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			Page
Plate XX.	A.	Marsh bay of Beaver Lake (Station 52), looking northeast	160
	B.	Northwest shore of Beaver Lake (Station 59), looking northeast	160
Plate XXI.	A.	Spruce Lake, looking northwest (Station 71)	160
	B.	Station 84, Spruce Lake, looking east. Floating mats of stonewort on the surface	160
Plate XXII.	A.	Station 85, Spruce Lake, looking south across the east end of the lake	160
	B.	Marshy north shore of Vermilion Lake	160
Plate XXIII.	A.	Small lake and wooded sand ridge about a half mile east of Vermilion (Station 106), looking northeast	160
	B.	West end of the small lake shown in A. Station 101, looking east	160
Plate XXIV.	A.	Mitten Lake, Station 116, looking east	160
	B.	Vermilion Creek at Vermilion. Great Blue Heron feeding	160
Plate XXV.	A.	Sheldrake Lake, looking southwest	160
	B.	Northwest shore of Sheldrake Lake, looking northeast (Station 142)	160
Plate XXVI.	A.	Sheldrake River and portion of wooded swamp, looking downstream from a high, north stream bank	160
	B.	Portion of Sheldrake River just south of Vermilion	160
Plate XXVII.	A.	Sheldrake River just south of Sheldrake Lake, looking south	160
	B.	Long-nosed Dace, *Rhinichthys cataractae*	160
Plate XXVIII.	A.	Manitoulin Tullibee, *Leucichthys tullibee* (?) caught at Station 2, Lake Superior	160
	B.	Young Whitefish, *Coregonus clupeaformis* (possibly *albus*), length of largest about three inches, caught at Station 1, on Lake Superior shoal	160

FIGURES.

Figure 1.	Outline map of South Twin Lake, Houghton county, Michigan	15
Figure 2.	Sketch map of Douglas Lake, Michigan	31
Figure 3.	Sketch map of the Marsh Lake region near Vermilion	113

OBSERVATIONS ON THE FISHES OF HOUGHTON COUNTY, MICHIGAN.

THOMAS L. HANKINSON,

STATE NORMAL SCHOOL, CHARLESTON, ILLINOIS.

OBSERVATIONS ON THE FISHES OF HOUGHTON COUNTY, MICHIGAN.

THOMAS L. HANKINSON.

During the latter half of August, 1905, the writer made a study of the fish in a number of small lakes in Houghton County, Michigan, for the Michigan Geological and Biological Survey. Most of the work was done on lakes lying along the Copper Range Railroad between Stonington and Winona, two small stations nearly ten miles apart and in general between seventeen and one-half and twenty-seven and one-half miles southwest of Houghton by rail. Only two lakes at any distance from this ten-mile stretch of railroad were examined—Kratt Lake, about two miles southeast of Winona, and Bear Lake, about seven and one-half miles north of Houghton in the sand dune region of Lake Superior.

As it was impossible in the time devoted to the work to make a detailed study of all of the fish environments in each lake, attention was principally confined to one kind of habitat—the shallow water, three feet or less in depth, about the shores and islands. Each habitat was seined with a six foot "common sense" seine, and in addition to observations on abundance, notes were made on the ecological distribution. A complete series of the fish taken in each place has been deposited in the Museum of Zoology, University of Michigan.

The writer is indebted to A. C. Lane, former State Geologist, for helpful suggestions in the course of the work, to A. G. Ruthven for assistance in the preparation of this paper for publication, and to the following persons for aid in identifying material: C. A. Davis, seed plants; A. G. Ruthven, reptiles and amphibians; S. E. Meek, three species of minnows; Edwin Linton and H. B. Ward, fish parasites; F. S. Collins, algae; J. P. Moore, leeches; N. A. Harvey, sponges.

LOCAL DISTRIBUTION OF FISH.

Stonington Lakes. Three small lakes close to the station of Stonington on the Copper Range Railroad are called the Stonington Lakes in this paper. Each of these lakes is surrounded by thick forest except where they come close to the railroad embankment. They are in general oblong in shape, and the largest is perhaps a quarter of a mile

in length. As in all of the lakes of this densely forested region south of Houghton, the water has an umber color, and the bottom material of the shoals is similar to that found in the shallow water of the other lakes—a firm sand tinged with the color of the water.

The lakes were examined and a number of collections made on August 25. No detailed study of the vegetation was attempted, but the following plants of special interest were noted:

Marchantia polymorpha L.—Growing in abundance on beaches.

