye is as long as the snout (probably because of its youth), and the lateral markings are in the form of a streak slightly expanded at about seven or eight places (a similar variation in coloration is shown by Alleghenian specimens). A further study of darters of this type in Oklahoma and Arkansas is much needed. In fact, the whole *maculatus* group needs revision.

61. **Percina caprodes caprodes** (Rafinesque)

(Southern log-perch)

Red River system in Arkansas.—Sta. 16, headwater tributary of Mountain Fork (of Little River), 8 miles east of state line (1 adult); Sta. 20, Rolling Fork (of Little River), near Wickes (1 young).

Arkansas River system in Arkansas.—Sta. 34, Poteau River, near Waldron (1 adult); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (1 adult); Sta. 36, Little Petit Jean River, 13 miles northwest of Waldron (1 adult).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek (tributary to Poteau River), 3 miles north of Red Oak (1 adult); Sta. 55, Elk River, tributary to Neosho River, 7 miles north of Grove (1 young and 2 large adults).

The nape is consistently scaled to the occiput in these specimens, and the bars on the body are long.

The adults from Elk River (Sta. 55) are the largest and most highly colored examples of this species that we have ever seen. Their sides are lemon-yellow, becoming dusky on the back and creamy on the belly, and are crossed by nine primary brown bands, which extends from the mid-dorsal line to the lower side. Shorter secondary bars alternate with the main ones, and some very narrow tertiary bars are present. The spinous dorsal shows some yellow at the very base and a conspicuous yellow subterminal band, which has not hitherto been described; the rest of the fin is translucent dusky, with blackish dashes or blotches on the membranes. The second dorsal rays are marked with alternating bars of deep brown and light yellow, each forming about five lengthwise rows; the yellow color becomes brightened toward the base and front of fin. The caudal fin is colored like the second dorsal. The anal is pale watery yellowish, with bare traces of dark markings. The paired fins are yellower, and are marked with evident dark dashes.

62. **Cottogaster copelandi** (Jordan)

(Copeland darter)

Red River system in Arkansas.—Sta. 22, Saline River (tributary to Little River), 6 miles west of Dierks (2 adults).

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, 3 miles east of Newhope (1 adult).

Arkansas River system in Arkansas.—Sta. 36, Little Petit Jean River, 13 miles northwest of Waldron (5 adults).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek (tributary to Poteau River), 3 miles north of Red Oak (1 adult).

Cottogaster copelandi has once before been recorded from Oklahoma: Jordan and Gilbert (1886: 9) obtained it in the Poteau River at Slate Fork.

Hubbs and Greene (1928: 382-384) erred in regarding this species as generically distinct from *C. putnami*. The two forms now appear to be at most only subspecifically distinct. The supposed difference in the stiffness of the anal spines does not hold, and the attributing to *copelandi* of an enlarged and tuberculated anal fin in the breeding male rose from the confusion of examples of *Imostoma* and *Cottogaster* from one locality. Except for these unfortunate errors, the account of Hubbs and Greene seems to be essentially correct.

63. **Ammocrypta vivax** Hay

(Arkansas sand darter)

Red River system in Arkansas.—Sta. 22, Saline River (tributary to Little River), 6 miles west of Dierks (11 adults).

This form, for years regarded as a subspecies of *A. pellucida*, appears to be specifically distinct. It has never been shown to intergrade with *pellucida*. It differs from that form not only in color features pointed out correctly by Jordan and Gilbert (1886: 9), but also in dentition: the outer teeth are moderately enlarged (scarcely enlarged in *pellucida*; much enlarged in *beani*). We have lately examined the types and numerous other specimens of these three species in the National Museum.

64. **Ulocentra stigmaea** (Jordan)

(Spotted darter)

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, 3 miles east of Newhope (1 adult).

Arkansas River system in Oklahoma.—Sta. 55, Elk River (tributary to Neosho River), 7 miles north of Grove (2 adults).

This species has been recorded several times from Arkansas, but never before from Oklahoma. It greatly resembles *Boleosoma nigrum*, but differs in having a sharper snout, two anal spines and brighter life colors. The specimens from Elk River when fresh had the extreme base of the first dorsal yellow, except over the dorsal saddles where it was black.

The cheeks are scaly above in the specimens from Sta. 24, but almost scaleless in those from Sta. 55.

