

12.—NOTES ON THE FISHES OF WESTERN IOWA AND EASTERN NEBRASKA.

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During the years of 1889 and 1890 I made some explorations of the streams of Iowa. The results were published in the Bulletin of the U. S. Fish Commission for 1890, pages 217 to 248. A few collections from western Iowa were not included in the above-named paper. In 1891 Prof. P. B. Burnet, Cotner University, Lincoln, Nebr., and myself collected in a few localities in eastern Nebraska.

In 1892 and again in 1893, while making investigations for the selection of a site for a fish-cultural station in Iowa, Prof. Evermann made some observations upon the fishes at the places visited by him. The present paper is based upon these various small collections, and may be considered as supplementing my "Report upon the Fishes of Iowa," already mentioned.

Collections were made under the direction of the U. S. Commissioner of Fish and Fisheries in 1890 in Little Sioux River and Mill Creek (one of its tributaries), and in Storm Lake, Spirit Lake, and Floyd River; and in 1891 at the following points in eastern Nebraska: Salt Creek near Lincoln, Platte and Elkhorn rivers at Fremont, and Blue River at Crete.

Prof. Evermann's notes are chiefly upon fishes observed by him at Ames, Waterloo, and Spirit Lake.

All the streams in western Iowa are short and of small size. Those north have more or less sandy bottoms, while those in the southwestern part of the State are very muddy. The country is decidedly prairie and more rolling in the northwest.

Spirit Lake.—This lake is in Dickinson County, Iowa, in the northwestern part of the State. The Minnesota State line crosses the extreme northern part of the lake. The greatest length and width are each about 4 miles and the total area 10 to 12 square miles. The southern half is from 1 to 1½ miles wide from east to west. This portion of Iowa is, of course, a glaciated region, and the shores and bottom of Spirit Lake are composed of drift material. The shores are low and gently sloping, as a rule, and are made up of clay, sand, and fine and coarse gravel. No marl was noticed, and but little marshy shore was seen. No trustworthy information as to the depth of this lake could be obtained, but it is probably not greater than 100 feet. The water is clear and cold. There is not a great deal of vegetation in the lake, but patches of *Alga*, *Myriophyllum*, and *Chara* were seen in places. Several species of *Unionida* are found in considerable numbers, and crawfish and frogs are abundant.

Spirit Lake is one of a group of lakes in Dickinson County. At the northwest corner of Spirit Lake, and separated from it by only a few rods, in some cases only a few feet, are Grover, Little Spirit, Hottes, Sunken, and Marble lakes. All of these are small, but of considerable importance as furnishing large quantities of food-fishes.

They do not differ, in general character, from Spirit Lake, except that they are more shallow and have a more abundant vegetation. Little Spirit Lake is particularly well supplied with various species of aquatic plants and also with several species of valuable food-fishes, such as black bass, ring perch, wall-eyed pike, and pickerel.

South of Spirit Lake are East and West Okoboji, two lakes of considerable size and importance. East Okoboji is a long and very narrow lake, the width being about one-half mile and the length not less than 8 miles. This lake is separated from Spirit Lake by a narrow neck of land not over 300 feet wide at the narrowest point. West Okoboji Lake lies west of East Okoboji, with the southern end of which it is connected by a narrow, shallow channel. This lake is the largest and most important of the group.

Among the almost innumerable lake-groups of the northwest there is none possessing a greater interest to the lover of angling than does that which centers about Spirit Lake and the two Okobojies. Both species of black bass, calico bass, ring perch, gray pike, pickerel, and wall-eyed pike abound; and in the pure, clear, and cold waters they have attained a gaminess of disposition, a firmness of flesh, and a delicacy of flavor quite unknown to him who is acquainted only with the less gamy fishes of our warmer rivers and lakes. These lakes are situated in a beautiful country and are easily reached over either of two well-equipped railroads (the Burlington, Cedar Rapids and Northern, and the Chicago, Milwaukee and Saint Paul). Excellent hotel accommodations can be had, and he who goes to Spirit Lake in quest of health and recreation in piscatorial sports will leave with regrets and resolves to return another year.

Little Sioux River is the outlet to Spirit and the Okoboji lakes. It flows through a prairie region, over a sandy or muddy bottom. At Cherokee at the time of our visit it was little more than a creek. *Mill Creek*, one of its small tributaries near Cherokee, is similar to the Little Sioux, only smaller.

Storm Lake is at the head waters of the Raccoon, Boyer, and Little Sioux rivers, its outlet being in the first of these. It is in a prairie region and has a very scanty growth of timber on its shore. The lake is comparatively shallow, not being over 15 or 20 feet in depth, while a large share of it is less than 7 feet in depth.

