THE FISHES OF
THE ILLINOIS RIVER IN OKLAHOMA

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By

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PREFACE

The study of the fishes of the Illinois River in Oklahoma is largely based on collections made from August 13 to 27, 1946, by the Illinois River Survey Party under the direction of Dr. G. A. Moore. The data for this study are derived from 15,387 specimens collected during the course of the survey and from field observations as well as all available information covering previous and subsequent collections from this drainage. The purpose of this study is to present an annotated list of the fishes of the Illinois River Drainage; the relative abundance, distribution, and size limits of each species to be expected in the Tenkillers impoundment 5 years after its completion.

All previous collections and surveys in Oklahoma, with a single exception (Moore and Mizelle, 1939), have been sample collections taken more or less at random to determine the species composition of the fishes of the state. The Illinois River Survey is the first of an ambitious long-range plan to make a comprehensive survey of the larger streams of Oklahoma.

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INTRODUCTION

From August 13 to 27, 1946, the first scientific survey of the fishes of the Illinois River in Oklahoma was made under the auspices of the Oklahoma Agricultural and Mechanical College Department of Zoology, Oklahoma Game and Fish Commission, and the Army Engineers, Tulsa District. The objectives of this expedition were as follows: to collect fishes of all species in order to determine the relative abundance, the physical condition, distribution, natural history, and growth rates; to give wildlife students enrolled in Ichthyology actual experience in the collection and classification of fishes in the field; to conduct a preimpoundment survey for the Army Engineers and the State Game and Fish Commission regarding the fish population of the river and possible needs for stocking the proposed Tenkillers impoundment. These three groups cooperated closely and harmoniously in this project with results so satisfactory that a similar survey of the Poteau River and its tributaries in Oklahoma was conducted from August 18 to 30, 1947, with equally gratifying results.

The expedition to the Illinois River was headed by Dr. George A. Moore of Oklahoma Agricultural and Mechanical College Department of Zoology and was composed of the following personnel: Dr. H. I. Featherly of the Botany Department, served as our photographer, plant taxonomist, and expedition quartermaster. We are indebted for his painstaking services. The members of the Ichthyology Class, whose long hours with the seines and keen interest in the work made possible the collection of 15,387 specimens, were as follows: Bill Burris, Robert Carter, Ralph Couch, Frank Cross,

Gordon Hall, Karl Jacobs, Perry Robinson, Donald Poole, and Dan Woesner. Cecil Haight of the Army Engineers, collected fish scales for age determination by his department and assisted us in many ways. The writer acted as assistant to Dr. Moore and obtained data for this paper.

The writer wishes to express his appreciation of the services of the following people whose efforts were of great importance to the success of the expedition: Mr. Jeff Kendall, State Game Warden; Mr. A. D. Aldrich, Superintendent of fisheries for the Oklahoma Game and Fish Commission, who made his library available and gave many helpful suggestions; Mr. O'Reilly Sandoz who made many helpful suggestions and pointed out geological formations in the field; and Mr. Ed Jarrell who was especially cooperative and gave helpful suggestions concerning the river while transporting part of our equipment from station to station.

Col. C. H. Chorpening of the Army Engineers, Tulsa District, made transportation available for personnel and also provided a boat and motor for our use. The cooperation of Mr. L. G. Duck, Biologist of the Army Engineers, in working out many details of the expedition is hereby gratefully acknowledged.

I wish especially to thank Dr. and Mrs. Moore for their aid and hospitality during the course of this work. Dr. Carl L. Hubbs has contributed materially to this paper in giving many helpful suggestions and in clearing up some taxonomic problems. Dr. Reeve M. Bailey has been especially helpful in supplying information on unpublished collections and identifying several troublesome specimens. Dr. A. I. Ortenburger granted permission to study the fishes in the Oklahoma University Museum of Zoology and to use his unpublished collections, many of which were first records for the Illinois River. Dr. William H. Irwin and Dr. Fredrick M. Baumgartner have

been very helpful in giving suggestions concerning the succession of fish population in lakes and ponds. Dr. R. Chester Hughes gave permission to use his personal library. Professor R. O. Whitenton has given the writer many helpful suggestions and wise counsel over a period of more than twenty years.

HISTORY OF PREVIOUS AND SUBSEQUENT COLLECTIONS

Dr. Seth Eugene Meek, during July and August, 1891, collected fishes in the Illinois River in Arkansas near Prairie Grove, Ladds Mill, Clear Creek at Johnston, and Jordans Creek and Barren Fork at Dutch Mill. He reported 31 species in his annotated list and 32 species in a table (Meek, 1894 : 86-7; 92). The Oklahoma Biological Survey, directed by Dr. A. I. Ortenburger in 1927, collected in the Illinois River, Bouyer Branch, Flint Creek, and Barren Fork, and reported 24 species (Hubbs and Ortenburger, 1929b). On July 5 and 11, 1929, Dr. Ortenburger collected 33 species from the Illinois River, Barren Fork, Courthouse Creek, and Tyner Creek. Trowbridge and Strode collected 6 species from Ward Branch, and Flint Creek in 1932. Hubert Dobson took 5 species from Ballard Creek and Illinois River in April, 1936. W. F. and F. A. Blair took 36 species in the Illinois River near Scraper from July 8 to 11, 1936. Dr. George A. Moore took 41 species while on week-end trips with his zoology classes to the Illinois River, Barren Fork, Tyner Creek, Peavine Branch, and Swimmers Branch during the spring or summer or both from 1939 to 1942. Mr. Arron Seamster, on March 29, 1941, collected 12 species in Swimmers Branch. Dr. Moore collected 23 species from Flint Creek, Barren Fork, Ben Knight Creek, and Caney Creek on May 3-4, 1947. Two small collections (4 species each) have been omitted because of questionable location near the Illinois and Grand River Divide.

The above collections from the Illinois Drainage in Oklahoma are represented by 58 species and subspecies in 34 genera. A search of the literature reveals that only 32 species and subspecies have been recorded.

MATERIALS AND METHODS

The Illinois Survey Party was divided into three groups each day.

Two parties were formed to operate seines and collect fishes. One man in each group served as secretary and recorded all species taken, pertinent observations and general field data. Another carried a large mouth glass jar half filled with a 10 percent solution of formalin, and a sack to hold specimens too large to place in the killing jar. Two men operated the seines and a fifth man, when available, took turns with the seine and served to release the seine from snags. Dr. Moore was in charge of one collecting group and the writer took over the second. The third group was a two man cook detail which was relieved by a new detail each morning until all members of the Ichthyology class had served a day then rotated again.

About seven hours each day was devoted to seining and collecting. Before breakfast, after supper and at night many of the men were free to do sportsfishing and set trotlines. All of the men had at least one and some had both fly and casting rods, as well as stocked tackle boxes. Most of the larger specimens of the Centrarchidae, and all of the larger specimens of Cyprinus, Ictalurus, and Pilodictis were taken while sportsfishing.

A few game fishes were preserved at each station and the remainder were counted and released. Larger specimens were also released after they had been measured and a few scales removed from the shoulder region. Non-game species too large for the killing jar were taken to camp for preservation. An incision 2 to 3 inches long was made on the right side and the specimens placed in a 10 gallon milk can containing 10 percent formalin. The smaller fishes were hardened for 24 hours in 10 percent formalin before wrapping in cheesecloth for storage and transportation in 10 gallon milk cans to the College Campus where they were washed in water for at least 48 hours and stored in 70 percent alcohol. During the winter of 1946-47 each

station lot was sorted to species, counted, measured and deposited in the Museum of Zoology of the Oklahoma Agricultural and Mechanical College.

At each station from 2 to 4 river miles of the stream were worked. One crew worked down stream from 1 to over 2 miles and the other group went up stream for about an equal distance then worked down stream to camp. A special effort was made to sample all feasible habitats including shallow riffles, fast to quiet deep water of the main channel and muddy to clear overflow pools and oxbow lakes on the floodplain. At stations 3 and 5 (fig. 1) there were a large number of overflow pools and small oxbow lakes which were visited by one crew while the other worked the river proper.

The expedition was provided with materials and equipment as follows: one 7 passenger station wagon, 1 boat with outboard motor, one 1/2 ton pick-up truck for transporting equipment, one 5 passenger car, one 4 x 3 foot commonsense seine heavily weighted, one 8 x 4 foot 1/4 inch mesh seine, two 10 x 4 foot 1/4 inch mesh seines (which had been laced together to make a 20 foot seine), one 50 x 3 foot commonsense seine, one 50 x 6 foot 1 inch mesh seine, one small fyke net, one 1/16 inch mesh screen wire seine 3 x 2 foot, three 50 foot trotlines, one pH set and two thermometers, 5 gallons of 40 percent formaldehyde, 25 yards of cheesecloth, 20 army shelter halves, four 10 gallon milk cans, camp cooking equipment, First-Aid kit, miscellaneous equipment and individual duffle such as bed-rolls and mosquito-bars.

The 8 foot seine proved so effective that the 20 foot seine was unlaced to give two 10 foot seines which were easier to manipulate in the swift current of the river. The 50 x 3 foot commonsense seine was too unwieldly in the river current, but was used in some of the larger overflow

pools and oxbow lakes. The 50 x 6 foot 1 inch mesh seine was used in the deeper pools only. The tar impregnated fyke net took very few specimens.

The above listed items are not considered sufficient, there should have been included one 100 x 8 foot 1 inch mesh seine and three or four 6 x 3 foot bobbinet seines. This subject was discussed last summer while traveling from one station to the next and O'Reilly Sandoz suggested making a bobbinet seine reinforced at the bottom with about 16 inches of heavy duck folded so as to give a strip about 8 inches high along the bottom of the seine with a lead line sewed in at the bottom of the fold. The sides and the top of the seine to be reinforced with a fold of duck 2 to 3 inches wide. Mrs. George A. Moore made three bobbinet seines as above specified for use on the Easter Vacation (1947) Blue River Expedition. This type of bobbinet seine proved very effective and we took many specimens (e.g. Microperca), that normally would have escaped through a 1/4 inch mesh seine. These same seines were used later in southeastern Oklahoma and adjacent parts of Arkansas with equally effective results.

GENERAL DESCRIPTION OF THE ILLINOIS RIVER

The Illinois River is about 145 miles long, and drains a total area of 1,620 square miles in eastern Oklahoma and western Arkansas. It rises near Hubard, Arkansas, and flows north for about 27 miles, then turns west for about 13 miles to cross the state line 5 miles south of Siloam Springs, Arkansas. From this point it continues west for about 16 river miles then turns to the south and continues a course south-southwest to its confluence with the Arkansas River southeast of Gore, Oklahoma. It is a clear and swift stream with an average gradient, from the state line to the mouth of Barren Fork, of about 4.5 feet per mile; and from Barren Fork to the mouth, of about 4.2 feet per mile (Anon. 1936). The bottom is predominately coarse chert gravel with the bed rock exposed in places. The water level was very low, during the period August 13 to 27, 1946, and in most places covered less than half of the bed of the river which varied from about 100 to over 200 feet in width. A water depth of a few inches, on the riffles, to over 10 feet in pools, was encountered. These pools varied from about 100 yards to over 1 mile in length. The banks varied from steep limestone or shale cliffs over 200 feet high to sloping or vertical gravel banks 5 to 20 feet high. A visibility depth of from 4 to 5 feet prevailed at all stations except at Station 1 where by virtue of a heavy shower near the headwaters, a reading of about 1 foot was obtained.

The course of the upper part of the Illinois River in Oklahoma is on Chattanooga formation (shale and sandstone), Tyner and Burgen undifferentiated formation (shale, brown sandstone, calcareous cherty sandstone, and limestone), and Burgen sandstone in the great bend northeast of Tahlequah. From 2 miles southeast of Tuscania to Chronister the course of the river

is on Boon formation (chert, chert limestone and limestone). From a short distance south of Chronister to the mouth numerous formations such as: the Pitkin limestone (a shaley limestone grading into massive limestone), the Winslow formation (a shale, thin bedded sandstone, and shale with quartz conglomerate), the Morror formation (a limestone, shale and calcareous sandstone), and for the last 6 or 7 miles the McAlester shale and alluvium lie exposed in the river bed. The exposure of these formations is due to faulting and subsequent erosion.

The principal tributaries of the Illinois River in Oklahoma are: Flint Creek with a drainage area of 121 square miles; Barren Fork, (to which Tyner Creek and Courthouse Creek are tributary), with a drainage area of 343 square miles; and Caney Creek with a drainage area of 94 miles (Anon. 1936). The clear, swift tributaries have the principal part of their courses on Boon chert.

The average temperature of the Illinois River from August 13 to 27, 1946, was 29° (27° - 32°). The pH was 7.6, except for Station 4 where a reading of 7.8- was obtained.

Very little emergent vegetation, except patches of Dianthera americana (in quiet water), was found in the river proper although microscopic algae was abundant on the bottom. There are many small oxbow lakes and flood pools which often receive water by underground flow from the river. In these, various combinations of filamentous algae, Chara, Elodea, Dianthera, Jessiaea, Echinodorus, and Sagitaria were present. The flora of the Illinois Drainage is typical of the Oak Hickory Climax of the Southwest Ozark Upland.

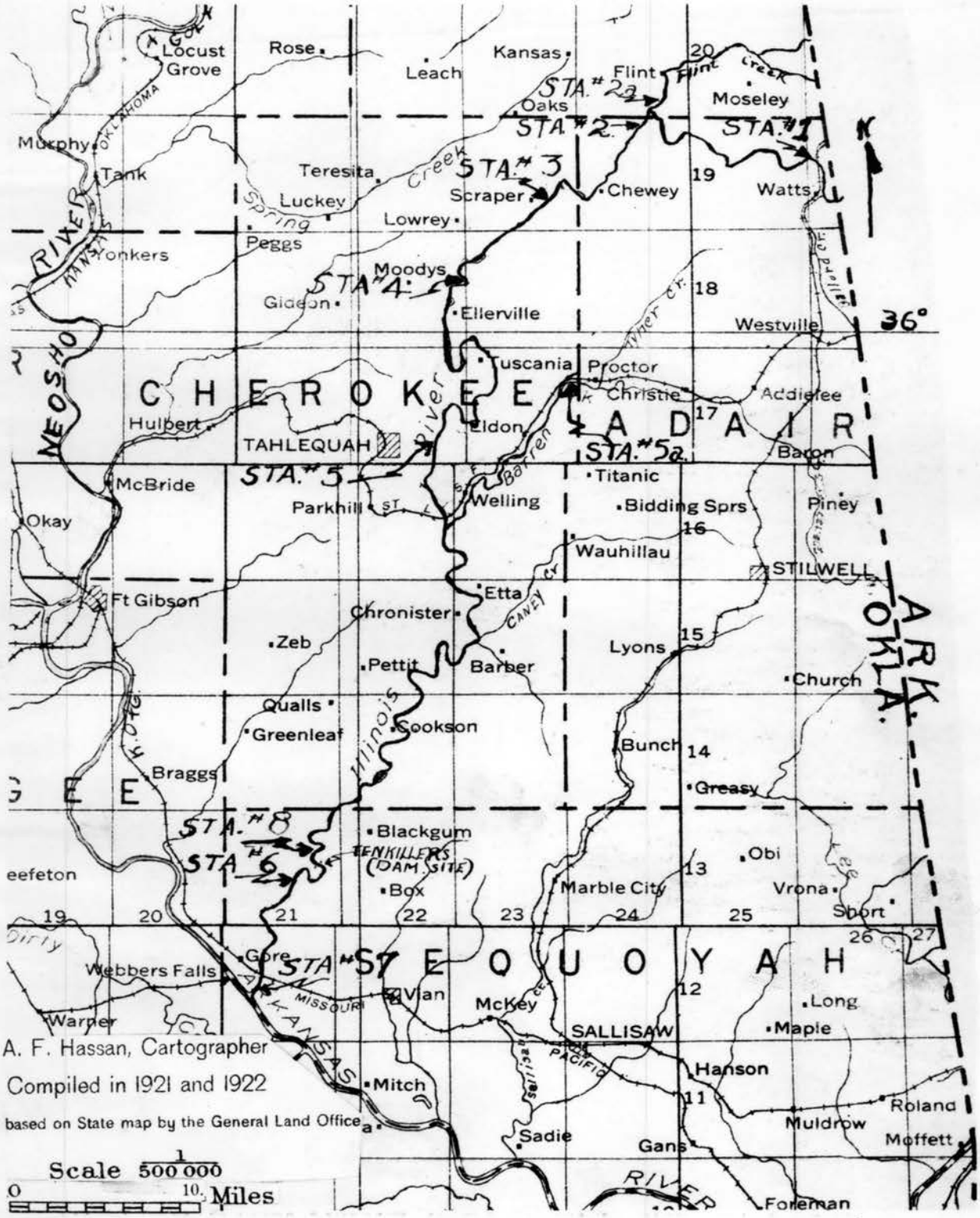

Fig. 1. Map showing stations of the Illinois River Survey Party, August 13 to 27, 1946.