Drosera rotundifolia L.—Abundant on the shore and extending out on partly floating logs.

Equisetum fluviatale L.—Growing in patches, and in places forming distinct zones along the water's edge.

Ericaulon articulatum (Huds).—Forming patches on the bottom in shallow water.

Myriophyllum Farwellii Morong.—On submerged portions of logs.

Potomogeton sp.?—In patches in deeper water.

Brasenia Shreberi Gmel.—In patches.

Gloiotrichia Pisum (Ag.) Thuret.—An alga forming gelatinous colonies in shallow water.

Conspicuous aquatic invertebrates noted were:

Spongilla lacustris (Linn.).—On brush and other submerged objects near shore.

Macrobdella decora (Say).—Apparently the common leech of the northern lakes about Houghton.

Caddice worms.—Common on the bottom of shoals. Their cases were made of sticks.

Two amphibians occurred in some numbers around the shores, *Rana septentrionalis* Baird and *Rana pipiens* Schreber.

The fish observed were:

Chrosomus erythrogaster.—Abundant in schools in both lakes.

Pimephales promelas.—Abundant in large schools in both lakes.

Couesius plumbeus.—One taken in the south lake.

Catostomus commersonii.—One caught in the south lake.

Pygosteus pungitius.—Eight taken in the middle lake.

Eucalia inconstans.—Two found in the middle lake.

South Twin Lake. This lake is located about three miles northeast of Winona, on the Copper Range Railroad. It is somewhat over a mile long and a half mile wide, and receives several small streams. The outlet (Plate VIII) is Misery Creek, which flows to the west into Lake Superior (Fig. 1). The lake is completely surrounded by the forest except for a small clearing about the single building on its shore (Plate II). A well-marked beach, continuous with a broad shoal of compact

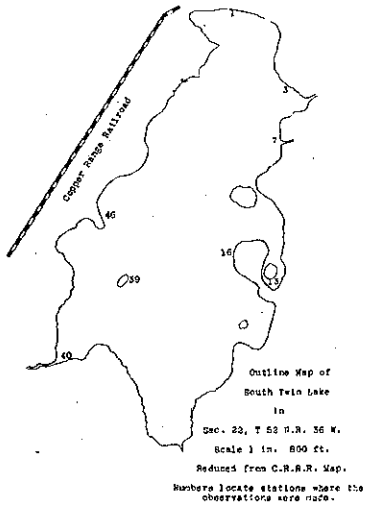

Figure 1.

sand or gravel, is present in most places. The water and bottom are tinged with umber.

South Twin lake received the most attention of the two. Stations were located in typical habitats and rather detailed studies were made at these places. Here again, the work was principally confined to the shallow water. Upon the beaches were sedges, rushes, and many other plants, forming in most places a thin growth of vegetation. A distinct zone of low shrubs, chiefly *Myrica Gale* (L.) and *Chamaedaphne calyculata* (L.) Moench, almost completely surrounds the lake just outside the beach region. Outside this is a zone of high bushes, and then comes the timber region, which is mainly composed of hardwoods but also includes many conifers, conspicuous among which are some large white pines.

The plants noted on the shoal were:

Bulrushes.—Formed a scant growth over many shoals. Thick patches were unusual.

Sparganium sp?—Often formed a thick growth in shallow water.

Ericaulon articulatum (Huds).—A rather conspicuous growth in places where there were but a few inches of water.

Lobelia Dortmanna L.—Found growing with the *Ericaulon*.

Potomogeton.—Several species grew on the shoal, principally on the outer part.

Brasenia purpurea Casp.—Patches were often present on deeper shoals.

Habitat Distribution of Fish in South Twin Lake.

Station 1. This is the shoal and adjacent shore at the extreme north end of the lake. The shallow water area is comparatively extensive with a bottom of hard sand. Over this is a scant growth of rushes, which form the only conspicuous vegetation. The shore zones of plants are distinct, but the low bush or heath zone practically covers the beach (Plate II).

Fishing with the hand seine was done on the morning of August 28 in water that was mostly between one and two feet in depth. The water temperature was 70° F. Fish were few and were not moving on the shoal: those taken were found resting beneath objects such as overhanging bushes, an old row boat and pieces of water-logged bark. The following species were collected:

Rhinichthys atronasus lunatus.—Several taken.

Semotilus atromaculatus.—Several small specimens taken.