65. **Boleosoma nigrum nigrum** (Rafinesque)

(Johnny darter)

Red River system in Oklahoma.—Sta. 6, Kiamichi River, Le Flore County, 7 miles west of Arkansas line (2 half-grown).

Arkansas River system in Arkansas.—Sta. 34, Poteau River, near Waldron (2 half-grown).

The examples from the Red River basin have the snout unusually blunt, but in other characters do not approach *B. camurum*: the dorsal fins are closely approximated, the lateral line is much more than half complete, the scales are absent on the cheeks and are of moderate size on the body.

Meek has given (1894: 94) the only previous Oklahoma record (McAlester) for this species.

66. **Poeciichthys coeruleus** (Storer): **pulchellus** (Girard) × **spectabilis** (Agassiz)

(Intergrades between Missouri and Oklahoma rainbow darters)

Arkansas River system in Oklahoma.—Sta. 50, Barren Fork (of Illinois River), near Baron (3 small adults); Sta. 55, Elk River, tributary to the Neosho River, 7 miles north of Grove (1 young and 1 adult).

It is often desirable to identify, record, and catalog specimens intermediate between two subspecies as intergrades. For this purpose an intergrade symbol, as concise as is consistent with clarity and distinctiveness, seems highly desirable. Hubbs and Greene (1928: 385) have proposed a form which we follow in the present instance: the specific name followed by a colon, and the subspecies names alphabetically arranged and separated by a multiplication sign (×)—the conventional symbol of hybridization.

In northeastern Oklahoma, which lies between the ranges of *spectabilis* and *pulchellus* (the form usually called *lepidus*), we find that the distinctive features of these two forms of rainbow darter do not hold. The opercles are neither consistently well scaled as in *spectabilis* (and typical *coeruleus*), nor wholly scaleless as in *pulchellus*. In the examples from Sta. 50, the opercles are well scaled in one and wholly scaleless in two; the dark streaks are interrupted abruptly at intervals of several spots, as in typical *pulchellus*, but are more conspicuous than in that form. In the adult from Sta. 55 the cheeks are incompletely scaled; the body is pale yellow, becoming orange between the 8 or 9 squarish brown saddles; the lateral bars are very indistinct, and developed only toward the caudal fin; the whole sides are marked with black streaks formed of dots on the scales, interrupted at intervals of 1 to 5 spots; the spinous dorsal is yellowish at the base, with black marks opposite the dorsal blotches, then light, then dark (becoming blackish near the front and toward the rear of the fin), then orange in a broad band, finally tipped narrowly with dusky.

We therefore follow Gilbert (1889: 609) in uniting *pulchellus* as well as *spectabilis* specifically with *Poecilichthys coeruleus.*

67. Poecilichthys coeruleus pulchellus (Girard)

(Oklahoma rainbow darter)

Red River system in Oklahoma.— Sta. 1, West Cache Creek, 9 miles northwest of Cache (2 young).

Ouachita River system in Arkansas.—Sta. 23, Fallen Fork (of Little Missouri River), near Newhope (1 young).

Arkansas River system in Oklahoma.—Sta. 42, tributary of Black Fork (of Poteau River), 6 miles south of Heavener (1 young, 1 adult); Sta. 48, Sallisaw Creek, near Bunch, Adair County (1 adult).

The single example from Sallisaw Creek (from which Meek in 1894 (p. 86) recorded *"Etheostoma coeruleum spectabile")* seems to be typical of *pulchellus.* It has the cheeks scaleless and the opercles rather loosely scaled. The dark streaks are barely evident, except as black spots and dashes on the dusky olivaceous bars. The light ground color is yellow, with a large orange area covering most of the median two-thirds of the vertical interspace between the dark bars. The spinous dorsal is bright orange near the base, then pale dusky orange to a light streak within the bluish black border. The soft dorsal is similarly but less intensely colored.