COLLECTING STATIONS (1946)

Station 1:- Illinois River, Adair County, 1 1/2 miles north of Watts, secs. 17 and 18, T. 19 N., R. 26 E.; August 13 and 14.

Station 2:- Illinois River, Delaware County, near the mouth of Flint Creek, secs. 34 and 35, T. 20 N., R. 24 E. and secs. 2 and 3, T. 19 N., R. 24 E.; August 14 to 16.

Station 2a:- Flint Creek, Delaware County, from the mouth on the Illinois River upstream for 1 1/2 miles, secs. 26 and 35, T. 20 N., R. 24 E.; August 15. At this time Flint Creek flowed underground through coarse gravel for about the last 200 yards of its course, while upstream one half mile there was a good current below riffles. The bottom was gravel and rocks - in places bedrock covered with microscopic algae. The stream at this station was 20 to 75 feet wide and varied from a few inches to 5 feet in depth. The water was very clear with a visibility of about 4 feet. The banks were rock cliffs often 50 feet high or sloping to vertical gravel banks from a few feet to over 10 feet in height.

Station 3:- Illinois River, Cherokee County, near Scraper, secs. 25, 26, 27 and 34, T. 19 N., R. 23 E.; August 16 to 18. There were many cutoff and overflow pools in this area.

Station 4:- Illinois River, Cherokee County, near Martin's Store east of Moody, secs. 13 and 24, T. 18 N., R. 22 E.; August 19 and 20.

Station 5:- Illinois River, Cherokee County, east of Tahlequah, secs. 25, 26 and 35, T. 17 N., R. 22 E.; August 21 to 23. There were numerous cutoff and overflow pools in this area.

Station 5a:- Barren Fork, Adair County, southwest of Proctor at and below the Bridge across Barren Fork on State Highway 51.; August 22. In this area the Tyner formation is exposed in the stream's course. The

bottom is composed of gravel and some rocks and along the south bank large boulders which had fallen from the steep rock cliff. The north bank was of sloping gravel. The stream at this station was from 30 to 75 feet wide and varied from a few inches to a little over 5 feet in depth. Objects were visible to a depth of about 5 feet in this swift stream where the only vegetation observed was microscopic algae.

Station 5b:- Rea Sun Spring, a tributary of the Illinois River, about one half mile east of the Illinois River Bridge on U. S. Highway 62; August 22. Like most springs of the region this fine spring forms a small brook with an abundance of water cress and other aquatic vegetation.

Station 6:- Illinois River, Sequoyah County, about 5 miles northeast of Gore, secs. 22, 23, 27, and 28, T. 13 N., R. 21 E.; August 23 to 27. This station also served as a base camp for Stations 7 and 8.

Station 7:- Illinois River, Sequoyah County, near the mouth of the river, secs. 20 and 21, T. 12 N., R. 21 E.; August 24.

Station 8:- Illinois River, Sequoyah County, above the proposed Tenkillers Dam, secs. 13 and 14, T. 13 N., R. 21 E.; August 25.

ANNOTATED LIST OF THE FISHES OF THE ILLINOIS RIVER

All Collections in the Illinois River are given first, starting at the headwaters and going down stream. The same method is used for the tributaries. The first tributary to enter the Illinois River in Oklahoma is given first and progressing thus downstream.

All locations designated by a station number refer to the Stations of the Illinois River Survey Party (1946) as shown in Figure 1.

Dates bearing an asterisk indicate published records.

All Creeks and Branches referred to in the annotated list are tributaries of the Illinois River unless otherwise indicated.

Limits of size are expressed in millimeters of standard length unless otherwise stated.

Hybrids are listed last in the annotated list.

PETROMYZONIDAE

1. Ichthyomyzon Girard

1. Ichthyomyzon castaneus Girard. Chestnut lamprey. Illinois River: Praters Ford, Sequoyah County, 3 miles northeast of Gore (1 adult 200 mm. total length), Moore (1933: 11)*; Station 4 (1 adult 214 mm. total length).

This is the third report of this species for Oklahoma. Meek (1894) reported this species from Sallisaw Creek (River), near Mackey's Ferry, Oklahoma.

2. Ichthyomyzon gagei Hubbs and Trautman. Southern brook lamprey. This form was not taken from the Illinois River but was taken in Barren Fork, a tributary to the Illinois, 10 miles east of Tahlequah (1 adult 161 mm. total length) and referred by Moore (1933)* to Richardina unicolor Creaser and Hubbs. At subsequent dates this specimen, now deposited in

the Museum of Zoology, University of Michigan, was examined by Dr. Hubbs and referred to Ichthyomyzon gagei and Bailey (1947) further discussed it.

POLYODONTIDAE

2. Polyodon Lacepede

3. Polyodon spathula (Walbaum). Paddlefish. This species was not taken by our party, however, a mounted head was seen at Watts and said to be from Station 1. One "paddle" 337 mm. long was obtained from Burt Tarkington, a commercial fisherman with a camp near the Illinois River Bridge on U. S. Highway 62, who gave information that 148 paddlefish were taken from the river during the winter (1945-1946). Sportsmen contacted along the river verified the presence of this form in the Illinois River.

LEPISOSTEIDAE

3. Lepisosteus Lecepede

4. Lepisosteus osseus oxyurus Rafinesque. The norther longnose gar is herein considered a first record for the Illinois River. Station 1 (1, 210 mm.); Station 2 (2, 262 and 266 mm.); Station 3 (3, 87 to 225 mm.); Station 4 (4, 70 to 762 mm.). The stomach of a 616 mm. specimen, killed by a giging party, contained 4 Notropis and 1 sunfish probably Lepomis cyanellus.

HIODONTIDAE

4. Amphiodon Rafinesque

5. Amphiodon alosoides Rafinesque. Goldeye. This constitutes a first record for Oklahoma although the species has been included in unpublished state lists by Dr. Hubbs. This listing of the goldeye for Oklahoma was based on specimens taken in the Red River in Texas. On August 25, 1946, a single specimen 250 mm. long was caught by a fisherman, in the Illinois

River, Station 4, on a hook baited with a helgramite. The specimen was presented to Mr. O'Rielly Sandoz, Oklahoma State Game and Fish Biologist. Since this date other specimens have been collected in the state from the Red and Arkansas River drainages (Moore, 1947).

CLUPEIDAE

5. Pomolobus Rafinesque

6. Pomolobus chrysochloris Rafinesque. Skipjack. Our specimens constitute a first record for the Illinois River and the second for the state. Hubbs and Trautman collected it from an overflow pool on the Grand River in 1935 (Hubbs in Aldrich, 1946)*. Station 2 (2, 80 and 280 mm.); Station 3 (1, 59 mm.); Station 4 (19, 30 to 42 mm.); Station 5 (1, 31 mm.); Station 7 (5, 54 to 63 mm.). The presence of so many young indicates clearly that Pomolobus is a spring or early summer breeder in the Illinois River.

6. Dorosoma Rafinesque

7. Dorosoma cepedianum (LeSueur). Gizzard shad. Illinois River: Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Sequoyah County, 2 miles northeast of Gore, Ortenburger (July, 1929b); Cherokee County, near Scraper, Blair and Blair (July, 1939); Station 1 (14, 27 to 68 mm.); Station 2 (4, maximum 269); Station 3 (3, 44 to 58 mm.); Station 5 (7, 56 to 250 mm.); Station 6 (2, 124 and 265 mm.); Station 7 (2, 64 and 79 mm.). The gizzard shad is apparently abundant and well distributed throughout the River. The specimens taken were very fat and vigorous - often leaping over the seine.

SALMONIDAE

7. Salmo Linnaeus

8. Salmo gairdnerii Richardson. Rainbow trout. Ben Knight Creek, tributary to Barren Fork, Adair County, 3 miles west of Westville, Moore (May, 1947). This young trout had evidently escaped from a small private trout hatchery a short distance above the point of capture.

CATOSTOMIDAE

8. Megastomatobus Fowler

9. Megastomatobus cyprinella (Valenciennes). The specimens of the bigmouth buffalofish herein recorded constitute a first record for the Illinois River. Station 5 (1, 320 mm. from an overflow pool); Station 6 (1, 240 mm.). Hubbs and Lagler (1941:41) considered this species as, "Typically an inhabitant of large rivers, oxbows and bayous."

9. Ictiobus Rafinesque

10. Ictiobus niger (Rafinesque). The black buffalofish is herein recorded for the first time from the Illinois River. Station 2 (2, 224 to 295 mm.); Station 6 (3, 129 to 285 mm.). This and the next species are doubtless more abundant than our collections indicate since they are frequently taken by gigging parties.

11. Ictiobus bubalus (Rafinesque). Smallmouth buffalofish, Illinois River, Station 6 (1, 300 mm.). This species, reported herein as a first record for the Illinois River, was taken in water 4 to 5 feet deep with I. niger and M. duquesnii. Both niger and bubalus were in excellent condition. Since no young of the year were taken, it is probable that the buffaloes do not spawn in the river.

10. Carpiodes Rafinesque

12. Carpiodes carpio carpio (Rafinesque). Northern carpsucker. This constitutes a first record for the river. Station 6 (1, 285 mm.); Station 7 (183, 15 to 44 mm.). These carpsuckers are probably not in their natural habitat in the Illinois River but rather reflect the influence of the larger and muddier Arkansas.

13. Carpiodes velifer (Rafinesque). Highfin sucker. Herein recorded for this river for the first time and the second for the state, velifer was previously reported from Stillwater Creek tributary to the Cimarron River, a tributary of the Arkansas River, Moore and Mizelle (1932)*. Station 5 (1, 220 mm.); Station 6 (3, 68 to 190 mm.).

11. Catostomus LeSueur

14. Catostomus commersonnii commersonnii (Lecepede). Common white sucker. This form was not taken during the survey of the Illinois River but has been taken from two tributaries. Hubbs and Ortenburger (1929b:62)* reported 3 young (largest 38 mm.) from Barren Fork, Adair County, near Baron; and Moore (May, 1947) took one 129 mm. specimen from Caney Creek, Cherokee County, 2 miles northeast of Barber (Meek (1894:86)* reported this species from the Illinois River and Barren Fork in Arkansas.

12. Hypentelium Rafinesque

15. Hypentelium nigricans (LeSueur). Hog sucker. Illinois River: in Arkansas Meek (1894:86); Station 1 (2, 70 and 246 mm.); Station 2 (2, 73 and 82 mm.); Station 3 (a, 62 and 63 mm.); Station 4 (3, 63 to 65 mm.); Station 5 (5, 63 to 310 mm.); Station 8 (3, 85 to 93 mm.); Station 6 (6, 69 to 87 mm.); Sequoyah County, 2 miles northeast of Gore, Ortenburger (July, 1929). Flint Creek, near Flint, Moore (May, 1947). Tyner Creek, 1/2 mile east of Proctor, Moore (April, 1939). Swimmers Branch, 5 miles

northeast of Gore, Moore (April, 1942). This species was taken primarily in the riffles and fast water.

13. Minytrema Jordan

16. Minytrema melanops (Rafinesque). Spotted sucker. Illinois River; Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 2 (1, 280 mm.); Station 3 (1, 196 mm.). This is the first record of this uncommon fish for the Illinois River.

14. Moxostoma Rafinesque

17. Moxostoma duquesnii duquesnii (LeSueur). Black redhorse. Illinois River: in Arkansas Meek (1894:86)*; Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 1 (1, 315 mm.); Station 2 (12, 160 to 310 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936), 1 mile south of Scraper, Moore (June, 1942); Station 3 (14, 52 to 145 mm.); Station 4 (23, 42 to 65 mm.); Station 5 (8, 260 to 296 mm.); Station 6 (14, 46 to 75 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929); Station 7 (1, 72 mm.). Tyner Creek, Adair County, 1/2 mile east of Proctor, Moore (April, 1942).

The black redhorse is of considerable economic importance as a food and forage fish and is considered by the inhabitants of the region to be superior in flavor to the black bass. They take it and the two succeeding forms by means of the gig and gang hooks.

18. Moxostoma erythrurum (Rafinesque). Golden redhorse. Illinois River: Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 1 (1, 49 mm.); Station 2 (2, 47 to 137 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 3 (7, 51 to 135 mm.); Station 4 (49, 33 to 91); Station 5 (2, 44 to 99 mm.); Station 6 (17, 43 to 64 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger

(July, 1929); Station 7 (1, 58 mm.). Tyner Creek, Adair County, 1/2 mile east of Proctor, Moore (April, 1942). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1942).

15. Placopharynx Cope

19. Placopharynx carinatus Cope. River redhorse. Illinois River: Station 1 (1, 183 mm.); Station 2 (3, 330 to 345 mm.); Station 4 (3, 49 to 119 mm.); Station 5 (1, 227 mm.). This form was reported from the Poteau River by Jordan and Gilbert (1896) and no subsequent report of the species has been found in the literature. In all 8 of the specimens taken from the Illinois River, there is a very conspicuous dentate pencil line of melanophores posterior to the scales at the base of the caudal fin (Paden, in press).

CYPRINIDAE

16. Cyprinus Linnaeus

20. Cyprinus carpio Linnaeus. Carp. Illinois River: Station 3 (2, 83 to 533 mm. and 1 "Mirror Carp" 135 mm.); Station 4 (1, 500 mm.); Station 6 (1, 300 mm.). This is the first record from the Illinois drainage. Carp were taken by means of gigs, trotlines and seines.

17. Semotilus Rafinesque

21. Semotilus atromaculatus atromaculatus (Mitchell). Northern creek chub. Illinois River: in Arkansas Meek (1894:87) Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 1 (1, 51 mm.); Station 2 (1, 35 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929); Station 3 (6, 46 to 67 mm.); Station 4 (9, 38 to 90 mm.). Barren Fork, Adair County, Near Baron and Bouyer Branch, 6 miles northwest of Watts, Hubbs and Ortenburger (1929b)*. Tyner Creek (tributary to Barren Fork), Adair County: 13 1/2 miles west of Westville, Ortenburger (July, 1929);

1/2 mile east of Proctor, Moore (April, 1939). Flint Creek, Delaware County: Station 2a (13, 24 to 43 mm.); near Flint, Moore (May, 1947). Ben Knight Creek (tributary to Barren Fork), Adair County, 3 miles due west of Westville (5, 53 to 190 mm.), Moore (May, 1947). Caney Creek, Cherokee County, 2 miles northeast of Barber, Moore (May, 1947).