Micropterus salmoides.—One small specimen 4.2 cm. long was caught.

Station 3. This is a shoal which differs from that of Station 1 in being much narrower, a depth of three feet being reached about thirty or forty feet out from the shore. The shore features are similar to those of Station 1, and this is also true of the bottom which is composed of a similar hard, reddish sand with little vegetation (a few rushes and other plants). Many logs (Plate III) were floating near the shore. Collecting was done with the six-foot minnow seine in water three feet or more in depth and there was no difficulty in getting a representative collection of fishes for they showed little fear of the net.

The invertebrates found were:

Macrobdella decora.—This large leech was common.

Dragon-fly nymphs and eggs of *Tetragoneuria* sp.—The latter were in long strings of jelly-like substance.

Caddice worms.

The fish taken were:

Semotilus atromaculatus.—Small specimens found in water less than a foot deep.

Chrosomus erythrogaster.—Many in shallow water near shore. A large, compact school was seen in three feet of water.

Rhinichthys atronasus lunatus.—Chiefly in the shallow water near shore.

Couesius plumbeus.—Three small specimens.

Leuciscus neogeus.—One taken.

Catostomus catostomus.—About a dozen small ones were taken and one comparatively large specimen, nearly a foot long, was found sucking on the submerged part of a floating log on the wood freshly bared by the stripping off of a portion of the bark.

Eucalia inconstans.—One taken.

Micropterus salmoides.—Small specimens under four inches in length were common in a few inches of water near shore.

Perca flavescens.—Small specimens under three inches in length were common. They were confined to the deeper part of the shoal in two or three feet of water and were found in compact schools.

The first three species of fish mentioned in this list were closely associated and tended to school together.

Station 16. A stretch of shore different from that of any other part of the lake is found at this station (Plate IV). The beach is unusually broad with low bushes scattered over it, and the shoal is also peculiar in that the bottom is covered with large pebbles over which no fish were found. The only place where fish were seen was in a shallow beach pool which was connected with the lake by a short, narrow channel. This little bay is scarcely more than a square yard in area and only an inch or so in depth. Many small fish were observed, and as the writer approached, they began to hasten through the little channel to the lake. A collection of these fish contained representatives of *Semotilus atromaculatus, Rhinichthys atronasus lunatus, Couesius plumbeus, Eucalia inconstans and Lepomis cyanellus*. All were small individuals of their species, and the Semotilus was most abundant, only one of each of the last four species being taken.

Station 13. As shown on the map, this station is at the end of a little bay. There is a diversity of conditions, but the whole region is a shoal with more aquatic vegetation than any of the stations yet described. In places the water reaches a depth of about four feet. The bottom is mostly hard and sandy, but close to the south end of the bay there is a thin layer of humus over the sand. Plate V shows a part of the eastern portion of the bay.

Rushes were abundant, and there was a good sized patch of *Brasenia Shreberi*.

The following invertebrates were found in this habitat:

Spongilla lacustris (Linn.) and *Spongilla fragilis*, Leidy.—These two

formed a conspicuous green growth on the submerged branches of a tree that had fallen into the water. This tree can be seen in Plate V.

Macrobdella decora.—A few were seen and collected.

Two species of fish were found, *Catostomus catostomus* (one small specimen) and *Micropterus salmoides* (small specimens, less than two inches long), the latter being common.

Station 7. Sparganium (Plate VI), growing in patches in one to two feet of water, covered much of the bottom of the shoal called Station 7. Except for many long slender leaves floating on the surface, the plants were submerged at the time studied. Beyond this growth, toward deep water, was a zone of pond weeds (*Potomogeton Nuttallii* and perhaps other species of the genus), followed by a zone of water lilies, which occupied the deepest part of the shoal and extended out to the beginning of deep water. A small, sandy delta at the mouth of a little creek entering the lake at this point broke the *Sparganium* zone.

The following fish were caught on the shoal, but a representative collection could not be made on account of the denseness of the vegetation: *Semotilus atromaculatus, Rhinichthys atronasus lunatus, Lepomis cyanellus, Micropterus salmoides.* Only a few small specimens of each of the listed species were taken. Ten of the small *Semotilus* caught were infested with a protozoan parasite, *Myxobolus.* Many small fishes were seen.