This form is the one usually known as *Ethcostoma lepidum,* and characterized by having the cheeks and opercles both scaleless. This identification we regard as probably incorrect, for the types of *Boleosoma lepida* Baird and Girard, in the National Museum and the Museum of Comparative Zoology, have the cheeks loosely to closely scaled (the opercles scaleless). In this respect they approach *P. lepidogenys* Evermann and Kendall from the same general region in Texas, but that form certainly looks different, and has smaller scales (scales along lateral line 50 to 52 in the types of *lepida).* An additional specimen of *lepidogenys* from the type-locality has the head blunter than in *lepidus,* and shorter (3.8, rather than 3.4 to 3.6 in standard length); a slenderer body (depth, 5.6); smaller scales (57); the cheek scales less imbedded, and hence more conspicuous; the color pattern more disrupted, the bars more numerous but less distinct; the caudal and soft dorsal fins more strongly barred; the caudal base with three spots; lateral line extending back to subtend only the first fourth of the second dorsal base. *P. lepidogenys* may be more closely related to *jessiae* or to *whipplii* than to *coeruleus; lepidus* is probably to be regarded as a subspecies of *P. coeruleus.*

The form usually called *lepidus* is now named *P. c. pulchellus,* because a cotype of *Oligocephalus pulchellus,* from Gypsum Creek, tributary of the Canadian River, examined in the Museum of Comparative Zoology, has the head wholly scaleless; 53 scales along lateral line to caudal base; the lateral line incomplete; the body banded, with lateral streaks best developed over the bands; the scapular spot little developed.

Proceeding from the northeast to the southwest, the subspecies of *Poecilichthys coeruleus* therefore appear to be (1) *P. c. coeruleus*

(Storer), with the opercles scaled, the cheeks scaleless except along the orbit, and no prominent lengthwise streaks, intergrading with *spectabilis* in southwestern Illinois and in eastern Iowa: (2) *spectabilis* Agassiz, similar to typical *coeruleus* but more conspicuously streaked and usually slenderer, centering in Missouri and Kansas, and intergrading with *pulchellus* in northeastern Oklahoma; (3) *P. c. pulchellus* (Girard), similar to *spectabilis* but with the opercles as well as the cheeks scaleless, occurring in the Arkansas and Red River systems at least; (4) *P. c. lepidus* (Baird and Girrard), possibly a valid species, similar to *pulchellus*, with the opercles scaleless, but the cheeks usually more or less completely scaled, occurring in Texas streams north of the Rio Grande. In addition to these there is a Rio Grande form, represented by cotypes of *Oligocephalus grahami, O. leonensis,* and *Boleichthys elegans* Girard, all preserved in the Museum of Comparative Zoology, and all having the opercles scaled and the cheeks scaleless. The relationships and nomenclature of these forms can not be finally determined with the poor material now in museums.

68. **Poecilichthys punctulatus** Agassiz

(Speckled darter)

Arkansas River system in Oklahoma.—Sta. 55, Elk River (Neosho system), 7 miles north of Grove (1 adult).

This specimen, the first of the species to be recorded for Oklahoma and for the Arkansas River system, was taken from the stomach of a water snake *(Natrix)* caught on the bank of Elk River. In the Field Museum are two additional specimens labeled as from Johnson, Arkansas, which is on Clear Creek, tributary to the Illinois River which passes into Oklahoma. These have about 65 rows of scales; the depth contained about 4.5 in the standard body; the scales with horizontal rows of spots posteriorly.

Our Oklahoma specimen is well preserved anteriorly, but the caudal peduncle was largely digested. The scales are small (probably in about 65 rows); the lateral line is developed over at least the first half of the body length. The body is rather thick but slender (depth 5.0); the head is rather slender and long (measured with membrane, 3.1 in standard length). The gill-membranes are not united; the opercular flap is very slender; the snout is moderately pointed. The coloration, so far as preserved, fits the description given by Jordan and Evermann (1896: 1090).

The Oklahoma and Arkansas specimens seem conspecific with those collected by Meek in the Niangua River near Marshfield, Missouri.

69. **Poecilichthys whipplii** (Girard)

(Red-fin darter)

Red River system in Oklahoma.—Sta. 2, headwater tributary to Kiamichi River, Le Flore County (3 adults); Sta. 11, tributary to Kiamichi River, Le Flore County (1 adult female).

Ouachita River system in Arkansas.—Sta. 30, tributary of Ouachita River, 4 miles west of Board Camp (1 adult male).

70. Microperca proeliaris Hay

(Mississippi least darter)

Arkansas River system in Oklahoma.—Sta. 42, tributary of Black Fork (Poteau River), 6 miles south of Heavener (1 adult).