This form was usually taken in springs and other small tributaries and is considered scarce in the river.

18. Nocomis Girard

22. Nocomis biguttatus (Kirtland). Hornyhead chub. Illinois River: in Arkansas, Hybopsis kentuckiensis (Rafinesque), Meek (1894:87)*; Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 1 (34, 23 to 49 mm.); Station 2 (31, 19 to 54 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 3 (6, 19 to 56 mm.); Station 4 (14, 19 to 46 mm.); Station 5 (35, 25 to 91 mm.); Station 8 (1, 133 mm.); Station 6 (14, 34 to 38 mm.). Flint Creek, Delaware County: 8 miles west of state line, Hubbs and Ortenburger (1929b)*; Station 2a (35, 19 to 76 mm.); near Flint, Moore (May, 1947). Barren Fork, Adair County: near Baron, Ortenburger (July, 1929); near Proctor, Moore and Mizelle (April, 1939). Tyner Creek (tributary to Barren Fork), Adair County: 13 1/2 miles southwest of Westville, Ortenburger (July, 1929); 1/2 mile east of Proctor, Moore (April, 1939 and 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch, 5 miles northeast of Gore, Seamster (March, 1941).

The hornyhead chub was usually taken in fast water, however some of the smaller specimens were found along the shallow quiet stretches of water. It is of economic importance as a forage fish and makes an excellent bait minnow.

19. Hybopsis Agassiz

23. Hybopsis storerianus (Kirtland). The 2 specimens (62 and 64 mm.) of the silver chub from Station 7 constitute a first record for the Illinois River but are not regarded as normal inhabitants of the river since they were taken at the river's mouth only.

24. Hybopsis amblops amblops (Rafinesque). Northern bigeyed chub. Illinois River: in Arkansas Meek (1894:87)*; Station 1 (6, 34 to 52 mm.); Station 2 (3, 42 to 63 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 3 (5, 26 to 46 mm.); Station 4 (32, 25 to 54 mm.); Station 8 (1, 34 mm.); Station 6 (7, 30 to 43 mm.). Flint Creek, Delaware County, near Flint, Moore (May, 1947). Barren Fork, Adair County: 1 mile south of Baron, Ortenburger (July, 1929); near Proctor, Moore and Mizelle (April, 1939); Station 5a (12, 30 to 39 mm.). Tyner Creek (tributary to Barren Fork), Adair County, 13 1/3 miles southwest of Westville, Ortenburger (July, 1929). Caney Creek, Cherokee County, Moore (May, 1947).

This is considered to be the first record for the Illinois drainage in Oklahoma. It was noted that this species seemed to prefer the quieter water.

20. Erimystax Jordan

25. Erimystax species. Spotted chub. This is the species known to Jordan and Evermann and to Forbes and Richardson as E. dissimilis (Kirtland) but the researches of Hubbs and Crow have shown that this name properly belongs with E. watauga, later named. The publication of the name of this form will appear later (Hubbs, personal communication).

Illinois River: Station 1 (4, 67 to 73 mm.); Station 2 (3, 39 to 40 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 3 (19, 40 to 70 mm.); Station 4 (12, 34 to 68 mm.); Station 5 (1, 50 mm.); Station 8, 8, 48 to 71 mm.); Station 6 (24, 34 to 67 mm.); Sequoyah County,

2 miles east of Gore, Ortenburger (July, 1929); Station 7 (7, 38 to 58 mm.). Flint Creek, Station 2a (3, 68 to 69 mm.). Barren Fork, Station 5a (1, 32 mm.).

This form was taken primarily from under flat rocks in shallow, fast water at the head of riffles. When disturbed, Erimystax was observed to dart swiftly away to hide under another rock. The retreat chosen was often too small to accomodate the entire body so "ostrich-like" the fish would hide its head only.

21. Extrarius Jordan

26. Extrarius aestivalis tetranemus (Gilbert). Seven specimens (27 to 30 mm.) of the Arkansas River speckled dace were obtained at Station 7 and constitute a first record for the Illinois River. The presence of this form at Station 7 again reflects the influence of the Arkansas River on the fish population near the mouth of the Illinois River.

22. Chrosomus Rafinesque

27. Chrosomus erythrogaster Rafinesque. Southern redbelly dace. Illinois River: Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Ballard Creek, Adair County, 2 miles northeast of Watts, Dobson (April, 1936); Bouyer Branch, Adair County, 6 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Flint Creek, Station 2a (7, 19 to 39 mm.); Peavine Branch, 1 mile south of Scraper, Moore (April, 1942); Barren Fork, Adair County: near Baron, Hubbs and Ortenburger (1929b)*; 1 mile south of Baron, Ortenburger (July, 1929); Station 5b (55, 17 to 46 mm.); Tyner Creek (tributary to Barren Fork), Adair County, 1/2 mile east of Proctor, Moore (April, 1939); Caney Creek, Cherokee County, 2 miles north of Barber, Moore (April, 1947).

All specimens taken by our party were from cool springs with considerable

emergent vegetation (Radicula, Jessiaea, and Dianthera), and some filamentous algae.

23. Notemigonus Rafinesque

28. Notemigonus crysoleucas auratus Rafinesque. The western golden shiner is herein considered a first record for the Illinois drainage. Station 3 (1, 71 mm.); Station 5 (3, 90 to 99 mm.); Station 7 (2, 42 to 53 mm.); Swimmers Branch, 5 miles northeast of Gore, Seamster (March, 1941); Moore (April, 1942).

Station 7 is only place where it was taken from the Illinois River proper; at Stations 3 and 5 it was taken from overflow pools adjacent to the river.

24. Notropis Rafinesque

29. Notropis atherinoides atherinoides Rafinesque. Emerald shiner. Illinois River: Station 4 (2, 32 and 52 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929); Station 7 (1, 32 mm.).

The emerald shiner herein reported constitutes a first record for the Illinois River.

30. Notropis percobromus (Cope). Plains shiner. The following collections of the Plains shiner constitute a first record for the Illinois drainage. Illinois River: Station 7 (52, 23 to 49 mm.). Tyner Creek (tributary to Barren Fork), 13 1/2 miles southwest of Westville, Ortenburger (July, 1929).

This form is not N. percobromus of Hubbs and Ortenburger (1929b), but is the species so frequently referred to N. atherinoides (Hubbs, 1945:16-17). This species is in the Arkansas River and its silty tributaries on the plains and has been reported as far west as Coldwater Creek (tributary to the North Canadian River), 8 miles southeast of Guymon, Oklahoma (Hubbs and Ortenburger,

1929a:34 and 1929b:86).

31. Notropis (species). Southwestern rosy shiner. Illinois River: Station 1 (269, 17 to 45 mm.); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (187, 10 to 49 mm.); Station 3 (204, 19 to 48 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Cherokee County, 1 mile south of Scraper, Moore (June, 1942); Station 4 (329, 11 to 48 mm.); Station 5 (109, 10 to 55 mm.); Station 8 (75, 25 to 43 mm.); Station 6 (274, 19 to 44 mm.); Station 7 (101, 13 to 52 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (1929). Flint Creek (tributary to the Illinois river), Delaware County: 8 miles west of state line, Hubbs and Ortenburger (1929b)*; near Flint, Trowbridge and Strode (March, 1932); Station 2a (27, 20 to 49 mm.). Barren Fork (of the Illinois River): Adair County, 1 mile south of Baron, Ortenburger (July, 1929); Station 5a (21, 19 to 41 mm.); Cherokee County, Heart-O-Hill Camp, Moore (May, 1947). Tyner Creek (tributary to Barren Fork), Adair County: 13 1/2 miles southwest of Westville, Ortenburger (July, 1929); 1/2 mile east of Proctor, Moore (March, 1942). Caney Creek (tributary to the Illinois River), Cherokee County, 2 miles north of Barber, Moore (May, 1947).

This is the southern representative of Notropis rubellus (Agassiz) under study by Hubbs and Black, and is the form provisionally referred to as Notropis percobromus by Hubbs and Ortenburger (1929b), according to Hubbs (personal communication) and Hubbs (1945).

The rosy shiner is the third most abundant species in the Illinois River. It is found in all habitats but shows a distinct preference for fast water and was almost invariably taken with Notropis zonatus pilsbryi at all of our stations. It was not as abundant as pilsbryi except at Station 7, near the mouth of the river, where it showed a station percentage frequency

of 03.64 compared with 00.69 for pilsbryi.

32. Notropis umbratilis umbratilis (Girard). The southern redfin shiner has not been previously recorded from the Illinois River in Oklahoma where it appears to be rather uncommon. Illinois River: Station 1 (1, 53 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929); Station 7 (17, 21 to 32 mm.); Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Seamster (April, 1941). This species, an inhabitant of more sluggish streams, has been taken from tributary streams of the Arkansas River on both sides of the Illinois drainage, Hubbs and Ortenburger (1929b)*, and doubtless will never be of significant importance in the Illinois River.

33. Notropis cornutus chrysocephalus (Rafinesque). Central common shiner. Illinois River: in Arkansas, Meek (1894-87); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 1 (1, 64 mm.); Station 4 (2, 23 to 24 mm.).

This form must be considered uncommon in the Illinois River at present, however Meek (1894) reported N. cornutus (Mitchell) abundant in the Illinois River at Prairie Grove, Arkansas. It is quite possible that it is still abundant in the head waters since farther north the same form favors small streams and is unlike N. c. isolepis in this respect. In the Blue River, tributary of the Red River and a stream quite similar in many respects to the Illinois, isolepis is a prominent minnow.

34. Notropis zonatus pilsbryi Fowler. Arkansas striped shiner. Illinois River: in Arkansas Meek (1894:87)*; Station 1 (333, 18 to 68 mm.); Station 2 (273 to 73 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 3 (303, 21 to 73 mm.); Cherokee County, 1 mile south of Scraper, Moore (June, 1942); Station 4 (430, 22 to 45 mm.); Station 5

(316, 22 to 50 mm.); Station 8 (123, 27 to 53 mm.); Station 6 (480, 25 to 50 mm.); Station 7 (19, 33 to 52 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). Bouyer Branch, 6 miles northwest of Watts, Hubbs and Ortenburger (1929b)*. Flint Creek, Delaware County; 8 miles west of state line, Hubbs and Ortenburger (1929b)*; near Flint, Moore (May, 1947); Station 2a (54, 23 to 64 mm.). Peavine Branch, 1 mile south of Scraper, Moore (June, 1942). Barren Fork: Adair County, near Baron, Hubbs and Ortenburger (1929b)*; 1 mile south of Baron, Ortenburger (July, 1929); Adair County, near Proctor, Moore and Mizelle (April, 1939); Station 5a (123, 28 to 72 mm.); Cherokee County, Heart-O-Hill Camp, Moore (May, 1947). Courthouse Creek (tributary to Barren Fork), Adair County, 9 miles west of Westville, Ortenburger (July, 1929). Tyner Creek (tributary to Barren Fork), Adair County: 13 1/2 miles southwest of Westville, Ortenburger (July, 1929); 1/2 mile east of Proctor, Moore (April, 1939, and April, 1942). Caney Creek, Cherokee County, Moore (May, 1947).

The Arkansas striped shiner is the most abundant species in the Illinois River drainage and the second most abundant in the Illinois River. A marked preference is indicated for fast water 2 to 4 feet deep, but due to its abundance it was taken from most of the habitats in the river, even from muddy overflow pools which must be considered an unnatural habitat for this species. It is used quite extensively as a bait minnow in the northeastern part of the state because of its abundance and size rather than any special desirable qualities.

35. Notropis blennius (Girard). The river shiner was first taken from the Illinois River by Ortenburger in Sequoyah County, 2 miles east of Gore (July, 1929) and later by us at Station 7 (35, 25 to 46 mm.).

This species appears to be restricted to the alluvial portion of the

river near its mouth where it has wandered from the Arkansas River in which it is rather widely distributed (Hubbs and Lagler, 1941).

36. Notropis greenei Hubbs and Ortenburger. The wedgespot shiner, although common, has not been reported for the Illinois drainage in Oklahoma. Illinois River: Station 1 (7, 40 to 51 mm.); Station 2 (44, 46 to 65 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 3 (78, 25 to 56 mm.); Station 4 (57, 26 to 53 mm.); Station 5 (30, 21 to 51 mm.); Station 8 (26, 25 to 62 mm.); Station 6 (84, 15 to 56 mm.); Station 7 (55, 22 to 52 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). Flint Creek (tributary to the Illinois River), Delaware County, Station 2a (1, 51 mm.). Swimmers Branch (tributary to the Illinois River), Sequoyah County, 5 miles northeast of Gore, Seamster (March, 1941).

The habitat preference of N. greenei is fast stretches of water from 1 to 3 feet deep where spawning was in progress on August 15. Ripe females extruded eggs into the hand when picked up from the seine. The presence of breeding females and the gradation in size of the young indicate an extensive breeding period. No doubt it serves as food for Micropterus since they have the same habitat preference. Bass were observed in pursuit of a school of greenei and in the excitement occasioned by the pursuer the minnows leapt from the water. One specimen landed on a gravel bank where it quickly died and thus made possible positive identification. Its use as a "Bait Minnow" cannot be recommended since it is so delicate.

37. Notropis spilopterus (Cope). Spotfin shiner. Illinois River: Station 1 (101, 27 to 80 mm.); Station 3 (3, 23 to 42 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936) (1 specimen); Station 8 (42, 30 to 65 mm.); Station 6 (123, 19 to 54 mm.); Station 7 (85 young to adult). Caney Creek (tributary to the Illinois River), Cherokee County, 2 miles north

of Barber, Moore (May, 1947). Swimmers Branch (tributary to the Illinois River), 5 miles northeast of Gore: Moore (March, 1941); Seamster (March, 1941).

The only listing of this fish for the state is Hubbs (in Aldrich 1946)*, and based on specimens collected by Dr. Moore and sent to the Museum of Zoology, University of Michigan. The single specimen taken by Blair and Blair (1936) was referred by Dr. Hubbs to N. whipplii (Girard), before the existence of spilopterus in Oklahoma was known. Dr. R. M. Bailey has kindly checked this specimen and referred it to spilopterus.

This species was taken principally from rather deep fast water just below the riffles. The larger specimens were taken in water too swift and deep to operate a 10 foot seine, in these places the seine was cast out from the head of the riffle and pulled back as quickly as possible. N. spilopterus was associated with N. camurus, N. z. zonatus, Campostoma, and Micropterus.

Adult and half grown of spilopterus and camurus are recognized without difficulty, the physical characters that differentiate the two species being quite discernible, but in the young less than 35 mm. all the specific characteristics seem to blend in direct proportion to the decrease in size. After the study of numerous combinations of measurements and pigment characters a provisional separation of the young was made with considerable hesitation.

38. Notropis camurus (Jordan and Meek). Bluntface shiner. Illinois River: Station 1 (53, 36 to 86 mm.); Station 2 (5, 45 to 61 mm.); Station 3 (1, 64 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (12, 35 to 55 mm.); Station 5 (14, 24 to 33 mm.); Station 8 (40, 19 to 77 mm.); Station 6 (295, 17 to 72 mm.); Station 7 (285, 16 to 67 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929).