Mr. Ezra Hurd, of Storm Lake, informs us that black bass are found in the lake, but in small numbers, having been put there about five years ago. He also says that the largest fish in the lake are the buffalo, catfish, eel, perch, redhorse, and what is called the black sucker. From the fact that he says the latter contains but few bones and is the best fish in the lake, we take it to be the Missouri sucker *Cycleptus elongatus*. Aside from this fish, the pickerel (*Lucius lucius*) and the perch (*Perca flavescens*) are the most important, and are found in great abundance. If the wall-eyed pike is found in the lake, it is very scarce. It seems strange that the best food and game fishes (wall-eyed pike and black bass) found in Spirit, Okoboji, and Clear lakes are not found in Storm Lake or, if found at all, are very scarce. It may also be worth while to remark that the minnow *Notropis hudsonius*, which is very abundant in Spirit, Okoboji, and Clear lakes, was not found in Storm Lake.

Floyd River is a rather small stream in northwestern Iowa. It empties into the Missouri River at Sioux City. The Floyd at Lemars is only a small creek. A dam across the stream at this point causes the water to back up and form a few small lakes. The bottom of the stream is sandy and muddy. The heavy rains previous to our visit made it difficult for us to seine above the dam, so most of our collecting was done in the stream just below the dam. At Sioux City the Floyd is some larger and has a

muddy bottom. There is also a dam across the stream at this point. Our collection was made just below it.

Eastern Nebraska is a considerably elevated and rolling prairie, containing very little timber, even along its streams. Its rivers and creeks are typical prairie streams. The running water in them, except in times of drought, is usually turbid, and their currents are swift, much more so than in the streams in Iowa.

Platte River is the largest and most important stream in eastern Nebraska. At Fremont, where visited, it is very wide and shallow, and resembles very much the Missouri River. The Platte is very full of shifting sand bars, and its water has the same milky appearance as that of the Missouri. The fishes taken from the Platte have a very pale, sickly color, which soon changes to a more natural color when the fishes are placed in clear water. Our collections were made from the river and from some bayous near by, which are connected with the river in times of high water.

Elkhorn River is one of the larger streams in eastern Nebraska. It empties into the Platte a few miles below Fremont. It has a sandy and muddy bottom and a very swift current. Our collections were made from the river, from a bayou, and from a small creek between the river and Fremont.

Blue River, near Crete, is somewhat smaller than the Elkhorn, but very similar to it in other respects. Blue River is a tributary of Kansas River. Our collections were made from both branches of the Blue River, a few miles west of Crete.

Salt Creek, near Lincoln, is a small stream with usually a muddy bottom and swift current. Our collections are from the creek and from some large ponds, or lakes, near the creek and connected with it in times of high water.

LIST OF SPECIES OBTAINED.

1. *Lepisosteus osseus* (Linnæus). *Long-nosed Gar*. Common in Spirit Lake.
2. *Noturus gyrinus* (Mitchill). Found in Platte River at Fremont, Floyd River at Lemars and Sioux City, and in Storm Lake. It does not appear to be common at any of these places.
3. *Noturus flavus* Rafinesque. Found by me only in Salt Creek near Lincoln, where but few examples were seen.
4. *Ameiurus melas* (Rafinesque). Platte and Elkhorn rivers at Fremont, Salt Creek at Lincoln, Floyd River at Lemars, and in Storm and Spirit lakes. Apparently not common at any of these places.
5. *Ictalurus punctatus* (Rafinesque). *Channel Cat*. Blue River at Crete, Platte and Elkhorn rivers at Fremont, and Salt Creek at Lincoln. Common.
6. *Ictiobus cyprinella* (Cuvier & Valenciennes). *Buffalo*. One small specimen taken in the Elkhorn at Fremont.
7. *Ictiobus bubalus* (Rafinesque). *Small-mouthed Buffalo*. Abundant in Floyd River below the dam at Sioux City. It is also found in East Okoboji Lake, where 2 or 3 small specimens were obtained. Very large buffalo fish are reported from this lake, which are probably this or the preceding species.
8. *Carpiodes velifer* (Rafinesque). *Quillback*. This small sucker appears to be common in Blue River at Crete, in the Platte and Elkhorn rivers, and in the Floyd River at Sioux City, below the dam. Dorsal rays, 24 to 30; scales in the lateral line, 36 to 41; head, $3\frac{1}{2}$ to 4; depth, $2\frac{1}{2}$ to 3.
9. *Catostomus teres* (Mitchill). *Common Sucker*. Apparently common in Floyd River at Lemars and Sioux City.
10. *Catostomus nigricans* Le Sueur. *Hog Sucker*. At Waterloo, Iowa, July 18, 1893, I examined the contents of the live box of a man who supplies live bait to the enthusiastic local anglers for black bass, pike, and pickerel. The box contained no fewer than 7 species, viz: 2 suckers (the above and *Moxostoma macrolepidotum duquesnei*), 3 minnows (*Campostoma anomalum*, *Cirola vigilax*, and *Notropis whipplei*), and 2 darters (*Etheostoma caprodes* and *Etheostoma evides*). All these specimens were taken in the Cedar River at Waterloo. (Evermann.)