This specimen has the cheeks and opercles scaly, two anal spines, and the scales marked with regular conspicuous dark cresents. We therefore identify it as *proeliaris*, and add this species to the Oklahoma list.

CENTRARCHIDAE

71. Micropterus dolomieu Lacépède

(Small-mouth black bass)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles northwest of Cache (few if any typical, but many apparent hybrids, with *pseudaplites*).

Red River system in Arkansas.—Sta. 16, headwater tributary of Mountain Fork (of Little River), 8 miles east of state line (1 yearling).

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, 3 miles east of Newhope (3 young); Sta. 25, Self Creek, tributary to the Little Missouri River, near Daisy (2 young); Sta. 27, Caddo Creek, near Glenwood (6 young); Sta. 28, Lick Creek, tributary to Caddo Creek, Montgomery County (4 young and 1 half-grown).

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, 11 miles south of Waldron (2 young, possibly hybrids with *pseudaplites*).

Arkansas River system in Oklahoma.—Sta. 53, Flint Creek, tributary to Illinois River, 8 miles west of state line (1 fry); Sta. 54, Spavinaw Creek (tributary to Neosho River), 7 miles south of Jay (1 fry); Sta. 55, Elk River, tributary to Neosho River, 7 miles north of Grove (several fry).

72. Micropterus pseudaplites Hubbs

(Kentucky bass)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles northwest of Cache (only a few typical, but many probably hybrids with *dolomieu*); Sta. 4, Kiamichi River, Le Flore County, 8 miles west of state line (2 adults); Sta. 12, Kiamichi River, 9 miles west of state line (4 fry); Sta. 13, Kiamichi River, 8 miles west of state line (1 fry); Sta. 14, same locality (3 small adults).

Red River system in Arkansas.—Sta. 20, Rolling Fork (of Little River), near Wickes (1 half-grown); Sta. 22, Saline River (tributary to Little River), 6 miles west of Dierks (1 fry).

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, 3 miles east of Newhope (12 young); Sta. 25, Self Creek (tributary to Little Missouri River), near Daisy (4 young to half-grown); Sta. 27, Caddo Creek, near Glenwood (9 young).

Arkansas River system in Arkansas.—Sta. 34, Poteau River, near Waldron (3 young); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (1 yearling).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek (tributary to Poteau River), 3 miles north of Red Oak (3 yearlings); Sta. 41, Black Fork (of the Poteau), 6 miles south of Heavener (1 young); Sta. 51, Illi-

nois River, 4 miles northwest of Watts (9 young to adults); Sta. 55, Elk River Neosho system, 7 miles north of Grove (a small series of fry to half-grown).

The probable hybridization of this species with *M. dolomieu* in Cache Creek will be accorded further study.

73. **Aplites salmoides** (Lacépède)

(Large-mouth black bass)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles northwest of Cache (small series of young); Sta. 5, Kiamichi River, Le Flore County, 8 miles west of state line (5 small fry); Sta. 12, same stream, 9 miles west of state line (2 fry).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek (tributary to Poteau River), 3 miles north of Red Oak (2 advanced fry); Sta. 54, Spavinaw Creek (Neosho system), 7 miles south of Jay (2 fingerlings); Sta. 55, Elk River, tributary to the Neosho, 7 miles north of Grove (2 fry); Sta. 58, Verdigris River, 5 miles west of Claremore (3 young and 1 half-grown).

74. **Apomotis cyanellus** (Rafinesque)

(Green sunfish)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles west of Cache (series of young to adults); Sta. 7 (6, yearlings to adult), Sta. 8 (6, yearlings to half-grown), Sta. 9 (3 young to half-grown); Sta. 11 (1 yearling), Sta. 12 (1 yearling and 1 adult), Sta. 13 (5 young of year), Sta. 14 (3 adults), all in Kiamichi River and tributaries in Le Flore County, 7 to 10 miles west of the state line.

Red River system in Arkansas.—Sta. 20, Rolling Fork (of Little River), near Wickes (1 half-grown); Sta. 21, Cossatot River (tributary of Little River), 7 miles northeast of De Queen (1 half-grown); Sta. 22, Saline River (tributary to Little River), 6 miles west of Dierks (1 half-grown).

Ouachita River system in Arkansas.—Sta. 31, tributary of Ouachita River, 6 miles north of Mena (1 half-grown).