The only literature reference to this species in Oklahoma appears to

be Hubbs (in Aldrich, 1946). N. Camurus was taken at all of our stations on the Illinois River. When it occurred at the same station with spilopterus they were often taken in the same seine haul. Little or no difference was noted in their habitat preference, except that camurus was taken in water that was not as swift as that preferred by spilopterus. The gradation in size of the young and the presence of gravid females would indicate an extensive breeding period similar to that of N. lutrensis. The gravid females ranged in size from about 45 to 77 mm. of standard length. It has been taken below the dam at Lake Spavinaw by Dr. Moore (1940).

39. Notropis lutrensis lutrensis (Baird and Girard). The Red Shiner is recorded for the first time for the Illinois River in Oklahoma. Illinois River: Station 1 (8, 35 to 41 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (7, 21 to 27 mm.); Station 5 (10, 23 to 28 mm.); Station 8 (1, 36 mm.); Station 6 (45, 17 to 42 mm.); Station 7 (630, 20 to 50 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). Caney Creek, 2 miles north of Barber, Moore (May, 1947).

Though not abundant, above the proposed impoundment site, the red shiner can be expected to be an important economic factor in the lake.

40. Notropis boops Gilbert. Bigeye shiner. Illinois River: in Arkansas, Notropis shumardi (Gilbert), Meek (1894:87)*; Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 1 (33, 24 to 54 mm.); Station 2 (9, 41 to 48 mm.); Station 3 (77, 16 to 60 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (92, 24 to 57 mm.); Station 5 (20, 37 to 48 mm.); Station 8 (8, 36 to 46 mm.); Station 6 (151, 15 to 60 mm.); Station 7 (16, 22 to 47 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). Barren Fork, Adair County: 1 mile south of Baron, Ortenburger (July, 1929); Station 5 (2, 38

and 41 mm.); near Proctor, Moore and Mizelle (April, 1939). Tyner Creek (tributary to Barren Fork), Adair County, 1/2 mile east of Proctor, Moore (April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1941); Seamster (March, 1941).

N. boops was associated with N. pilsbryi, N. greenei, the southern representative of N. rubellus and Dionda in swift water 1 to 3 feet in depth.

41. Notropis volucellus (Cope). Mimic shiner.

41a. Notropis volucellus (subspecies). Southwestern mimic shiner. Illinois River: Station 5 (3, 20 to 21 mm.); Station 8 (1, 35 mm.); Station 6 (13, 12 to 38 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929).

Hubbs and Gordon have recognized this form but as yet it is undescribed.

41b. Notropis volucellus buchanani Meek. This is the first record of the ghost mimic shiner for the Illinois River. Station 7 (115, 21 to 26 mm.). This pale, small eyed, form is not considered to be a normal inhabitant of the Illinois River, but rather another inhabitant of the Arkansas River that has wandered for a short distance up the mouth of a tributary stream. It is not considered as an economic factor in the Illinois River except for the last few miles of its course.

25. Phenacobius Cope

42. Phenacobius mirabilis (Girard). The suckermouth minnow is herein recorded for the first time for the Illinois River. Station 7 (5, 53 to 58 mm.). The absence of this species from all other collections in this drainage would indicate that it does not find the Illinois River a suitable habitat, except for the alluvial region near the mouth, and is considered to be an occasional visitor from the Arkansas River where it is known to

have a wide distribution in tributaries with a sandy bottom and considerable gradient.

26. Dionda Girard

43. Dionda nubila (Forbes). Ozark minnow. Illinois River: in Arkansas Meek (1894:87)*; Station 1, (47, 20 to 64 mm.); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (81, 19 to 62 mm.); Station 3 (295, 20 to 55 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (426, 15 to 52 mm.); Station 5 (101, 21 to 53 mm.); Station 8 (119, 17 to 48 mm.); Station 6 (1248, 15 to 51 mm.); Station 7 (400, 23 to 37 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). Bouyer Branch, Adair County, 6 miles northwest of Watts, Hubbs and Ortenburger (1929b)*. Flint Creek, Delaware County: 8 miles west of the state line, Hubbs and Ortenburger (1929b)*; near Flint, Trowbridge and Strode (March, 1932); near Flint, Moore (May, 1947); Station 2a (29, 21 to 58 mm.). Peavine Branch, Cherokee County, 1 mile south of Scraper, Moore (April, 1942). Barren Fork: Adair County, 1 mile south of Baron, Ortenburger (July, 1929); Adair County, near Proctor, Moore and Mizelle (April, 1939); Station 5a (126, 18 to 53 mm.); Cherokee County, Heart-O-Hills Camp, Moore (May, 1947). Ben Knight Creek (tributary to Barren Fork), Adair County, 3 miles due west of Westville, Moore (May, 1947). Courthouse Creek (tributary to Barren Fork), Adair County, 9 miles southwest of Westville, Ortenburger (July, 1929). Tyner Creek (tributary to Barren Fork), Adair County:13 1/2 miles southwest of Westville, Ortenburger (July, 1929); 1/2 mile east of Proctor, Moore (April, 1939) and (April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore: Moore (April, 1941); Seamster (March, 1941); Moore (April, 1942).

On the basis of the total number of specimens taken by us Dionda ranks first in abundance in the river, but second to N. z. pilsbryi for the Illinois drainage in Oklahoma. Due to the frequent occurence of Dionda young in overflow pools and small oxbow lakes it appears that this species might be able to maintain itself in a lake habitat, however, more study is needed to determine this point.

27. Hybognathus Agassiz

44. Hybognathus placitus placitus (Girard. The plains minnow is a first record for the Illinois River in Oklahoma. H. nuchalis and H. n. placita were reported from the Illinois River, near Prairie Grove, Arkansas, Meek (1893:238)*, but were not included in a subsequent report which included the Prairie Grove Collection, Meek (1894:87 and 92)*. Illinois River, Station 7 (5, 28 to 39 mm.). The presence of this silty water form in the Illinois River near its confluence with the Arkansas River is not considered significant but rather the normal movement of the fish into the mouth of a tributary stream in search of food.

28. Pimephales Rafinesque

45. Pimephales promelas confertus (Girard). The southern fathead minnow is herein considered a first record for the Illinois River in Oklahoma.

Illinois River: in Arkansas Meek (1894:87)*; Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 7 (3, 23 to 37); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). The lateral line, on all three of our specimens, extends to the end of the hypural.

29. Ceratichthys Baird and Girard

46. Ceratichthys perspicuus (Girard). The bullhead minnow herein recorded is considered a first record for the Illinois River. Illinois

River, Station 7 (91, 21 to 49 mm.). Tyner Creek (tributary to Barren Fork), Adair County, 13 1/2 miles southwest of Westville, Ortenburger (July, 1929).

Hubbs and Black (1947) did not include the Tyner Creek collection on their distribution map. "The preferred habitat of C. perspicuus appears to be the sluggish muddy backwater and bayous of the large and medium-sized streams," Hubbs and Black (1947). The bullhead minnow is a fairly common species in Lake Carl Blackwell near Stillwater, Oklahoma, and is known to occur in other artificial Oklahoma lakes.

47. Ceratichthys tenellus tenellus (Girard). Neosho mountain minnow. Illinois River: Station 4 (6, 34 to 45 mm.); Station 5 (4, 22 to 26 mm.); Station 8 (9, 21 to 42 mm.); Station 6 (131, 19 to 47 mm.); Station 7 (183, 17 to 53 mm.); Cherokee County, 2 miles east of Gore, Ortenburger (1929) and reported by Hubbs and Black (1947). Barren Fork (of the Illinois River), Station 5a (9, 19 to 26 mm.).

C. tenellus is more typical of the Ozark uplands and for this reason we are of the opinion that of the two species of Ceratichthys, taken in the Illinois River, perspicuus would have the better chance of survival in a lake habitat.

30. Hyborhynchus Agassiz

48. Hybohynchus notatus (Rafinesque). Bluntnose minnow. Illinois River: in Arkansas Meek (1894:87)*; Station 1 (63, 22 - 59); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (1, 31 mm.); Station 3 (44, 22 to 66 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (74, 21 to 62 mm.); Station 5 (18, 26 to 52 mm.); Station 6 (249, 14 to 56 mm.); Station 7 (131, 21 to 45 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). Flint

Creek, Delaware County: 8 miles west of the state line, Hubbs and Ortenburger (1929b)*; near Flint, Trowbridge and Strode (March, 1932). Barren Fork, Adair County: near Proctor, Moore and Mizelle (April, 1939); Station 5a (21, 20 to 50 mm.). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch (tributary to the Illinois River), Sequoyah County, 5 miles northeast of Gore, Moore (April, 1941, and April, 1942); Seamster (March, 1941).

The bluntnose minnow is common in the quieter stretches of the river and very common in back waters and small oxbow lakes. This forage fish can be expected to prosper and be of considerable economic importance in the proposed impoundment.

31. Campostoma Agassiz

49. Campostoma anomalum pullum (Agassiz). Central stoneroller. Illinois River: in Arkansas Meek (1894:86)*; Station 1 (40, 32 to 92 mm.); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (33, 25 to 72 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (36, 39 to 58 mm.); Station 5 (74, 24 to 110 mm.); Station 8 (4, 52 to 60 mm.); Station 6 (72, 32 to 72 mm.); Station 7 (7, 60 to 78 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). Ballard Creek, Adair County, 2 miles northeast of Watts, Trowbridge and Strode (March, 1932). Bouyer Branch, Adair County, 6 miles northwest of Watts, Hubbs and Ortenburger (1929b)*. Flint Creek, Delaware County: 8 miles west of the state line, Hubbs and Ortenburger (1929b)*; near Flint, Trowbridge and Strode (March, 1932) and Moore (May, 1947); Station 2a (12, 21 to 107 mm.). Peavine Branch, Cherokee County, 1 mile south of Scraper, Moore (April, 1942). Rea Sun Spring, Station 5b (30, 25 to 43 mm.). Barren Fork: Adair County, near Baron, Hubbs and Ortenburger (1929b)*; Adair County,

1 mile south of Baron, Ortenburger (July, 1929); Adair County, near Proctor, Moore and Mizelle (April, 1939); Station 5a (20, 33 to 37 mm.); Cherokee County, Heart-O-Hills Camp, Moore (May, 1947). Ben Knight Creek (tributary to Barren Fork), Adair County, 3 miles west of Westville, Moore (May, 1947). Courthouse Creek (tributary to Barren Fork), Adair County, 9 miles west of Westville, Ortenburger (July, 1929). Tyner Creek (tributary to Barren Fork), Adair County: 13 1/2 miles southwest of Westville, Ortenburger (July, 1929); 1/2 mile east of Proctor, Moore (April, 1939, and April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch, Sequoyah County, Moore (April, 1941, and April, 1942).

The central stoneroller is abundant in the Illinois drainage in spite of the fact that commercial bait dealers take large numbers each year. Construction of the Tenkillers Dam would have a profound effect on the stoneroller, although it can exist in a lake habitat and will spawn in culture ponds (Langlois, 1937). It shows a distinct preference for flowing water and therefore might be expected to move out of the lake into the tributary streams.

AMEIURIDAE

32. Ictalurus Rafinesque

50. Ictalurus lacustris punctatus (Rafinesque). Southern channel catfish. Illinois River: Station 1 (4, 36 to 117 mm.); Station 2 (1, 41 mm.); Station 3 (1, 330 mm.); Station 4 (2, 250 to 300 mm.); Station 5 (4, 208 to 310 mm.); Station 8 (9, 30 to 536 mm.); Station 6 (12, 24 to 46 mm.); Station 7 (17, 30 to 73 mm.).

The southern channel catfish recorded herein is believed to be the first record for the Illinois River in Oklahoma. Many young channel catfish were observed by Dr. Moore at Station 6 hiding under small flat stones in

the quiet shallow water along the sides of a long riffle. None of this species over 120 mm. long was taken by means of the seine, all over this length were either specimens examined on fishermen's strings or caught on light tackle or trotlines by members of our party, usually in water over 6 feet deep or in water that contained obstructions of such a nature that seining was impossible and therefore the numbers taken are in no way an indication of the abundance of channel catfish in the Illinois River.

33. Ameiurus Rafinesque

51. Ameiurus melas catulus (Girard). The southern black bullhead. This is a first record for the Illinois River in Oklahoma. Illinois River: in Arkansas Meek (1894:86)*; Station 2 (19, 22 to 31 mm.); Station 3 (2, 23 and 24 mm.); Station 5 (1, 69 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1941).

A. m. catalus was taken from cutoff pools and oxbow lakes only.

52. Ameiurus natalis natalis (LeSueur). Northern yellow bullhead. Illinois River: Station 1 (2, 41 and 44 mm.); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (1, 85 mm.); Station 3 (5, 35 to 106 mm.); Station 4 (1, 55 mm.); Station 5 (11, 29 to 45 mm.); Station 6 (1, 52 mm.). Bouyer Branch, Adair County, 6 miles northwest of Watts, Hubbs and Ortenburger (1929b)*. Flint Creek, Station 2a (1, 45 mm.). Barren Fork, Station 5a (1, 58 mm.). Tyner Creek (tributary to Barren Fork), Adair County, 1/2 mile east of Proctor, Moore (April, 1942). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1941).

The yellow bullhead is uncommon in the river proper most of our specimen being taken from cutoff pools and small oxbow lakes. This fish is known

to prosper in lake habitats but like the black bullhead its abundance rapidly falls off after the first few years following impoundment.

34. Pilodictis Rafinesque

53. Pilodictis olivaris (Rafinesque). The flathead catfish is a first record for the Illinois River: Station 2 (2, 37 to 290 mm.); Station 6 (9, 40 to 94 mm.).

The obstructions found in the deeper water such as boulders, submerged tree stumps and even large trees prevented efficient seining of the preferred habitat of this large river species just as it did in the collection of channel catfish. Collections from habitats such as these are selective and are not indicative of relative abundance. The presence of the 37 mm. specimen about 90 river miles from the mouth of the river indicates that it does spawn in the river. At Station 6 many young were observed in association with Noturus and Erimystax under flat rocks at the head of a riffle.

35. Noturus Rafinesque

54. Noturus flavus Rafinesque. Stonecat. Illinois River: Station 2 (1, 38 mm.); Station 3 (3, 105 to 175 mm.); Station 5 (5, 33 to 95 mm.); Station 8 (6, 52 to 152 mm.); Station 6 (6, 50 to 130 mm.); Station 7 (6, 41 to 65 mm.). Flint Creek, Station 2a (3, 105 to 150 mm.).

The stonecat was first recorded for the Illinois River and Barren Fork by Meek (1893:229), but in a later publication Meek (1894:87 and 92), apparently covering the earlier collections, this species was omitted.

This small catfish was found beneath flat stones at the head of riffles where the water, less than one foot deep, was beginning to increase its velocity in the riffles proper. The small size (usually less than 300 mm.) and apparent small numbers of stonecats suggest that it is actually of little importance. Judging from its natural habitat one would suppose that

this species would probably be absent from the lake. The stonecat seems to require fairly large and usually flat stones but occasionally makes use of other objects such as a paper pie plate.

36. Schilbeodes Bleeker

55. Schilbeodes nocturnus (Jordan and Gilbert). Freckled madtom. Illinois River: Station 8 (4, 25 to 37 mm.); Station 6 (4, 25 to 41 mm.); Station 7 (10, 23 to 48 mm.).

The freckled madtom is a first record for the Illinois River. This species was taken from the shallow water at the head of riffles and associated with Schilbeodes insignis. It is considered to be of minor economic importance in the river.