11. *Moxostoma macrolepidotum duquesnei* (Le Sueur). *Common White Sucker*. Common in Blue River at Crete, Nebr. A few specimens examined at Lemars, Iowa, from the Floyd River just below the dam. Also seen among "live bait" at Waterloo, Iowa.
12. *Placopharynx carinatus* Cope. *Big-jawed Sucker*. Very abundant in the Floyd River at Sioux City and Lemars.
13. *Campostoma anomalum* (Rafinesque). *Stone-roller*. A few were obtained in Floyd River at Sioux City, but it was found in considerable numbers in College Creek at Ames. Also seen among "live bait" at Waterloo, Iowa. (Evermann.)
14. *Hybognathus nuchalis* Agassiz. Abundant in the Platte River at Fremont, less so in the Elkhorn at Fremont and Salt Creek at Lincoln. It was also found to be a common minnow in the Floyd River at Sioux City and Lemars, and in College Creek at Ames. In individuals $2\frac{7}{8}$ inches long the intestine was 9 inches in total length.
15. *Pimephales promelas* Rafinesque. Blue River, Crete, Nebr.; Platte River, Fremont, Nebr.; Elkhorn River, Fremont, Nebr.; Salt Creek, Lincoln, Nebr.; Floyd River, Sioux City and Lemars, Iowa; College Creek, Ames, Iowa; and Storm Lake, Iowa. Abundant in all suitable places.
16. *Pimephales notatus* (Rafinesque). Found at Fremont in the Elkhorn, at Crete in Blue River, at Sioux City and Lemars in the Floyd, and in College Creek at Ames. Common at Ames only.
17. *Cirola vigilax* Baird & Girard. Seen in "live bait" box at Waterloo, Iowa. (E.)
18. *Notropis heterodon* (Cope). Found among the weeds near the shore of Storm Lake and in College Creek at Ames. An examination of Prof. Hay's type of *Notropis germanus*, which came from Smoky Hill River at Wallace, Kans., shows that it belongs to this species. The specimen is in very poor condition.
19. *Notropis cayuga* Meek. This minnow was found in limited numbers in Floyd River at Sioux City and Lemars, in Storm Lake with *N. heterodon*, and in College Creek at Ames. At Ames it is an abundant species.
20. *Notropis deliciosus* (Girard). Abundant in Platte and Elkhorn rivers at Fremont, Salt Creek at Lincoln, Blue River at Crete, and Floyd River at Sioux City and Lemars. Less common at Crete than elsewhere.
21. *Notropis gilberti* Jordan & Meek. A few individuals were found in the Floyd River at Sioux City and Lemars.
22. *Notropis topeka* Gilbert. Found in Salt Creek at Lincoln, Blue River at Crete, and Floyd River at Sioux City and Lemars. It was found in greater numbers in Salt Creek than elsewhere.
23. *Notropis hudsonius* (De Witt Clinton). A few specimens were obtained from the Floyd River at Sioux City, while in Spirit and the two Okoboji lakes it is by far the most abundant minnow. At these lakes it is the principal minnow used by local fishermen as live bait.
24. *Notropis lutrensis* Baird & Girard. Platte and Elkhorn rivers at Fremont, Salt Creek at Lincoln, Blue River at Crete, and Floyd River at Sioux City and Lemars. The eastern limit of this widely distributed species seems to be in Central Iowa, it having been found by me in the Des Moines River at Des Moines. Ravenna, Nebr., seems to be near the northwest limit of its range, as it was not found in any of the streams in southwestern South Dakota. To the southward it is an abundant fish in all suitable streams, as far at least as the Rio de los Conchos, in Chihuahua, Mexico, where it was obtained by Mr. A. J. Woolman.
25. *Notropis whipplei* (Girard). A few specimens from Storm Lake. Noticed also in "live bait" box at Waterloo, Iowa. (E.)
26. *Notropis megalops* Rafinesque. This species is abundant in College Creek, from which the collection contains 12 young specimens. These do not differ from eastern specimens, except that the caudal peduncle is unusually long. This species is not common in Floyd River at Lemars and Sioux City, and is apparently more numerous in the Elkhorn River at Fremont, Nebr. No specimens were taken from other localities.
27. *Notropis jejunus* Forbes. This species was found in the Platte and Elkhorn rivers near Fremont, where it appears to be rather scarce.
28. *Notropis dilectus* (Girard). This species is also common in the Elkhorn River at Fremont, Nebr., and less common in Floyd River at Sioux City, Iowa.
29. *Phenacobius mirabilis* (Girard). From Blue River at Crete; apparently not common.