Arkansas River system in Arkansas.—Sta. 33, tributary of Fourche la Fave River, 9 miles south of Waldron (1 half-grown); Sta. 34, Poteau River, near Waldron (3 young to half-grown).

Arkansas River system in Oklahoma.—Sta. 38, North Canadian River, 7 miles south of Weleetka (3 young to yearlings); Sta. 39, Brazil Creek (tributary to Poteau River), 3 miles north of Red Oak (2 half-grown); Sta. 40, pool near Bache, probably tributary to Gaines Creek (14 young and 1 small adult); Sta. 43, Poteau River, about 6½ miles southwest of Fort Smith (small series of young to adult); Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (series, young to small adults, mostly young); Sta. 46, Big Skin Bayou, 9 miles east of Sallisaw (1 half-grown); Sta. 47, Little Sallisaw Creek, 3 miles east of Sallisaw (1 young and 5 half-grown); Sta. 49, Sallisaw Creek, near Bunch (a large series of young to adults, mostly young); Sta. 51, Illinois River, 4 miles northwest of Watts (8 young and 1 large adult); Sta. 54, Spavinaw Creek, 7 miles south of Jay (series of young); Sta. 55, Elk River (tributary to Neosho River), 7 miles north of Grove (several yearlings to half-grown); Sta 55a, same locality (4 half-grown); Sta. 56, Little Cabin Creek, 3 miles east of Vinita (4 large

young or yearlings); Sta. 57, Pryor Creek (tributary to the Neosho), near Chelsea (7 yearlings); Sta. 58, Verdigris River, 5 miles west of Claremore (series, yearlings to adults); Sta. 59, Hominy Creek (Verdigris system), 8 miles west of Skiatook (1 young and 1 half-grown); Sta. 60, South Canadian River, just south of Norman (7 young to half-grown).

The adult from Sta. 51 is unusually large for the species, 173 mm. long to caudal or 8½ inches over-all.

We now have specimens from near the type localities of three of the nominal species of *"Calliurus"* described by Girard; namely, *formosus, microps* and *longulus*. While it is true that specimens from different localities often have a distinctive appearance, we are unable to recognize more than one species.

75. **Allotis humilis** (Baird and Girard)

(Orange-spotted sunfish)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles northwest of Cache (7 adults).

Arkansas River system in Arkansas.—Sta. 34, Poteau River, near Waldron (small series, half-grown to adults); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (1 half-grown).

Arkansas River system in Oklahoma.—Sta. 38, North Canadian River, 7 miles south of Weleetka (7 adults, the females about ripe); Sta. 39, Brazil Creek (tributary to Poteau River), 3 miles north of Red Oak (4 half-grown to mature adults); Sta. 41, Black Fork (of Poteau River), 6 miles south of Heavener (2 adults); Sta. 42, tributary to Black Fork (2 adults); Sta. 43, Poteau River, about 6½ miles southwest of Fort Smith (large series, young to adult, many breeding but many spent); Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (series of young to adult, mostly young, some breeding); Sta. 47, Little Sallisaw Creek, 3 miles east of Sallisaw (1 young and 12 mature and spent adults); Sta. 51, Illinois River, 4 miles northwest of Watts (small series of adults); Sta. 55, Elk River, tributary to the Neosho, 7 miles north of Grove (6 adults); Sta. 56, Little Cabin Creek (Neosho system), 3 miles east of Vinita (10 half-grown to adults); Sta. 57, Pryor Creek, near Chelsea, in the Neosho system (5 half-grown to adults); Sta. 58, Verdigris River, 5 miles west of Claremore (series, yearlings to adults); Sta. 60, South Canadain River, just south of Norman (3 young to half-grown).

Some of the breeding males from Sta. 51 resemble the local form of *Xenotis megalotis breviceps* in having a light streak along the middle of the nape. Some breeding males of this species also simulate *Xenotis megalotis breviceps* in the extreme modification of form; some examples from the Poteau River above Fort Smith are particularly bizarre in this respect.

76. **Helioperca incisor** (Cuvier and Valenciennes)

(Bluegill)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles northwest of Cache (2 hybrids between *Helioperca* and *Xenotis*); Sta. 5, Kiamichi River, Le Flore County, 8 miles west of state line (1 half-grown); Sta. 9, same location (2 yearlings); Sta. 12, Kiamichi River, 9 miles west of the state line (1 yearling).