56. Schilbeodes insignis (Richardson). Slender madtom. Illinois River: in Arkansas Noturus exilis Nelson, Meek (1894:86)*; Station 1 (25, 28 to 62 mm.); Station 2 (13, 43 to 52 mm.); Station 3 (15, 26 to 55 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (21, 34 to 56 mm.); Station 5 (26, 24 to 66 mm.); Station 8 (25, 25 to 57 mm.); Station 6 (40, 30 to 55 mm.); Station 7 (33, 28 to 47 mm.). Flint Creek, Delaware County: near Flint, Moore (May, 1947); Station 2a (9, 27 to 55 mm.). Peavine Branch, Cherokee County, 1 mile south of Scraper, Moore (April, 1942). Barren Fork: Adair County, near Proctor, Moore and Mizelle (April, 1939); Station 5a (8, 44 to 53 mm.); Cherokee County, Heart-O-Hills Camp, Moore (May, 1947). Tyner Creek (tributary to Barren Fork), Adair County, 1/2 mile east of Proctor, Moore (April, 1939, and April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947).

The slender madtom is probably more abundant than all other ameiurids combined. They were usually taken at the head of riffles in loose gravel and under flat rocks during the day and at night were observed swarming over

the shallow shoals, where the water was from 2 to 6 inches deep, just above the riffles. With the aid of a flash light, from 5 to 10 of these interesting little madtoms were counted in the circle of light about 18 inches in diameter. When the flash light was turned on they would swim madly around for about 2 or 3 seconds, then in an instant disappear into the interstices of the gravel and small stones with such ease that it was difficult to believe. This is one of the species that would be expected to disappear from that part of the river covered by the lake.

The slender madtom was readily taken as bait by Micropterus; in fact it seemed to be the best live bait available.

57. Schilbeodes miurus (Jordan). The brindled madtom is a first record for the Illinois River: Station 6 (1, 22mm.); Station 7 (4 specimens). This form, provisionally referred to miurus because it is more like this species than eleutherus, is definitely different from the Poteau River miurus. These specimens have a larger eye, more white on the margins of the fins, and the black blotch does not extend on to the adipose fin. This form has been compared with the single 26 mm. specimen (No. 7586) in the University of Oklahoma Museum of Zoology from the Little Petit Jean River, Scott County, Arkansas, reported by Hubbs and Ortenburger (1929b)* and found not to agree. The Scott County specimen is more like the Poteau River form. Our specimens have been sent to Dr. Reeve M. Bailey for study.

ANGUILLIDAE

37. Anguilla Shaw

58. Anguilla bostoniensis (LeSueur). The first record of the American eel for the Illinois River is our single dead and somewhat mutilated specimen (about 600 mm.) found floating in the main channel at Station 7. Eel are not uncommon in the river according to information obtained from

fishermen. Many of these find food fish are killed and discarded because they resemble a snake. Several dressed specimens, which had been taken on trotlines, were seen in the possession of fishermen.

CYPRINODONTIDAE

38. Fundulus Lacepede

59. Fundulus notatus (Rafinesque). Blackstripe topminnow. Illinois River: in Arkansas, Meek (1894:87)*; Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (5, 48 to 52 mm.); Station 3 (39, 33 to 63 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (3, 18 to 48 mm.); Station 5 (12, 22 to 50 mm.); Station 6 (17, 22 to 43 mm.); Station 7 (2, 24 and 25 mm.). Tyner Creek (tributary to Barren Fork), Adair County, 1/2 mile east of Proctor, Moore (April, 1939). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1942).

The blackstripe topminnow was more common in the overflow pools and small oxbow lakes than in backwaters. F. notatus and F. olivaceus occupy more or less the same habitat without any apparent interbreeding. A special effort was made to pick up single pairs of adults to determine whether or not they were of the same species, and when this was accomplished they invariably were. The gradation in the size of the young and the presence of gravid females at Stations 2, 3 and 4 would indicate an extensive spawning period for this form.

60. Fundulus olivaceus (Storer). Blackspotted topminnow. Illinois River: Station 1 (14, 30 to 53 mm.); Station 2 (17, 29 to 58 mm.); Station 3 (54, 23 to 63 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (28, 17 to 63 mm.); Station 5 (74, 22 to 61 mm.); Station 8 (17, 22 to 58 mm.); Station 6 (9, 22 to 37 mm.); Station 7 (1, 51 mm.).

TABLE 1. Comparison of Fundulus notatus and Fundulus olivaceus by Dr. Carl L. Hubbs, based on specimens taken together in the Illinois River in Oklahoma by Dr. Moore (April, 1941).

	Fundulus notatus	Fundulus olivaceus
General body form	Deeper, particularly in males	More attenuate
Muzzle	More bluntly rounded in side view	More depressed
Mouth	More nearly transverse	With larger gape particuly in premaxillary region
Eye	Larger	Smaller
Eye in snout	About 1.2 in small adults to about 1.4 in large ones	About 1.5 in small adults, about 1.7 in large ones
Fins	Larger, especially in male (in high males D. and A. sharply pointed behind and reaching C.)	Smaller, more rounded; D. and A. less produced in males
Lateral band	Less intense, less even-edged; generally broader	More intense, more even-edged; generally narrower
Cross Bars	Lacking to moderately developed in females; strong in males	Lacking in females, usually weak in males
Sexual dimorphism	Greater	Less
Predorsal stripe	Rather strong, though often dashed, in young; remnant of spots usually retained in adult	Very weak and diffuse in young, lacking in adult
Post anal stripe	Rather strong and continuous in young; weak in adult	A row of dusky blotches in young; lacking in adult
Spots on body	More diffuse and irregular, brownish; less striking on darker ground color	More discrete - smaller, rounder, blacker; more bold on the light background
Black pigment about anal fin and anus young	Less developed (area narrower, less solid)	Well developed (area broad, more solid)

Flint Creek, Station 2a (10, 18 to 54 mm.). Peavine Branch, Cherokee County, near Scraper, Moore (March, 1942). Barren Fork, Adair County: near Proctor, Moore and Mizelle (April, 1939); Station 5a (3, 28 to 34 mm.). Tyner Creek (tributary to Barren Fork), Adair County, Moore (April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1942).

The blackspotted topminnow was included in the list of the fishes of Oklahoma, (Hubbs in Aldrich, 1946). F. olivaceous, long confused with F. notatus (see Table 1), was the more abundant of the two species except at Stations 6 and 7 where notatus was the more common. As in F. notatus the gradation in size of the young and gravid females with well developed eggs at Stations 2, 3 and 5 denotes a long breeding period. No difference was noted in the general habitat preference of this species as compared with notatus.

POECILIIDAE

39. Gambusia Poey

61. Gambusia affinis affinis (Baird and Girard). Gambusia. Illinois River: Station 1 (35, 17 to 39 mm.); Station 2 (31, 15 to 41 mm.); Station 3 (22, 20 to 46 mm.); Station 4 (56, 17 to 44 mm.); Station 5 (29, 17 to 38 mm.); Station 8 (2, 18 and 22 mm.); Station 6 (36, 13 to 35 mm); Station 7 (29, 15 to 30 mm.). Flint Creek, Station 2a (8, 17 to 38 mm.). Ben Knight Creek (tributary to the Barren Fork), Adair County, 3 miles west of Westville, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1942).

This report constitutes a first record for the Illinois River in Oklahome. This unique little fish was common in the backwaterof the river and in the overflow pools and oxbow lakes, but was less common in the tributary

streams. Members of our party slept without protection from mosquitoes, the scarcity of which, was no doubt due, in part, to the activities of Gambusia. Many of the females were heavy with young and some of them liberated one or two when picked up from the seine.

PERCIDAE

40. Stizostedion Rafinesque

62. Stizostedion canadense (Smith). Sauger. During the course of this expedition conversations with sportsmen gave us considerable trouble in determining the identity of the "jack salmon" which, we were told, was frequently taken in the river. A photograph in the possession of Mr. A. D. Aldrich verified our suspicions that Stizostedion was the fish in question. Since canadense is the only member of this genus which has previously been taken in Oklahoma we feel that its inclusion in this list is not unwarranted. On May 25, 1947, a head and skin of canadense from Spring Creek, a tributary of the Grand River (Neosho River), was presented to us by Mr. Bud Jackson.

41. Hadropterus Agassiz

63. Hadropterus phoxocephalus (Nelson). Slenderhead darter. Illinois River: Station 1 (4, 53 to 62 mm.); Station 8 (2, 55 to 58 mm.); Station 6 (9, 39 to 64 mm.); Station 7 (4, 43 to 52 mm.).

The slenderhead darter, another first record and a complete surprise, was taken in moderate to swift water from 1 to 2 feet deep and from the riffles. In Oklahoma this species has previously been taken in the siltier tributaries of the Arkansas River such as the Poteau River, the Chickaskia River, and Red Rock Creek.

42. Percina Haldeman

64. Percina caprodes carbonaria (Baird and Girard). Southwestern

logperch. Illinois River: in Arkansas, Meek (1894:87)*; Adair County, 2 miles northeast of Watts, Dobson (April, 1936); Station 1 (2, 34 and 67 mm.); Station 2 (1, 42 mm.); Station 3 (4, 43 to 70 mm.); Station 4 (6, 41 to 140 mm.); Station 8 (1, 66 mm.); Station 6 (3, 68 to 71 mm.). Flint Creek, Station 2a (6, 103 to 116 mm.).

The logperch herein reported constitutes a first record for the Illinois River in Oklahoma. In Flint Creek, Percina was associated with Etheostoma under flat stones in moderately swift water, from 1 to 2 feet in depth. In the Illinois River Percina was less selective of its habitat and was found in cutoff pools, slower currents below the riffles, and also in association with Etheostoma under flat stones at the head of riffles.

43. Doration Jordan

65. Doration (species). The Oklahoma speckled darter has been recognized by Dr. Hubbs as an undescribed species. Illinois River: Station 1 (8, 24 to 42 mm.); Station 2 (3, 26 to 42 mm.); Station 3 (7, 25 to 43 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (18, 27 to 43 mm.); Station 5 (1, 29 mm.). Barren Fork, Adair County, near Proctor, Moore and Mizelle (April, 1939).

Meek (1894:87) reported Etheostoma saxatile (Hay), referable to this species, from the Illinois River in Arkansas. The manuscript name of this form was included by Hubbs (in Aldrich, 1946). This undescribed species was taken in 14 Mile Creek, a tributary of the Grand River (Neosho River), by Dr. Moore on May 4, 1947, in breeding color from a shallow riffle with a weak current. In the Illinois River it was taken from similar habitats and frequently with Catonotus f. lineolatus though not necessarily on the same part of the riffle. They were taken together in a shallow backwater where several springs were flowing up through the gravel producing little

saucer-shaped depressions.

44. Poecilichthys Agassiz

66. Poecilichthys zonalis arcansanus Jordan and Gilbert. Arkansas banded darter. Illinois River: in Arkansas, Meek (1894:87)*; Station 1 (225, 23 to 44 mm.); Station 2 (83, 22 to 48 mm.); Station 3 (47, 40 to 52 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (64, 24 to 49 mm.); Station 5 (74, 24 to 57 mm.); Station 8 (73, 22 to 44 mm.); Station 6 (58, 30 to 46 mm.); Station 7 (31, 28 to 39 mm.). Flint Creek, Delaware County: near Flint, Moore (May, 1947); Station 2a (38, 24 to 46 mm.). Barren Fork, Adair County, near Proctor, Moore and Mizelle (April, 1939); Station 5a (19, 35 to 49 mm.); Cherokee County, Heart-O-Hills Camp, Moore (May, 1947). Ben Knight Creek (tributary to Barren Fork), Adair County, 3 miles west of Westville, Moore (May, 1947). Tyner Creek (tributary to Barren Fork), Adair County, 1/2 mile east of Proctor, Moore (March, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947).

The Arkansas banded darter is the most abundant percid in the Illinois drainage. Although this species showed a definite preference for a riffle habitat, it was so abundant that we took it everywhere, even in muddy overflow pools.

67. Poecilichthys spectabilis Agassiz. Orangethroat darter. Illinois River: in Arkansas, Meek (1894:87)*; Station 1 (21, 25 to 45 mm.); Station 2 (10, 28 to 44 mm.); Station 3 (9, 23 to 44 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (24, 25 to 44 mm.); Station 5 (94, 24 to 52 mm.); Station 8 (21, 26 to 37 mm.); Station 6 (29, 19 to 39 mm.); Station 7 (2, 30 and 46 mm.). Flint Creek, Delaware County, near Flint, Moore (May, 1947); Station 2a (31, 21 to 55 mm.). Rea Sun Spring, Station 5b (5, 38 to 55 mm.). Barren Fork, Adair County: near

Baron, Hubbs and Ortenburger (1929b)*; near Proctor, Moore and Mizelle (March, 1929); Station 5a (29, 29 to 41 mm.). Ben Knight Creek (tributary to Barren Fork), Adair County, 3 miles west of Westville, Moore (May, 1947). Tyner Creek (tributary to Barren Fork), 13 1/2 miles southwest of Westville, Ortenburger (July, 1929); 1/2 mile east of Proctor, Moore (April, 1939, and April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1941).

The orangethroat darter was more abundant in the springs and shallow riffles with weak to moderate current, and along a gentle sloping shore in shallow water with a moderately swift current. The females were more uniform in color and body form than the males which were taken in all stages of sixual maturity from young to old individuals in rather high color. The coloration varied from light orange to orange red and the darker pigments often intensified on the dorsal and anterior parts of old males.

68. Poecilichthys punctulatus Agassiz. Stippled darter. Illinois River: Station 3 (2, 38 and 39 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (4, 35 to 42 mm.); Station 5 (6, 39 to 59 mm.); Station 6 (1, 40 mm.). Ben Knight Creek (tributary to Barren Fork), Adair County, 3 miles west of Westville, Moore (May, 1947). Tyner Creek (tributary to Barren Fork), 1/2 mile east of Proctor, Moore (April, 1939, and April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Seamster (March, 1941).

The first and only other record of the stippled darter for Oklahoma is that of Hubbs and Ortenburger (1929b)*. The stippled darter was taken on the shallow riffles, shallow water along gentle sloping shores where small indentations often filled with leavers occur, in weak to moderate

current, and in heavily vegetated springs with slight gradient. They were frequently associated with P. spectabilis, and of course the ever-present P. z. arcansanus.

69. Poecilichthys whipplii whipplii (Girard). Western redfin darter. Illinois River: in the headwaters in Arkansas, Hubbs and Black (1941:3)*; Station 8 (20, 27 to 42 mm.); Station 6 (29, 26 to 48 mm.); Station 7 (64, 30 to 48 mm.). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore: Seamster (March, 1941); Moore, (April, 1942).

The redfin darter was taken on the riffles and from shallow water with a moderate current, but like P. z arcansanus its population pressure seems to force it into all habitats including backwater and cutoff pools. Toward the river's mouth it tends to replace the later. P. w. whipplii was recorded for the headwaters of the Illinois River in Arkansas by Hubbs and Black (1940:3)*, but from this point to a point about 15 river miles above the mouth of the Illinois River not a single specimen has been reported from the river or its tributaries. This is the first report for the Illinois River in Oklahoma.

45. Catonotus Agassiz

70. Catonotus flabellaris lineolatus Agassiz. Striped fantail darter. Illinois River: in Arkansas (Etheostoma flabellare) Meek (1894:87)*; Station 1 (11, 27 to 45 mm.); Station 2 (1, 35 mm.); Station 3 (3, 26 to 29 mm.); Station 4 (6, 28 to 34 mm.); Station 5 (11, 29 to 35 mm.). Flint Creek, Delaware County, near Flint, Moore (May, 1947). Barren Fork, Adair County, Moore and Mizelle (March, 1939). Tyner Creek (tributary to Barren Fork, Adair County, 1/2 mile east of Proctor, Moore (March, 1939, and March, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947).