Station 46. The shoal with the greatest amount of plant life of any visited is on the west side of the lake and just north of a small point of land. This is called Station 46. No attempt will be made to describe the complex association of plants found in this habitat, but an idea of its general character may be had from Plate VII. The water is mostly three or four feet deep and the sand is covered by several inches of humus.

As at Station 7, the abundance of vegetation did not permit careful seining. Many fish, including some large *Semotilus atromaculatus* 100-120 mm. long, were seen, showing that this was a favorite fish habitat, and even from the small amount of data obtained it was evidently the type most favored by shoal fish. A noteworthy feature was the great abundance of red-bellied leeches, *Macrobdella decora*, which, while found at other stations in some numbers, were nowhere so abundant as on this shoal.

The following fish were found at this station:

Semotilus atromaculatus.—Many seen, none taken.

Leuciscus neogeus.—Three small specimens collected.

Micropterus salmoides.—Many small bass were seen but none were

captured. The habitat undoubtedly represented an important feeding ground for them.

Perca flavescens.—One small specimen taken.

Deep Water Region.—As previously stated, the deep water region, by which is meant all of that extensive portion of the lake surrounded by the relatively narrow shoals, was scarcely examined in any of the lakes, but in this lake, a little hook and line fishing, done just off the shoal called Station 1, yielded seven *Perca flavescens* (130-160 mm. long); and just off the lily zone of Station 7, in deep water, two rather large *Lepomis cyanellus* (150-180 mm. long) and a *Micropterus salmoides* (265 mm. long) were taken.

Stream at Station 7. The stream already referred to as entering the lake at this station is a very small one, and fish were found only close to its mouth, in a deep pool (as deep as four feet in places). Satisfactory collecting could not be done with a net, but a number of good sized *Semotilus atromaculatus* (10-15 cm. long) were caught there with a hook and line baited with worms.

Station 40. This is the area about the head of Misery Creek, the principal and perhaps the only outlet of the lake. The general character of the region is shown in Plate VIII. The water is very deep at the source of the creek, but about a bridge and for a considerable distance below it, the stream is shallow enough to permit fishing with the small seine. In the center of the stream the depth averages perhaps three feet. The bottom is of hard sand covered in places with considerable brush and other forest debris. Fish tended to keep under the bridge, where they were abundant; few were found in the other part of the creek visited. The following species were noted and collected:

Chrosomus erythrogaster.—Abundant; many large specimens, 60-70 mm. long were taken.

Semotilus atromaculatus.—Abundant; many large specimens, 120 or more mm. long, were taken. As many as two dozen of these large chubs were caught at a haul with the six-foot seine.

Rhinichthys atronasus lunatus.—Abundant; many large specimens, some 100 mm. long, were collected.

Leuciscus neogeus.—Two were taken, each about 70 mm. long.

Couesius plumbeus.—Common. They were mostly about 50 mm. long.

Perca flavescens.—Five were taken, 50-70 mm. in length.

Micropterus salmoides.—One taken, about 40 mm. long.

North Twin Lake. This lake lies to the north and east of South Twin Lake and is considerably the larger of the two. Very little work was

done there, only about an hour being spent in collecting along the south end. It appeared to be surrounded by unbroken forest except at the south end where lumbering was going on. The bottom and vegetation seemed to be like those of South Lake. Many fish were observed in the shallow water area, and the following five species were taken: *Chrosomus erythrogaster, Semotilus atromaculatus, Rhinichthys atronasus lunatus, Catostomus catostomus, Lepomis cyanellus.* With the exception of *Rhinichthys atronasus lunatus,* which was very common, only a few specimens of each species were caught.

Kratt Lake. Kratt Lake is located about two miles southeast of Winona, mostly south of Sections 33 and 34, Township 52. It is surrounded by dense forest except for the clearing about an inhabited house. It is smaller but similar to South Twin Lake in the character of the bottom and vegetation; and the shoal, as far as observed, is narrower. The same brown-stained water and bottom sand was found as in the other forest lakes visited. The sand beach is more or less obscured by the zone of low bushes, outside of which is a zone of high bushes and beyond this the timber region. The small shrubs bordering the beach, and in places covering it, seemed to be entirely of two species—*Myrica Gale* and *Chamaedaphne calyculata.*

The following strictly aquatic plants were found: *Sparganium* sp? (forming large, dense, submerged patches in places), *Potamogeton natans* L., *Fontinalis antipyretica* L., *Myriophyllum Farwellii, Utricularia vulgaris* L., *Tolypothrix tenuis* Kutz, *Batrachospermum* sp?