Red River system in Arkansas.—Sta. 21, Cossatot River, tributary of Little River, 7 miles northeast of De Queen (1 half-grown).

Arkansas River system in Arkansas.—Sta. 33, tributary of Fourche la Fave River, 9 miles south of Waldron (3 yearlings to adult); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (1 half-grown).

Arkansas River system in Oklahoma.—Sta. 43, Poteau River, about 6½ miles southwest of Fort Smith (3 half-grown); Sta. 51, Illinois River, 4 miles northwest of Watts (2 yearlings); Sta. 55a, Elk River (Neosho system), 7 miles north of Grove (4 half-grown); Sta. 56, Little Cabin Creek, tributary to the Neosho, 3 miles east of Vinita (4, yearlings to half-grown); Sta. 58, Verdigris River, 5 miles west of Claremore (series, yearlings to adults); Sta. 59, Hominy Creek, 8 miles west of Skiatook, Verdigris system (1 yearling).

77. **Xenotis megalotis breviceps** (Baird and Girard)

(Long-ear sunfish of the Southwest)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles northwest of Cache (large series, yearlings to adults); Sta. 4 (1 small adult), Sta. 5 (1 half-grown), Sta. 7 (series, yearlings to small adults), Sta. 8 (large series, yearlings to small adults), Sta. 10 (3 small adults), Sta. 11 (1 small adult), Sta. 12 (series, yearlings to small adults), Sta. 14 (1 adult), all in Kiamichi River and tributaries, Le Flore County, 7 to 11 miles west of state line.

Red River system in Arkansas.—Sta. 16, headwater tributary of Mountain Fork (of Little River), 8 miles east of state line (3 small adults); Sta. 17, tributary of Mountain Fork, 3 miles south of Mena (1 yearling); Sta. 18, tributary of Mountain Fork, southwest of Potter (1 half-grown); Sta. 20, Rolling Fork (of Little River), near Wickes (small series, half-grown to adults); Sta. 21, Cossatot River, tributary to Little River, 7 miles northeast of De Queen (series, yearlings to adults); Sta. 22, Saline River, also tributary to Little River, 6 miles west of Dierks (small series, half-grown to adults).

Ouachita River system in Arkansas.—Sta. 23, Fallen Fork (of Little Missouri River), near Newhope (1 adult male); Sta. 24, Little Missouri River, 3 miles east of Newhope (10 yearlings); Sta. 25, Self Creek, tributary to the Little Missouri, near Daisy (1 adult); Sta. 27, Caddo Creek, near Glenwood (15, half-grown to adults); Sta. 28, Lick Creek, tributary to Caddo Creek, Montgomery County (2 half-grown); Sta. 29, tributary to Ouachita River, 1 mile west of Board Camp (2 small adults); Sta. 30, tributary to the Ouachita, 4 miles west of Board Camp (1 half-grown).

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, 11 miles south of Waldron (1 half-grown); Sta. 33, tributary to the Fourche la Fave, 9 miles south of Waldron (small series, yearlings to adults); Sta. 34, Poteau River, near Waldron (6 half-grown to adult males); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (10, half-grown to adults); Sta. 37, Lee Creek, 3 miles northwest of Van Buren (1 half-grown).

Arkansas River system in Oklahoma.—Sta. 39, Brazil Creek, tributary to Poteau River, 3 miles north of Red Oak (5, yearlings to adults); Sta. 41, Black Fork (of Poteau River), 6 miles south of Heavener (1 small adult);

Sta. 42, tributary to the Black Fork, 6 miles south of Heavener (3 half-grown); Sta. 46, Big Skin Bayou, 9 miles east of Sallisaw (3 adult males); Sta. 47, Little Sallisaw Creek, 3 miles east of Sallisaw (1 half-grown); Sta. 48, Sallisaw Creek, near Bunch (2 adult males); Sta. 51, Illinois River, 4 miles northwest of Watts (small series, yearlings to small adults); Sta. 54, Spavinaw Creek, Neosho system, 7 miles south of Jay (1 adult male); Sta. 55, Elk River, another Neosho tributary, 7 miles north of Grove (series, yearlings to adults).