This report constitutes a first record for the Illinois River in Oklahoma. C. f. lineolatus was found almost exclusively in the shallow riffles habitat where the water was from 1/2 to 3 inches in depth. There is no record of Catonotus or its frequent associate, Doration, south of Caney Creek, and it would appear that they are restricted to the upper two thirds of the Illinois River in Oklahoma.

46. Etheostoma Rafinesque

71. Etheostoma (species). Southern greenside darter. (This is an undescribed species recognized by Hubbs and Harry and is now under study). Illinois River: in Arkansas, Etheostoma blennioides (Rafinesque) Meek (1894:87)*; Station 1 (8, 38 to 70 mm.); Station 2 (6, 39 to 80 mm.); Station 3 (3, 36 to 52 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (9, 42 to 62 mm.); Station 5 (3, 35 to 50 mm.); Station 8 (12, 43 to 74 mm.); Station 6 (12, 46 to 57 mm.). Flint Creek, Station 2a (15, 57 to 98 mm.). Barren Fork, Station 5a (1, 50 mm.). Ben Knight Creek (tributary to the Barren Fork), Adair County, 3 miles west of Westville, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1941).

This form has been previously reported for the state as a subspecies of Etheostoma blennioides (Hubbs in Aldrich, 1946), but is now considered by Hubbs (personal communication) as an undescribed species. This rather large, exquisite greensided, redspotted darter, was usually taken under flat rocks at the head of riffles where it was often associated with Noturus and Percina. In Flint Creek, about one mile from its mouth, Etheostoma was taken in the main channel under flat rocks in moderately swift water from 1 to 2 feet deep.

CENTRARCHIDAE

47. Micropterus Lacepede

72. Micropterus punctulatus punctulatus (Rafinesque). Northern spotted bass. (Station 1 (73, 29 to 150 mm.); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (66, 36 to 255 mm.); Station 3 (61, 36 to 157 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (180, 27 to 177 mm.); Station 5 (26, 50 to 250 mm.); Station 8 (12, 55 to 286 mm.); Station 6 (34, 55 to 65 mm.); Station 7 (8, 81 to 82 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). Flint Creek, Station 2a (13, 38 to 78 mm.). Barren Fork: Station 5a (1, 39 mm.); Cherokee County, Heart-O-Hills Camp, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1942).

The northern spotted bass is the most abundant game fish in the Illinois River. The larger specimens were taken in a moderate to swift current and deep backwater while the young frequented almost all habitats including muddy overflow pools. It would appear that this species seldom reaches a total length of more than 15 inches. However, Hubbs and Bailey (1940:16) reported a specimen 17 1/2 inches long. The largest specimen taken by our party, and this includes some 200 spotted bass taken while sport-fishing but not recorded in this paper, was 286 mm. (11 1/4 in.) standard length.

73. Micropterus dolomieu velox (Hubbs and Bailey. Neosho smallmouth bass. Illinois River: in Arkansas, Meek (1894:87)*; Station 1 (201, 31 to 53 mm.); Station 2 (66, 43 to 205 mm.); Station 3 (42, 50 to 175 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (24, 26 to 215 mm.); Station 5 (13, 32 to 54 mm.); Station 6 (12, 52 to 85 mm.); Station 7 (6, 85 to 88 mm.); Sequoyah County, 2 miles east of Gore,

Ortenburger (1929). Flint Creek, Delaware County: 8 miles west of the state line, Hubbs and Ortenburger (1929b)*; Station 2a (16, 40 to 60 mm.). Peavine Branch, Cherokee County, 1 mile south of Scraper, Moore (April, 1942). Barren Fork, Adair County: near Baron, Hubbs and Ortenburger (1929b)*; 1 mile south of Baron, Ortenburger (July, 1929); near Proctor, Moore and Mizelle (April, 1939); Station 5a (71, 36 to 44 mm.). Courthouse Creek (tributary to Barren Fork), Adair County, 9 miles southwest of Westville, Ortenburger (July, 1929). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (March, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1942).

The Neosho smallmouth bass is usually smaller than the spotted bass. These two species frequent the same habitat, but velox shows a definite preference for the upper swifter portions of the river (see Table 2), and for the fast water of the larger tributaries, such as Flint Creek and Barren Fork.

74. Micropterus salmoides (Lacepede). Largemouth bass. Illinois River: in Arkansas, Meek (1894:87)*; Station 1, (3, 53 to 92 mm.); Station 2 (6, 73 to 135 mm.); Station 3 (60, 40 to 218 mm.); Station 4 (13, 44 to 75 mm.); Station 5 (32, 34 to 150 mm.); Station 6 (2, 63 to 65 mm.). Barren Fork, Station 5a (1, 77 mm.). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Seamster (March, 1941); Moore (April, 1942).

The largemouth bass was taken from overflow pools, oxbow lakes, and backwaters. The writer using a fly rod with Schilbeodes insignis for bait, took fifteen bass, at Station 3. All three species were taken within a distance of fifty feet along one side of a large pool which varied from a very swift current to almost still water. Micropterus dolomeiu and M.

punctulotus usually taken from the fast to moderately swift current and the largemouth from the deeper and quieter water at one side of the pool.

It is considered quite probable that some of the largemouth bass reported from the Illinois River in Arkansas by Meek (1894) were northern spotted bass, since the distinction between these two species had not been made at that time.

48. Chaenobryttus Gill

75. Chaenobryttus coronarius (Bartram). Warmouth. Illinois River: Station 2 (1, 79 mm.); Station 3 (2, 62 and 65 mm.); Hanging Rock, Cherokee County, 1 mile south of Scraper, Moore (June, 1942); Station 5 (10, 20 to 106 mm.); Station 6 (1, 130 mm.).

The warmouth is herein recorded for the first time for the Illinois drainage where only a few specimens were taken in backwaters, overflow pools and oxbow lakes.

49. Lepomis Rafinesque

76. Lepomis cyanellus Rafinesque. Green sunfish. Illinois River: in Arkansas, Meek (1894:87); Adair County, 1 1/2 miles northeast of Watts, Dobson (April, 1936); Station 1 (14, 23 to 142 mm.); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (2, 29 and 65 mm.); Station 3 (16, 26 to 135 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (8, 21 to 64 mm.); Station 5 (25, 20 to 55 mm.); Station 6 (7, 21 to 65 mm.); Station 7 (12, 36 to 54 mm.). Flint Creek, Station 2a (6, 31 to 33 mm.). Barren Fork, Adair County; near Proctor, Moore and Mizelle (April, 1939); Station 5a (6, 18 to 91 mm.). Ben Knight Creek (tributary to Barren Fork), 3 miles west of Westville, Moore (May, 1947). Tyner Creek (Tributary to Barren Fork), Adair County, Moore (April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore,

(May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1941, and April, 1942).

The green sunfish was common in the overflow pools and oxbow lakes, but was not so common in the backwaters of the river. It is of some economic importance as a forage fish and when over 6 inches long a very fine food fish.

77. Lepomis humilis (Girard). Orangespotted sunfish. Illinois River: Station 1,(3, 36 to 46 mm.); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 3 (1, 48 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 5 (1, 54 mm.); Station 6 (1, 23 mm.); Station 7 (10, 18 to 45 mm.).

This small species was taken from overflow pools and oxbow lakes, and at Station 7 from backwater. The orangespot is considered to be of little economic importance in the Illinois drainage since it is present in small numbers. Typically a fish of muddier waters, this species is probably represented in the Illinois by wanderers from the Arkansas.

78. Lepomis megalotis (Rafinesque). Longear sunfish. Illinois River: in Arkansas, Meek (1894:87)*; Station 1 (18, 25 to 113 mm.); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (5, 23 to 63 mm.); Station 3 (38, 18 to 60 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Hanging Rock, Cherokee County, 1 mile south of Scraper, Moore (June, 1942); Station 4 (49, 10 to 102 mm.); Station 5 (23, 16 to 89 mm.); Station 8 (3, 26 to 73 mm.); Station 6 (83, 10 to 98 mm.); Station 7 (48, 17 to 55 mm.); Sequoyah County, 2 miles east of Gore, Ortenburger (July, 1929). Flint Creek, Delaware County: near Flint, Trowbridge and Strode (March, 1932); Station 2a (9, 39 to 90 mm.). Barren Fork: Adair County, 1 mile south of Baron, Ortenburger (July, 1929); Adair County, near

Proctor, Moore and Mizelle (April, 1939); Station 5a (27, 25 to 80 mm.); Cherokee County, Heart-O-Hills Camp, Moore (May, 1947). Tyner Creek (tributary to Barren Fork), Adair County: 13 1/2 miles southwest of Westville, Ortenburger (July, 1929); 1/2 mile east of Proctor, Moore (April, 1939, and April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1942).

Lepomis megalotis was common along the shore in brush, in water with partly submerged boulders, backwaters, overflow pools, and oxbow lakes. This tasty little pan-fish is of considerable economic importance as forage for the game fishes and as a source of food and sport for fishermen who do not disdain its small size.

79. Lepomis macrochirus macrochirus Rafinesque. Bluegill. Illinois River: in Arkansas, Meek (1894-87)*; Station 1 (54, 52 to 60 mm.); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (9, 45 to 59 mm.); Station 3 (45, 8 to 75 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (2, 56 and 58 mm.); Station 5 (28, 20 to 125 mm.); Station 6 (7, 113 to 133 mm.); Station 7 (24, 13 to 57 mm.). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947); Swimmers Branch, Sequoyah County, 5 miles northeast of Gore, Moore (April, 1942).

This form is indicated as a trinomial solely on the basis of previous identification of the subspecies from the Illinois River by Hubbs.

The bluegill, an important forage and sport fish, was the second most abundant small sunfish taken in the Illinois River where it was found to be more common in the overflow pools and oxbow lakes. However, most of the larger specimens were taken from the river in backwaters that contained

some shelter such as dead trees or stumps.

80. Lepomis microlophus (Gunther). Redear sunfish. Illinois River: Station 5 (13, 51 to 112 mm.). Near the mouth of Swimmers Branch, Moore (March, 1941).

This introduced species was taken in overflow pools and backwaters. On August 23, 1946, a number of fine male specimens, 8 or 9 inches estimated length, were observed in a culture pond at the Tahlequah State Fish Hatchery guarding their nests. The surplus water from this hatchery flows into Tahlequah Creek which enters the Illinois River about 2 miles south of our Station 5. This is considered as one of the possible explanations for the occurrence of L. microlophus at this station.

50. Ambloplites Rafinesque

81. Ambloplites rupestris rupestris (Rafinesque). Northern rock bass. Illinois River: Station 1 (1, 28 mm.); Station 2 (2, 25 and 118 mm.); Station 3 (4, 25 to 38 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (3, 20 to 23 mm.); Station 5 (13, 18 to 30 mm.). Flint Creek, Station 2a (10, 22 to 79 mm.). Barren Fork, Station 5a (1, 23 mm.). Tyner Creek (tributary to Barren Fork), Adair County, 1/2 mile east of Proctor, Moore (April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947). Swimmers Branch, Sequoyah County, 5 miles northeast of Gore; Seamster (March, 1941); Moore (April, 1942).

The rock bass, not previously reported, was scarce in the river and usually uncommon in the overflow pools and oxbow lakes. All of the specimens from Flint Creek were taken under a single small bush, that had accumulated leaves and trash on the branches after it had toppled into the river from a low undercut bank. The young rock bass were usually taken from this type of habitat in the river and tributary streams.

51. Pomoxis Rafinesque

82. Pomoxis annularis Rafinesque. White crappie. Illinois River: Station 1 (7, 29 to 115 mm.); Station 3 (1, 102 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 5 (43, 27 to 126 mm.); Station 6 (1, 64 mm.); Station 7 (2, 59 to 61 mm.).

The white crappie was usually taken from overflow pools and oxbow lakes. This species has been planted in the Illinois River, but according to Mr. Ed Jarrell, Superintendent of the State Fish Hatchery at Tahlequah, the swift water of this clear stream is unsuitable for both crappie species and the practice of stocking them has been discontinued.

83. Pomoxis nigro-maculatus (LeSueur). Black crappie. Illinois River: Station 5 (1, 113 mm); Station 7 (1, 53 mm.).

The black crappie is scarce in the Illinois drainage. The comments on the white crappie are also applicable for this species.

ATHERINIDAE

52. Labidesthes Cope

84. Labidesthes sicculus (Cope). Brook silversides. Illinois River: in Arkansas, Meek (1894:87)*; Station 1 (8, 18 to 70 mm.); Adair County, 4 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Station 2 (4, 41 to 66 mm.); Station 3 (96, 20 to 69 mm.); Cherokee County, near Scraper, Blair and Blair (July, 1936); Station 4 (27, 18 to 48 mm.); Station 5 (58, 23 to 67 mm.); Station 8 (10, 21 to 50 mm.); Station 6 (52, 25 to 62 mm.); Station 7 (9, 32 to 40 mm.).

This beautiful silversided, semitranslucent fish was common in the oxbow lakes, overflow pools, and backwaters. Labidesthes was usually associated with Gambusia and Fundulus.

SCIAENIDAE

53. Aplodinotus Rafinesque

85. Aplodinotus grunniens Rafinesque. Drum. Illinois River: Station 2 (1, 305 mm.); Station 3 (1, 330 mm.); Station 7 (1, 113 mm.).

This is the first record for the Illinois River. According to information obtained from sportsmen who have fished in the river for many years, this species is probably more common than above indicated.

COTTIDAE

54. Cottus Linneaus

86. Cottus (species). Muddler. Illinois River: in Arkansas, Meek (1894:87); Station 1, 10, 30 to 75 mm.); Station 2 (4, 36 to 44 mm.); Station 3 (2, 43 and 48 mm.); Station 4 (13, 38 to 55 mm.); Station 5 (54, 26 to 105 mm.). Ward Branch, Adair County, 3 miles northeast of Watts, Trowbridge and Strode (March, 1932). Bouyer Branch, Adair County, 6 miles northwest of Watts, Hubbs and Ortenburger (1929b)*; Flint Creek, Delaware County: 8 miles west of the state line, Hubbs and Ortenburger (1929b)*; near Flint, Trowbridge and Strode (March, 1932); near Flint, Moore (May, 1947); Station 2a (17, 35 to 85 mm.). Barren Fork: Station 5a (9, 38 to 49 mm.); Cherokee County, Heart-O-Hills Camp, Moore (May, 1947). Courthouse Creek (tributary to Barren Fork), Adair County, 9 miles southwest of Westville, Ortenburger (1929). Tyner Creek (tributary to Barren Fork), Adair County, 1/2 mile east of Proctor, Moore (April, 1939, and April, 1942). Caney Creek, Cherokee County, 2 miles north of Barber, Moore (May, 1947).

There are several southwest forms of Cottus under study. The sculpins were taken from springs and under flat stones in the slow current on shallow riffles. Most of the 54 specimens taken at Station 5 were found in a large seepage spring clogged with emergent and submergent vegetation and small

boulders.

The stomachs of 3 specimens (one 75 mm. from Station 1, and 2 from Flint Creek 96 and 97 mm.) contained one 43 mm. Etheostoma, 6 helgramites 1 1/2 to 2 1/2 inches long, and 6 helgramites 1 1/2 to 2 inches long and a small crayfish cheliped respectively.