Sponges were abundant but none were collected.

Only the following two species of fish were found:

Lepomis cyanellus.—This species was very abundant, and took a baited hook greedily. In fact, the great abundance and voracity of this sunfish was a prominent characteristic of this lake. In a short time, seventy individuals around 15 cm. in length were caught. They seemed to be most abundant in the deep water just off the shoal. In the shallow water a few small specimens (20-30 mm. in length) were taken, but no other species were found in this shoal region.

Perca flavescens.—One small specimen, about 100 mm. long, was taken by hook.

All of the fish taken in Kratt Lake were very dark in color with a decided umber tinge like that of the water.

Bear Lake. Bear Lake is out of the region of the other lakes studied and already considered. It is in the brush-covered sand dune area

about a half mile from Lake Superior and about seven and a half miles directly north of Houghton. The lake is nearly a mile long with an average width of perhaps a quarter of a mile and presents conditions very different from those in the lakes in the forest south of Houghton. The water is clear and the sand unstained. The shoal is variable in extent; in some places it is narrow and in others one can wade out a hundred feet or so from shore.

Bulrushes were more or less abundant in different parts of the shallow water region, and formed dense and extensive patches. There was also a growth of stoneworts on the bottom, associated with some gelatinous and filamentous green algae which appeared to be chiefly Zygnema and Spirogyra.

Two small crayfish, *Cambarus* sp?, were taken here, the only place in the county where they were found.

Only the shoal was fished, on August 23, but an attempt was made to get a representative collection. The following species were obtained:

Pimephales notatus.—Rather common.

Abramis chrysoleucas.—One small specimen (30 mm. long) taken.

Notropis cayuga.—This species was common and occurred in large schools. The specimens were mostly from 60-70 mm. long.

Perca flavescens.—Small specimens about 40 mm. long were common in shallow water.

Etheostoma iowae.—A number were found on the sandy bottom.

The fish found in Bear Lake were of normal coloration and not umber-tinged as were all of those found in the umber-colored water of the forest lakes.

CONCLUSION.

As has already been stated, the work upon which this paper is based was only a reconnaissance made for the purpose of obtaining a general knowledge of the fishes and fish environments in the lakes of the region. Study was centered on the shoals since in that habitat more species, and thus a better representation of the fauna, could be obtained in the time that could be given to the work. The main value of the report must then be the additional data on the distribution of the species in the state and the general information on the fish faunas of the lakes of this region which it contains.

Five general conclusions may be drawn from the ecological data given above and that contained in the list of species which follows.

(1). The forest lakes examined, which have apparently very similar conditions, have quite different fish faunas.

(2). All of the fishes from the stained waters of the forest lakes are very dark in color, their bodies being tinged with the same color as the water.

(3). In August the shoal fishes are generally most abundant where there is most aquatic vegetation.

(4). Fish enemies in the form of parasites appear to be very frequent in the lakes examined.

(5). South Twin Lake is one of the northern lakes that may be advantageously studied to determine its suitability as an environment for the black bass. The young evidently thrive there, and one of size was caught which was in very good condition. The many minnows in the lake might furnish a large quantity of available food for the bass.

LIST OF SPECIES.

The following list comprises only the species actually secured or observed by the writer, and, as has been said, is principally confined to the shoal species. It is of course incomplete, but it contains additional data on the distribution of the species. The nomenclature and the order of consideration are, with a few modifications, those used in Jordan and Evermann's Fishes of North and Middle America. The millimeter numbers given refer to the length of the fish, which was taken from the tip of the snout to the posterior end of the caudal fin.

1. *Catostomus catostomus* (Forster). Long-nosed Sucker.—Found only in Twin Lakes, where it appeared to be common.

2. *Catostomus commersonii* (Lacépède). Common Sucker.—A single small specimen (36 mm.) taken from South Stonington Lake.

3. *Chrosomus erythrogaster* Rafinesque. Red-bellied Dace.—Common in both Twin Lakes and in each of the two Stonington Lakes examined. In the latter, it was found schooling with *Pimephales promelas*. The specimens collected measured 21-63 mm. One fish with bright red under-parts was found.

4. *Pimephales promelas* Rafinesque. Fat-head Minnow.—Taken only at Stonington, where it was abundant in both of the lakes studied. Two hundred and four specimens (22-60 mm.) were collected. Three were found with cestodes (probably Ligula) filling their body-cavities and greatly distending their abdomens.