30. *Hybopsis kentuckiensis* (Rafinesque). *Chub*. A few specimens from the Elkhorn at Fremont.
31. *Hybopsis storerianus* (Kirtland). This species was found to be common in the Elkhorn at Fremont, Nebr., and scarce in Floyd River at Sioux City, Iowa. No specimens were taken from other localities.
32. *Hybopsis hyostomus* Gilbert. Found in Platte and Elkhorn rivers at Fremont, and Blue River at Crete. Apparently scarce in all of these places.
33. *Platygobio gracilis* (Richardson). *Flat-headed Minnow*. A few small specimens were found in Platte River at Fremont.
34. *Semotilus atromaculatus* (Mitchill). *Creek Chub*. Floyd River at Sioux City, scarce; more common in College Creek at Ames.
35. *Notemigonus chrysoleucus* (Mitchill). *Bream*. Platte River near Fremont, Floyd River at Sioux City, College Creek at Ames, and Storm and Spirit lakes, in all of which waters this species is common.
36. *Hiodon alosoides* (Rafinesque). *Moon-eye*. A few taken in Platte River at Fremont and Floyd River at Sioux City.
37. *Dorosoma cepedianum* (Le Sueur). *Hickory Shad*. A common species in the Elkhorn River in suitable places at Fremont, but less so in the Floyd River at Sioux City.
38. *Percopsis guttatus* Agassiz. *Trout Perch*. Found by us only in Floyd River at Lemars and in East Okoboji Lake, from which latter place four specimens were obtained November 2, 1892, from a minnow box at one of the summer hotels. Mr. H. C. Owen, proprietor of the Lake Park House at Spirit Lake, says that this curious fish is abundant in the lakes in that vicinity and that it is used extensively for live bait. Professor Meek, in June, 1890, made special investigation in East Okoboji Lake for this species, but was unable to find it. The specimens obtained by me vary in length from 3½ to 5 inches. In Mill Creek, a small tributary of the Little Sioux River, which is the outlet of the Spirit Lake group, Professor Meek found *Percopsis guttatus* to be the most abundant species. In these specimens the serrations of the preopercle are much more pronounced than in specimens from the Little Miami River, Ohio, with which I have compared them. (Evermann.)
39. *Fundulus zebrinus* Jordan & Gilbert. Common in Storm and East Okoboji lakes. It will doubtless be found to occur in all the lakes of Iowa and southern Minnesota.
40. *Zygonectes sciadicus* (Cope). Specimens were obtained from the Platte and Elkhorn rivers at Fremont, and 2 young individuals from Floyd River at Lemars. It seems to be very scarce at each of these places. This species and *Z. macdonaldi* Meek very closely resemble each other, although the specimens so far collected show constant, but slight differences. In *Z. sciadicus* the teeth in the upper jaw are in a broad band with the outer ones but little enlarged, and their tips but slightly hooked. Dorsal rays, 10; anal, 11. *Z. macdonaldi* has the teeth of the upper jaw in a narrower band with the outer ones considerably enlarged and decidedly hooked. Dorsal rays, 11 or 12; anal, 13.
41. *Luciulus lucius* (Linnaeus). *Pike*; *Northern Pickerel*. Found in Floyd River at Lemars and Sioux City, where it was common; in Storm Lake, where it is the most abundant and most important food and game fish; also in East and West Okoboji and Spirit lakes, in each of which it is abundant, being second in importance only to the wall-eyed pike (*Stizostedion vitreum*).
42. *Pomoxis sparoides* (Lacépède). *Calico Bass*. Specimens of the calico bass were identified at East Okoboji Lake, in which it is said to be a common species.
43. *Ambloplites rupestris* (Rafinesque). *Goggle-eye*. A few specimens were obtained at Sioux City in Floyd River.
44. *Lepomis cyanellus* (Rafinesque). *Green Sunfish*. Common in the ponds of the Nebraska State fish-hatchery at South Bend; also in Platte and Elkhorn rivers at Fremont, Floyd River at Lemars, and in Storm Lake.
45. *Lepomis humilis* (Girard). Common at South Bend, Nebr., in the ponds of the State fish-hatchery; also in Platte and Elkhorn rivers at Fremont, Salt Creek near Lincoln, Floyd River at Lemars and Sioux City, Blue River at Crete, and in Storm Lake.
46. *Lepomis pallidus* (Mitchill). *Blue Sunfish*. Found in Spirit Lake, and doubtless occurring in the other lakes of that group.
47. *Lepomis gibbosus* (Linnaeus). *Common Sunfish*. Specimens obtained from Spirit Lake, where it does not appear to be at all common.