HYBRID COMBINATIONS

Lepomis macrochirus x Lepomis microlophus. Illinois River: Station 2 (1, 70 mm.). This specimen has been compared with both macrochirus and microlophus and found to have characteristics intermediate between species. Body pigmentation is more like that of microlophus but a somewhat diffused dusky spot is present on the posterior rays of the soft dorsal as in macrochirus; scales 6-40-14; 19 rows of scales around peduncle; cheek scales in 4 rows; eye 4 in head; head 2.9 in body length; depth 2.2; D. X. 12; A. III, 11. Pectoral fin reaches origin of dorsal. The pharyngeal teeth are intermediate between macrochirus and microlophus having a few teeth with flattened tips and the bone of intermediate width.

Notropis (sp.) x Notropis zonatus pilsbryi. Illinois River: Station 6 (1, 29 mm.). This specimen was determined by Dr. Moore and later checked by Dr. Bailey. It resembles pilsbryi in having two lateral bands which are not as intense as in that form. The anterior lateral line is not conspicuously outlined with melanophores, a conspicuous character Notropis (sp.), and the origin of the dorsal fin is almost over the organ of the pelvic fins. It resembles Notropis (sp.) (southern representative of Notropis rubellus) in having a sharper pointed head; dorsal streak slightly more intense; and body slender, but slightly deeper. The eye is intermediate between the two. Teeth 4-4, with pronounced hooks and a rather long grinding surface - the third from the bottom serrated. The anal fin has 9 principal rays.

Dionda nubila x Notropis zonatus pilsbryi. Illinois River: Station 1 (1, 52 mm.); Station 3 (3, 28 to 39 mm.); Station 5 (5, 27 to 32 mm.); Station 6 (1, 44 mm.). Barren Fork, Station 5a (18, 23 to 50 mm.). Swimmers Branch, Sequoyah County, 5 miles northwest of Gore, Seamster (April, 1941).

The Swimmers Branch specimen was determined by Dr. Moore and checked

by Dr. Hubbs at a later date. These specimens have two lateral bands, oblique mouth, intestines longer and eye smaller than pilsbryi but larger than Dionda. The dorsal streak is intermediate and the teeth usually 4-4.

This is by far the most common hybrid combination of the Illinois River. During the Spring of 1947 some observations made by Dr. Moore seem to indicate a possible explanation of the high incidence of hybridization. His account follows:

> "May 3, 1947 was one of those beautiful balmy spring days (air temperature 22°C., water 20°) with a perfectly clear sky and no wind. As we approached a long stretch of riffle, shortly after midday, a considerable area of water appeared to reflect a beautiful crimson. Approaching closer to about 20 feet a most unusual sight greeted our eyes. An area of about 10 by 6 feet in gently flowing water about 1 or 1 1/2 inches deep was occupied by thousands of male zonatus lying so close to each other that it seemed there was no room for more. They were so beautiful that the eye at first failed to detect the occasional less brilliant female, and surely there were not very many lying between the males. Their activities made the surface of the water quite rough and so the whole process of spawning escaped us. The males were rolling from side to side so that their brilliant crimson underparts made the water appear to be on fire. When we stepped into the riffle the minnows scattered. By means of a screen we were able to collect eggs, presumed to be of this species, from the redd.
>
> "Below the riffles occuped by Notropis zonatus was a deeper area (about 2 to 2 1/2 feet) from which our seines took a considerable number of Dionda in breeding color. No.evidence of the spawning of the ozark minnow was obtained but its seems quite possible that spermatozoa of Notropis zonatus could be carried by the current into the spawning area of Dionda nubila where they might fertilize the eggs of that species."

One 33 mm. specimen of a hybrid, doubtless a cross between Notropis zonatus pilsbryi and some other species, was taken from the Illinois River, Station 4. Body comparatively elongate; head rather pointed; mouth oblique; lower jaw almost equal to upper jaw which is 3.4 in head; lips pigmented; depressed dorsal 1.5 from origin to occiput; origin of dorsal slightly back of middle of body and behind origin of pelvic fins. Dorsal stripe not interrupted by dorsal fin; not as wide as pilsbryi; single lateral band less intense than in pilsbryi; ventral surface below lateral band with few

melanophores except for the row on each side of anal fin; peritoneum black; intestine short with two loops; eye 3 in head; snout 4 in head; depth 5.1; D. 7; A. 7; Pelvics 8-8; C. 19 (principal rays); scales 5-33-3 and teeth 2,4-4,2 crowded and with hooks and rather long narrow grinding surfaces. This specimen is being sent to Dr. Bailey for identification.

TABLE 2. The frequency distribution of fishes expressed in percent and actual numbers taken from each collecting station in the Illinois River from August 13 to 27, 1946. The limits of size are expressed in millimeters of standard length.

Scientific Name		Sta. #1	Sta. #2	Sta. #3	Sta. #4	Sta. #5	Sta. #8	Sta. #6	Sta. #7
Ichthyomyzon castaneus	Percent					00.05			
	Number					1			
	Length					214			
Polydon spatula		R[1]				R			
Lepisosteus osseus oxyurus	Percent	00.06	00.19	00.18	00.18				
	Number	1	2	3	4				
	Length	210	262-266	87-225	70-762				
Amphiodon alosoides	Percent						00.15		
	Number						1		
	Length						250		
Pomolobus chrysochloris	Percent		00.19	00.06	00.86	00.07			00.18
	Number		2	1	19	1			5
	Length		80-280	59	30-42	31			54-63
Dorosoma cepedianum	Percent	00.79	00.37	00.18		00.48		00.05	00.07
	Number	14	4	3		7		2	2
	Length	27-68	?-269	44-58		56-250		124-265	64-79
Megastomatobus cyprinella	Percent					00.07		00.03	
	Number					1		1	
	Length					320		240	
Ictiobus niger	Percent		00.37					00.08	
	Number		4					3	
	Length		224-295					139-285	
Ictiobus bubalus	Percent							00.03	
	Number							1	
	Length							300	
Carpiodes c. carpio	Percent							00.03	06.60
	Number							1	183
	Length							285	15-44

[1]Mounted head at Watts from our Station 1. Paddle from Station 5.

TABLE 2 (Continued)

Scientific Name		Sta. #1	Sta. #2	Sta. #3	Sta. #4	Sta. #5	Sta. #8	Sta. #6	Sta. #7
Carpiodes velifer	Percent					00.07		00.08	
	Number					1		3	
	Length					220		68-190	
Hypentelium nigricans	Percent	00.11	00.19	00.12	00.14	00.34	00.44	00.16	
	Number	2	2	2	3	5	3	6	
	Length	70-246	73-82	62-63	63-65	65-310	85-94	69-87	
Minytrema melanops	Percent		00.09	00.06					
	Number		1	1					
	Length		280	196					
Moxostoma d. duquesnii	Percent	00.06	01.12	00.82	01.04	00.55		00.37	00.04
	Number	1	12	14	23	8		14	1
	Length	315	160-310	52-145	42-65	260-295		46-75	72
Moxostoma erythrurum	Percent	00.06	00.19	00.41	02.22	00.14		00.46	00.04
	Number	1	2	7	49	2		17	1
	Length	49	47-135	51-135	33-91	44-99		43-64	58
Placopharynx carinatus	Percent	00.06	00.28		00.14	00.07			
	Number	1	3		3	1			
	Length	183	330-345		49-119	227			
Cyprinus carpio	Percent			00.18	00.05			00.03	
	Number			3	1			1	
	Length			83-533	500			300	
Semotilus a. atromaculatus	Percent	00.06	00.09	00.35	00.41				
	Number	1	1	6	9				
	Length	51	35	46-67	38-90				
Nocomis biguttatus	Percent	01.92	02.90	00.35	00.64	02.41	00.15	00.37	
	Number	34	31	6	14	35	1	14	
	Length	23-49	19-54	19-56	19-46	25-91	133	34-88	
Hybopsis storerianus	Percent								00.07
	Number								2
	Length								62-64
Hybopsis a. amblops	Percent	00.34	00.28	00.29	01.45	00.15	00.15	00.09	
	Number	6	3	5	32		1	7	
	Length	34-52	42-63	26-46	25-54		34	30-43	

TABLE 2 (Continued)

Scientific Name		Sta. #1	Sta. #2	Sta. #3	Sta. #4	Sta. #5	Sta. #8	Sta. #6	Sta. #7
Erimystax (sp.)	Percent	00.23	00.28	01.12	00.54	00.07	01.18	00.64	00.25
	Number	4	3	19	12	1	8	24	7
	Length	67-73	39-40	40-77	34-68	50	48-71	34-67	38-58
Extrarius a. tetranemus	Percent								00.25
	Number								7
	Length								27-30
Notemigonus c. auratus	Percent			00.06		00.21			00.07
	Number			1		3			2
	Length			71		90-99			42-53
Notropis a. atherinoides	Percent				00.09				00.04
	Number				2				1
	Length				32-52				31
Notropis percobromus	Percent								01.88
	Number								52
	Length								23-49
Notropis (sp.)	Percent	15.18	17.48	11.97	14.93	07.49	11.10	07.30	03-64
	Number	269	187	204	329	109	75	274	101
	Length	17-45	10-49	19-48	11-48	10-55	25-43	19-44	13-52
Notropis u. umbratilis	Percent	00.06							00.61
	Number	1							17
	Length	53							21-32
Notropis cornutus chrysocephalus	Percent	00.06			00.09				
	Number	1			2				
	Length	64			23-24				
Notropis z. pilsbryi	Percent	18.79	25.51	17.78	19.51	21.72	18.19	12.85	00.69
	Number	333	273	303	430	316	123	480	19
	Length	18-68	21-73	21-73	22-45	22-50	27-53	25-49	33-52
Notropis blennius	Percent								01.26
	Number								35
	Length								25-46
Notropis greenei	Percent	00.40	04.11	04.58	02.59	02.06	03.40	02.25	01-98
	Number	7	44	78	57	30	23	84	55
	Length	40-51	46-65	25-56	26-53	21-51	25-62	15-56	22-52

TABLE 2 (Continued)

* Scientific Name		Sta. #1	Sta. #2	Sta. #3	Sta. #4	Sta. #5	Sta. #8	Sta. #6	Sta. #7
Notropis spilopterus	Percent	05.70		00.18			06.21	03.29	03.07
	Number	101		3			42	123	85
	Length	27-80		23-42			30-65	19-54	
Notropis camurus	Percent	02.99	00.47	00.06	00.64	00.96	05.92	07.90	10.29
	Number	53	5	1	12	14	40	295	285
	Length	36-84	45-61	64	36-53	24-33	19-77	17-72	16-67
Notropis l. lutrensis	Percent	00.45			00.32	00.69	00.15	01.20	22.74
	Number	8			7	10	1	45	630
	Length	35-41			21-27	23-28	36	17-42	20-50
Notropis boops	Percent	01.86	00.84	04.52	04.17	01.37	01.18	04.04	00.58
	Number	33	9	77	92	20	8	151	16
	Length	24-54	41-48	16-60	24-57	37-48	36-46	15-60	22-47
Notropis volucellus (subsp)	Percent					00.21	00.15	00.35	
	Number					3	1	13	
	Length					20-21	35	12-38	
Notropis v. buchanani	Percent								04.15
	Number								115
	Length								20-26
Phenacobius mirabilis	Percent								00.18
	Number								5
	Length								53-58
Dionda nubila	Percent	02.65	07.57	17.31	19.33	06.94	17.60	33.41	14.44
	Number	47	81	295	426	101	119	1248	400
	Length	20-64	19-62	20-55	15-52	21-53	17-48	15-51	23-37
Hybognathus p. placitus	Percent								00.18
	Number								5
	Length								28-39
Pimephales p. confertus	Percent								00.11
	Number								3
	Length								23-37
Ceratichthys perspicuus	Percent								03.28
	Number								91
	Length								21.49

TABLE 2 (Continued)

Scientific Name		Sta. #1	Sta. #2	Sta. #3	Sta. #4	Sta. #5	Sta. #8	Sta. #6	Sta. #7
Ceratichthys t. tenellus	Percent				00.27	00.27	01.33	03.51	06.60
	Number				6	4	9	131	183
	Length				34-45	22-26	21-42	19-47	17-53
Hyborhynchus notatus	Percent	03.56	00.09	02.58	03.36	01.24		06.67	04.73
	Number	63	1	44	74	18		249	131
	Length	22-59	31	22-66	21-62	26-52		14-56	21-45
Campostoma a. pullum	Percent	02.26	03.08	02.52	01.63	05.09	00.59	01.92	00.25
	Number	40	33	43	36	74	4	72	7
	Length	32-92	25-72	27-65	39-58	27-110	52-60	32-72	60-78
Ictalurus l. punctatus	Percent	00.23	00.09	00.06	00.09	00.27	01.33	00.32	00.61
	Number	4	1	1	2	4	9	12	17
	Length	36-117	41	330	250-300	203-210	30-536	24-46	30-73
Ameiurus m. catulus	Percent		01.78	00.12		00.07			
	Number		19	2		1			
	Length		22-31	23-24		69			
Ameiurus n. natalis	Percent	00.11	00.09	00.29	00.05	00.76		00.03	
	Number	2	1	5	1	11		1	
	Length	41-44	85	35-106	55	29-45		52	
Pilodictis olivaris	Percent		00.19					00.24	
	Number		2					9	
	Length		37-290					40-94	
Noturus flavus	Percent		00.09	00.18		00.34	00.89	00.16	00.22
	Number		1	3		5	6	6	6
	Length		38	105-175		33-95	52-152	50-130	41-65
Schilbeodes nocturnus	Percent						00.59	00.11	00.36
	Number						4	4	10
	Length						25-37	25-41	23-48
Schilbeodes insignis	Percent	01.41	01.21	00.88	00.95	01.79	03.70	01.07	01.19
	Number	25	13	15	21	26	25	40	33
	Length	28-62	43-52	26-55	34-56	24-66	25-57	30-55	28-47
Schilbeodes miurus	Percent							00.03	00.14
	Number							1	4
	Length							22	

TABLE 2 (Continued)

Scientific Name		Sta. #1	Sta. #2	Sta. #3	Sta. #4	Sta. #5	Sta. #8	Sta. #6	Sta. #7
Anguilla bostoniensis	Percent								00.04
	Number								1
	Length								600
Fundulus notatus	Percent		00.47	02.29	00.14	00.82		00.46	00.07
	Number		5	39	3	12		17	2
	Length		48-52	33-63	18-48	22-50		20-43	24-25
Fundulus olivaceus	Percent	00.79	01.59	03.17	01.27	05.09	02.51	00.24	00.04
	Number	14	17	54	28	74	17	9	1
	Length	30-53	29-58	23-63	17-52	22-61	20-58	22-37	51
Gambusia a. affinis	Percent	01.98	02.90	01.29	02.54	01.99	00.30	00.96	01.05
	Number	35	31	22	56	29	2	36	29
	Length	17-39	15-41	20-46	17-44	17-38	18-22	13-35	15-30
Hadropterus phoxocephalus	Percent	00.23					00.30	00.24	00.14
	Number	4					2	9	4
	Length	53-62					55-58	39-64	43-52
Percina caprodes carbonaria	Percent	00.11	00.09	00.23	00.27		00.15	00.08	
	Number	2	1	4	6		1	3	
	Length	34-67	42	43-70	41.140		66	68-71	
Doration (sp.)	Percent	00.45	00.28	00.41	00.82	00.07			
	Number	8	3	7	18	1			
	Length	24-42	26-42	25-43	27-43	29			
Poecilichthys z. arcansanus	Percent	12.70	07.76	02.76	02.90	05.09	10.80	01.55	01.12
	Number	225	83	47	64	74	73	58	31
	Length	23-44	22-48	40-52	24-49	24-57	22-44	30-46	28-39
Poecilichthys spectabilis	Percent	01.19	00.94	00.53	01.09	06.46	03.11	00.78	00.07
	Number	21	10	9	24	94	21	29	2
	Length	25-45	28-44	23-44	25-44	24-52	26-37	19-39	30-31
Poecilichthys punctulatus	Percent			00.12	00.18	00.41		00.03	
	Number			2	4	6		1	
	Length			38-39	35-42	39-59		40	
Poecilichthys w. whipplii	Percent						02.96	00.78	02.31
	Number						20	29	64
	Length						27-42	26-48	30-48