78. **Ambloplites rupestris** (Rafinesque)

(Rock bass)

Arkansas River in Oklahoma.—Sta. 55, Elk River (Neosho system), 7 miles north of Grove (1 adult).

79. **Pomoxis annularis** Rafinesque

(White crappie)

Arkansas River system in Arkansas.—Sta. 32, Fourche la Fave River, 11 miles south of Waldron (1 half-grown).

Arkansas River system in Oklahoma.—Sta. 43, Poteau River, about 6½ miles southwest of Fort Smith (small series of large young); Sta. 44, Arkansas River, 5½ miles southwest of Fort Smith (small series of large young); Sta. 55, Elk River (Neosho system), 7 miles north of Grove (2 half-grown); Sta. 58, Verdigris River, 5 miles west of Claremore (series, young to adults).

80. **Pomoxis sparoides** (Lacépède)

(Black crappie; calico bass)

Red River system in Oklahoma.—Sta. 1, West Cache Creek, 9 miles northwest of Cache (1 half-grown).

Arkansas River system in Oklahoma.—Sta. 44, Arkansas River 5½ miles southwest of Fort Smith (3 young); Sta. 58, Verdigris River, 5 miles west of Claremore (small series of young and 1 half-grown).

ATHERINIDAE

81. **Labidesthes sicculus** (Cope)

(Brook silverside)

Red River system in Arkansas.—Sta. 4, Kiamichi River, Le Flore County, 8 miles west of state line (8, half-grown to adults); Sta. 6 Kiamichi River, 7 miles west of state line (4 adults); Sta. 10, Big Cedar Creek, tributary to the Kiamichi, 11 miles from state line (1 adult); Sta. 12, Kiamichi River, 9 miles west of state line (series, half-grown to adults).

Red River system in Arkansas.—Sta. 16, headwater tributary of Mountain Fork (of Little River), 8 miles east of Oklahoma line (3 half-grown to adults); Sta. 17, tributary of Mountain Fork, 3 miles south of Mena (5 half-grown to adults); Sta. 18, tributary of Mountain Fork, southwest of Potter (1 adult); Sta. 19, Mountain Fork, 3 miles southwest of Potter (3 adults); Sta. 22, Saline River, tributary to Little River, 6 miles west of Dierks (1 young and 1 adult).

Ouachita River system in Arkansas.—Sta. 24, Little Missouri River, 3 miles east of Newhope (several, young to adults); Sta. 27, Caddo Creek, near Glenwood (1 young and 1 adult).

Arkansas River system in Arkansas.—Sta. 33, tributary to Fourche la

Fave River, 9 miles south of Waldron (4 half-grown); Sta. 34, Poteau River, near Waldron (1 adult); Sta. 35, Petit Jean River, 11 miles northwest of Waldron (2 adults); Sta. 37, Lee Creek, 3 miles northwest of Van Buren (1 half-grown).

Arkansas River system in Oklahoma.—Sta. 41, Black Fork of Poteau River, 6 miles south of Heavener (1 half-grown); Sta. 51, Illinois River, 4 miles northwest of Watts (2 half-grown); Sta. 54, Spavinaw Creek (tributary to the Neosho), 7 miles south of Jay (small series of large young); Sta. 55, Elk River (Neosho system), 7 miles north of Grove (2 young).

SCIAENIDAE

82. **Aplodinotus grunniens** Rafinesque

(Sheepshead)

Red River system in Oklahoma.—Sta. 14, Kiamichi River, 8 miles west of Arkansas line (1 half-grown).

COTTIDAE

83. **Cottus bairdii zopherus** (Jordan)

(Southern muddler or miller's-thumb)

Arkansas River system in Oklahoma.—Sta. 52, Bouyer Branch (of Illinois River), 6 miles northwest of Watts (3 half-grown); Sta. 53, Flint Creek (branch of the Illinois), 8 miles west of the Arkansas line (1 adult); Sta. 54, Spavinaw Creek (Neosho system), 7 miles south of Jay (1 half-grown); Sta. 55, Elk River (Neosho system), 7 miles north of Grove (2 half-grown).

We refer our *Cottus* material (the first to be recorded for Oklahoma) to the southern subspecies *zopherus*, on account of the small size, chubby form, dark ground color and black bands. Of course we cannot positively affirm that these features have a fixed genetic basis.

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