5. *Pimephales notatus* (Rafinesque). Blunt-nosed Minnow.—Found only at Bear Lake, where thirteen were taken (24-35 mm.).

6. *Semotilus atromaculatus* (Mitchill). Horned Dace.—The horned dace was only observed in Twin Lakes where it was abundant. Only small specimens, 60-70 mm. long, were found on shoals, but large ones (100-155 mm.) were in streams close to the lake. The fish were much infested with a protozoan parasite, Myxobolus, which produced whitish swellings of the skin and often made the fish conspicuous. Of the two hundred and thirteen specimens preserved, thirty-five were diseased

with this parasite. They are parasitized internally as well as externally, for fourteen parasitic worms, Echinorynchus, were found in their alimentary canals. A superficial examination was made of the digestive tracts of ten large dace (103-143 mm.) and the contents observed were as follows: elytra and other parts of beetles, pieces of dragon-fly and May-fly nymphs, small spiders, winged ants, a small amphipod, some pieces of wood, and the vertebral columns of two frogs. The two hundred and thirteen specimens preserved measured 27-155 mm.

7. *Leuciscus neogeus* (Cope).—Eight (44-70 mm.) were taken from South Twin Lake.

8. *Abramis chrysoleucas* (Mitchill). Golden Shiner.—Only one very small specimen (31 mm.) was observed. This was found in Bear Lake.

9. *Notropis cayuga*, Meek.—Common at Bear Lake but none were found elsewhere in the region. Twenty-four specimens (61-66 mm.) were taken.

10. *Rhinichthys atronasus lunatus* (Cope). Black-nosed Dace.—Noted only in Twin Lakes, where it was present in considerable numbers. The fifty-five specimens preserved measured 25-98 mm.

11. *Couesius plumbeus* (Agassiz).—Found in some numbers in South Twin Lake. Forty-two were taken, the measurements of which were 40-50 mm.

12. *Salvelinus fontinalis* (Mitchill). Brook Trout.—A common fish in the streams. None were found in lakes, but the writer was told that they frequent the shoals in the spring, retiring into the deep water in summer, when they rarely take a hook.

A few small specimens were taken by hook in a small branch o Sleepy Creek, at Winona. On three small specimens (46-84 mm.) fou large copepod parasites (probably Lernaepoda) were found.

13. *Esox lucius* L. Common Pike.—The writer saw fish of thi species that had been taken in a small lake located some seven mile southeast of Winona. This lake is said to contain so many of these fis that it is called "Pike Lake."

14. *Eucalia inconstans* (Kirtland). Brook Stickleback.—Six spec mens of this stickleback were collected at Stonington and South Twi Lake. They measured from 32-53 mm.

15. *Pygosteus pungitus* (Linnaeus). Nine-spined Stickleback.-Found only at Middle Stonington Lake where eight were taken from single school. They measured 42-49 mm.

16. *Lepomis cyanellus* Rafinesque. Blue-spotted Sunfish.—Fou in small numbers at Twin Lakes and very abundant at Kratt Lak Those collected measured 20-166 mm. An examination of the digesti tracts of ten specimens, averaging about 120 mm. in length, show

the fish in Kratt Lake to be feeding on animal and plant material. The stomach contents were as follows: insect fragments (heads of hemipterous insects and parts of beetles), pieces of wood, alga fragments, leaves of Sparganium or Ericaulon, and water lily seeds.

17. *Micropterus salmoides* (Lacépède). Large-mouth Black Bass.—Small specimens were very abundant on shoals of South Twin Lake, but none were noticed elsewhere. Those caught measured 34-78 mm. in length. In the stomachs examined were fish bones, teeth of a minnow, entomostracans, and Chironomus larvae. One comparatively large specimen (265 mm.) was caught with hook and line in South Twin Lake.

18. *Perca flavescens* (Mitchill). Yellow Perch.—Found at South Twin Lake, Bear Lake and Kratt Lake. Small specimens were generally distributed on shoals in South Twin Lake. Some of those taken were 43-70 mm. long. None were found on the shoals of Kratt Lake or Stonington Lakes. Larger perch (133-185 mm.) were taken from deep water off the shoals in South Twin Lake, Bear Lake and Kratt Lake.

19. *Etheostoma iowae*, Jordan and Meek.—Found only in Bear Lake, where four were taken in shallow water on a sandy bottom. These were 37-45 mm. in length.