TABLE 2 (Continued)

Scientific Name		Sta. #1	Sta. #2	Sta. #3	Sta. #4	Sta. #5	Sta. #8	Sta. #6	Sta. #7
Catonotus f. lineolatus	Percent	00.62	00.09	00.18	00.27	00.76			
	Number	11	1	3	6	11			
	Length	27-45	35	26-29	28-34	29-35			
Etheostoma (sp.)	Percent	00.45	00.56	00.18	00.41	00.21	01.78	00.32	
	Number	8	6	3	9	3	12	12	
	Length	38-70	39-80	36-52	42-62	35-50	43-74	46-57	
Micropterus p. punctulatus	Percent	04.12	06.17	03.58	08.17	01.79	01.78	00.91	00.29
	Number	73	66	61	180	26	12	34	8
	Length	29-150	36-255	36-157	27-177	50-250	55-286	55-65	81-82
Micropterus d. velox	Percent	11.34	06.17	02.46	01.09	00.89		00.32	00.22
	Number	201	66	42	24	13		12	6
	Length	31-53	43-205	50-175	26-215	32-54		52-85	85-88
Micropterus salmoides	Percent	00.17	00.56	03.52	00.59	02.20		00.05	
	Number	3	6	60	13	32		2	
	Length	53-92	73-135	40-218	44-75	34-150		63-75	
Chaenobryttus coronarius	Percent		00.09	00.12		00.69		00.03	
	Number		1	2		10		1	
	Length		79	62-65		20-106		130	
Lepomis cyanellus	Percent	00.79	00.84	00.94	00.36	01.72		00.19	00.43
	Number	14	9	16	8	25		7	12
	Length	23-142	29-65	26-135	21-63	20-55		21-65	36-54
Lepomis humilis	Percent	00.17		00.06		00.07		00.03	00.36
	Number	3		1		1		1	10
	Length	36-46		48		54		23	18-45
Lepomis megalotis	Percent	01.02	00.47	02.23	02.22	01.58	00.44	02.22	01.73
	Number	18	5	38	49	23	3	83	48
	Length	25-113	25-63	18-60	10-102	16-89	26-73	10-98	17-55
Lepomis m. macrochirus	Percent	03.05	00.84	02.64	00.09	01.92		00.19	00.87
	Number	54	9	45	2	28		7	24
	Length	52-60	42-59	8-75	56-58	20-125		113-133	13-59
Lepomis microlophus	Percent					00.89			
	Number					13			
	Length					51-112			

TABLE 2 (Continued)

Scientific Name		Sta. #1	Sta. #2	Sta. #3	Sta. #4	Sta. #5	Sta. #8	Sta. #6	Sta. #7
Ambloplites r. rupestris	Percent	00.06	00.19	00.23	00.14	00.89			
	Number	1	2	4	3	13			
	Length	28	25-118	25-38	20-23	18-30			
Pomoxis annularis	Percent	00.40		00.06		02.96		00.03	00.07
	Number	7		1		43		1	2
	Length	29-115		102		27-126		64	59-61
Pomoxis nigro-maculatus	Percent					00.07			00.04
	Number					1			1
	Length					113			53
Labidesthes s. sicculus	Percent	00.45	00.37	05.63	01.23	03.99	01.48	01.39	00.32
	Number	8	4	96	27	58	10	52	9
	Length	18-70	41-66	20-69	18-48	23-67	21-50	25-62	32-40
Aplodinotus grunniens	Percent		00.09	00.06					00.04
	Number		1	1					1
	Length		305	330					113
Cottus (sp.)	Percent	00.56	00.37	00.12	00.59	03.71			
	Number	10	4	2	13	54			
	Length	30.75	36-44	43-48	38-55	26-105			
Total number of specimens		1772	1070	1704	2204	1455	676	3735	2771

Grand total number of specimens - 15,387

CONCLUSIONS AND POLICY RECOMMENDATIONS

The Illinois River provides optimum environmental conditions for the support of an abundant and varied fish population. Jordan might well have had this river in mind when he stated that:

> "Some of the conditions most favorable to the existence in any stream of a large number of species of fishes are the following, the most important of which is the one mentioned first: Connection with a large hydrographic basin; a warm climate; clear water; a moderate current; a bottom of gravel (preferably covered by a growth of weeds); little fluctuation during the year in the volume of the stream or in the character of the water....Limestone streams usually yield more species than streams flowing over sandstone, and either more than streams of regions having metamorphic rocks." (Jordan, 1925:101).

These conditions all obtain in the river except that little emergent vegetation is present in the river proper. The fishermen's report of stunted micropterus salmoides in the river was not verified by our findings, rather it is thought that this species, although restricted by its habitat preference, is being confused with Micropterus punctulatus which is the most abundant bass in the drainage, exclusive of Barren Fork and Flint Creek.

Although it has been the general policy of the Oklahoma Game and Fish Commission, in the past, to thoroughly stock all public artificial lakes with game, food, and forage fishes, such a program is not considered necessary for the proposed Tenkillers impoundment. However, our investigations do indicate a need for stocking the following species: Notemigonus crysoleucaus, Pimephales p. confertus, Chaneobryttus coronarius, Amploplites rupestris, Pomoxis annularis, and Pomoxis nigro-maculatus.

A tentative list of 49 species that can be expected in the Tenkillers impoundment 5 years after its completion is presented with considerable hesitation as follows: Lepisosteus osseus oxyurus, Amphiodon alosoides, Pomolobus chrysochloris, Dorosoma cepedianum, Megastomatobus cyprinnella,

Ictiobus niger, Ictiobus bubalus, Minytrema melanops, Moxostoma duquesnii, Moxostoma erythrurum, Cyprinus carpio, Notemigonus crysoleucas auratus, Notropis a. atherinoides, Notropis zonatus pilsbryi, Notropis spilopterus, Notropis lutrensis, Notropis boops, Pimephales p. confertus, Ceratichthys perspicuus, Hyborhynchus notatus, Campostoma anomalum pullum, Ictalurus lacustris punctatus, Ameiurus melas catulus, Ameiurus natalis, Pilodictis olivaris, Anguilla bostoniensis, Fundulus natus, Fundulus olivaceus, Gambusia affinis, Stizostedion canadense, Percina caprodes carbonaria, Poecilichthys spectabilis, Poecilichthys zonalis arcansanus, Poecilichthys w. whipplii, Micropterus punctulatus, Micropterus dolomieu velox, Micropterus salmoides, Chaenobryttus coronarius, Lepomis cyanellus, Lepomis humilus, Lepomis megalotis, Lepomis macrochirus, Lepomis microlophus, Ambloplites rupestris, Pomoxis annularis, Pomoxis nigro-maculatus, Labidesthes sicculus, Aplodinotus grunniens, and Cottus species.

BIBLIOGRAPHY

Aldrich, A. D.
1946 Fish management guide for Oklahoma. (With a list of the fishes of Oklahoma by Carl L. Hubbs.) Oklahoma City: State Game and Fish Commission (5th ed.): 1-40, 21 figs., 1 map.

Anonymous.
1936 Arkansas River and Tributaries. Report on Illinois River, Arkansas and Oklahoma. Vol. II, pt. 9: 1149-1209, many maps and charts.

Bailey, R. M.
1941 The scientific name of the black crappie. Copeia, 1941: 21-23.

Cram, I. H.
1930 Cherokee and Adair Counties. Oklahoma Bull. Geol. Serv. 40: 530-586.

Creaser, C. W., and C. L. Hubbs.
1922 A revision of the holartic lamprey. Occ. Papers Mus. Zool. Univ. Mich., 120: 1-14, pl. 1.

Evermann, B. W., and H. W. Clark.
1920 Lake Maxinkukee. A physical and biological survey. Indiana Dept. Cons., Indianapolis: Vol. 1: 1-660, 23 figs., 36 pls. (many col.), frontisp., 1 map.

Forbes, S. A., and R. E. Richardson.
1920 The fishes of Illinois (2nd ed.). Nat. Hist. Surv. Ill., Vol. 3: i-cxxxvi, 1-357. figs. 1-76, many col. pls.)

Fowler, H. W.
1945 A study of the fishes of the Southern Piendmont and Coastal Plains. Acad. Nat. Sci. Philadelphis: Monograph Number 7. Wichersham Printing Co: i-vi, 1-408, figs. 1-313.

Hubbs, C. L.
1930 Material for a revision of the catostomid fishes of Eastern North America. Misc. Publ. Mus. Zool. Univ. Mich., 20: 1-47, frontisp.

Hubbs, C. L.
1940 Speciation of fishes. Amer. Nat. 74: 198-211.

1945 Corrected distributional records of Minnesota fishes. Copeia, 1945: 13-22.

Hubbs, C. L., and R. M. Bailey.
1940 A revision of the black basses (Micropterus and Huro) with description of four new forms. Mis. Publ. Mus. Zool. Univ. Mich., 48: 1-51, pls. 1-6, fig. 1, maps 1-2.

Hubbs, C. L., and J. D. Black.
1940 Subspecies of the American percid fishes, Poecilichthys whipplii. Occ. Papers Mus. Zool. Univ. Mich., 429: 1-27, pl. 1, figs. 2, map 1.

1947 Revision of Ceratichthys, a genus of American cyprinid fishes. Misc. Publ. Mus. Zool. Univ. Mich., 66: 1-56, pls. 2, figs. 6, maps 2.

Hubbs, C. L., and G. P. Cooper.
1936 Minnows of Michigan. Bull. Cranebrook Inst., 8: 1-95, figs. 2, 10 pls.

Hubbs, C. L., and C. W. Greene.
1936 Two new subspecies of fishes from Wisconsin. Reprint of the Transactions of the Wisconsin Academy of Science, Arts and Letters Vol. 29: 89-101, pls. 2-3, 8 figs.

Hubbs, C. L., and K. F. Lagler.
1941 Guide to the fishes of the Great Lakes and tributary waters. Bull. Cranbrook inst. Sci. 18: 1-100, figs. 1-118, 2 figs., 10 pls.

1947 Fishes of the Great Lakes Region. Bull. Cranbrook Inst. Sci. 26: i-xi, 1-186, 248 figs., many col. pls.

Hubbs, C. L., and G. A. Moore.
1940 The subspecies of Notropis zonatus, a cyprinid fish of the Ozark upland. Copeia, 1940: 91-99, fig. 1, pl. 1.

Hubbs, C. L., and A. I. Ortenburger.
1929a Further notes on the fishes of Oklahoma with descriptions of new species of Cyprinidae. Univ. Okla. Bull. (n. s.) 434. (Publ. Univ. Okla. Biol. Surv. 1): 15-43, pls. 1-5.

1929b Fishes collected in Oklahoma and Arkansas in 1927. Ibid., 45-112, pls. 6-13.

Hubbs, C. L., and E. C. Raney.
1944 Systematic notes on North American siluroid fishes of the genus Schilpeodes. Occ. Papers Mus. Zool. Univ. Mich., 487: 1-36 pls. 1, map 1.

Hubbs. C. L., and M. B. Trautman.
1936 A revision of the lamprey genus Ichthyomyzon. Misc. Bubl. Mus. Zool. Univ. Mich., 35: 1-109, pls. 2, figs. 1-5, map 1.

Jordan, D. S.
1925 Fishes. (rev. ed.) New York: D. Appleton and Co.: ixvi, 1-773, 17 col. pls., figs. 1-673, col. frontisp.

1929 Manual of the vertebrate animals of Northeastern United States inclusive of marine species. (13th ed.). New York: World Book Co.: i-xxxi, 1-446.

Jordan, D. S., and C. H. Gilbert.
1883 Synopsis of the fishes of North America. Bull. U. S. Nat. Mus. 16: i-lvi, 1-1018.

1886 List of fishes collected in Arkansas, Indian Territory and Texas, in Sept. 1884, with notes and descriptions. Proc. U. S. Nat. Mus., 9: 1-14.

JORDAN, D. S., and B. W. Evermann.
1896 The fishes of North and Middle America. Part I, Bull. U. S. Nat. Mus., 47: i-lx, 1-1240.

Jordan, D. S., B. W. Evermann, and H. W. Clark.
1930 Check list of the fishes and fish-like vertebrates of North and Middle America, north of the northern boundary of Venezuela and Colombia. Rept. U. S. Fish Comm., 1928 (pt. 2): 1-670.

Kuhne, E. R.
1939 A guide to the fishes of Tennessee and the mid-south. Nashville: Div. Game and Fish, Tenn. Dept. Cons.: 1-124, figs. 1-81.

Kyle, H. M.
1926 The biology of fishes. New York: The MacMillan Co.: i-xci, 1-396, pls. 1-17, figs. 1-77.

Langlois, T. H.
1937 Bait culture. Put-in Bay: Ohio Dept. Agric. Bull. Dic. Cons., Franz Theodore Stone Lab., 137: 19, 4 figs.

Meek, B. E.
1891 Report of exploration made in Missouri and Arkansas during 1889, with an account of the fishes observed in each of the river basins examined. Bull. U. S. Fish Comm., 9, 1889: 113-141, pl. 42.

1893 A catalog of the fishes of Arkansas. Ann. Rept. Geol. Surv. Ark., 2, 1891: 215-276, pls. 1-12.

1894 Report of investigations respecting the fishes of Arkansas, conducted during 1891, 1892, and 1893, with a synopsis of previous explorations in the same state. Bull. U. S. Fish Comm., 14: 67-94.

1896 A list of fishes and mollusks collected in Arkansas and Indian Territory in 1894. Bull. U. S. Fish Comm., 15, 1895: 341-349.

Moore, G. A.
1933 Two lampreys from Oklahoma. Proc. Okla. Acad., 13, 1932: 1-11.

1947 Know your Oklahoma fishes (Amphiodon alosoides) Okla. Game and Fish News, 3: 10, 1 fig.

1947 A key to the fishes known to occur in Oklahoma. MS. (1947): 1-26.

Moore, G. A., and J. D. Mizelle.
1939 A fall survey of the fishes of the Stillwater Creek Drainage System (Payne and Noble Counties, Oklahoma). Proc. Okla. Acad. Sci., 19: 1938: 43-46.

Ortenburger, A. I., and C. L. Huggs.
1927 A report on the fishes of Oklahoma, with descriptions of two new genera and species. Proc. Okla. Acad. Sci., 6, 1926: 123-141.

Paden, J. M.
1948 Notes on four species of fishes from Oklahoma. Proc. Okla. Acad. Sci., (1946), 28: (in press).

Pratt, H. S.
1935 Manual of land and fresh water vertebrate animals of the United States (exclusive of birds). (2nd ed.). Philadelphia: P. Blackinston's Sons & Co.: i-xvii, 1-416, figs. 1-184, 1 map.

Stone, J. A., and C. L. Cooper.
1930 Geology of Haskell, Latimer, LeFlore, and Sequoyah Counties. Bull. Okla. Geol. Surv. 4: 411-430, figs. 90-91.

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