48. *Micropterus salmoides* (Lacépède). *Large-mouthed Black Bass*. Common in the Platte and Elkhorn rivers at Fremont, less so in Floyd River at Lemars and Sioux City. It is also found in Spirit Lake, where it is probably common.
49. *Micropterus dolomieu* Lacépède. *Small-mouthed Black Bass*. Among the waters covered by this report, the small-mouthed black bass was found only in Spirit Lake.
50. *Etheostoma nigrum* Rafinesque. Elkhorn River at Fremont, scarce; Floyd River at Lemars and Sioux City, common; College Creek at Ames, and Storm, East Okoboji, and Spirit lakes. It seemed most abundant in Storm Lake. A specimen was found in a minnow bucket at Spirit Lake, where it seems to be used as live bait to some extent.
51. *Etheostoma caprodes* (Rafinesque). *Log Perch*. Several specimens seen in a "live bait" box at Waterloo, Iowa, where it was called "stickleback." (E.)
52. *Etheostoma aspro* (Cope & Jordan). *Black-sided Darter*. A few specimens found in Floyd River at Sioux City.
53. *Etheostoma evides* (Jordan & Copeland). A very brilliantly colored male of this beautiful darter was noticed among the minnows in the live box of a fisherman at Waterloo, Iowa, July 18, 1893. The nose, lower jaw, opercles, and cheeks, were of a rich orange in color; rest of head orange but not so rich; eight broad, vertical, greenish bars on side; spinous dorsal plain. Several local fishermen to whom this fish was shown called it a "stickleback," and I learned that this is the name which they apply to all the darters found there. (Evermann.)
54. *Etheostoma cœruleum* Storer. *Rainbow darter*. Found only in Storm Lake, where it is not common.
55. *Etheostoma iowæ* Jordan & Meek. This interesting little darter, originally described from Iowa, was found in limited numbers in the Platte and Elkhorn, near Fremont. In the State fish commission ponds at South Bend, Nebr., it was found to be very abundant, the collection containing 42 small specimens from that place. It was found in Floyd River, both at Lemars and Sioux City, but did not appear to be common. We also found it in College Creek at Ames and in Storm and Spirit lakes, 11 specimens from Ames being in the collection. An examination of specimens from these different localities shows considerable variation in the dorsal-fin formula. In 25 specimens from South Bend the dorsal-fin formula was as follows: ix-10 in 9, x-11 in 5, x-10 in 4, ix-11 in 4, ix-9 in 2, and xi-10 in 1. Two of the specimens from Fremont give x-11, and one each viii-10, ix-10, and x-10. The one specimen we have from Lemars has the dorsal viii-10. The four specimens from Storm Lake give vii-10, viii-9, viii-11, and ix-10, respectively. Of the 11 specimens from Ames four give ix-11, four ix-10, and one each x-10, x-11, and vii-9. Of these 46 specimens, 15 count ix-10, while the variation in 22 others is from ix or x-10 or 11.
56. *Perca flavescens* (Mitchill). *Ring Perch*. Abundant in Storm, East Okoboji, and Spirit lakes. At the mouth of a small inlet near the northeast corner of Spirit Lake, about the last of June, 1890, young yellow perch were so abundant that they could be scooped up by the handful.
57. *Stizostedion vitreum* (Mitchill). *Wall-eyed Pike*. This is by far the most important and valuable fish of Spirit and West Okoboji lakes, where it is known as "pike."
58. *Stizostedion canadense* (C. H. Smith). *Sand Pike*; *Gray Pike*. Found in Platte River at Fremont, Floyd at Lemars and Sioux City, and in Spirit Lake.
59. *Roccus chrysops* (Rafinesque). *White Bass*. One specimen from Storm Lake. Local fishermen report that it is taken but rarely.
60. *Aplodinotus grunniens* (Rafinesque). *Freshwater Drum*. Common in the Elkhorn River near Fremont.