

NOTES ON CERTAIN PROTOZOA AND OTHER INVERTEBRATES OF
LAKE MAXINKUCKEE.

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The field work upon which these notes are based was carried on under the auspices of the United States Bureau of Fisheries, at irregular intervals between July, 1899, and October, 1913, in connection with a physical and biological survey of Lake Maxinkuckee, Indiana.

THE PROTOZOANS AND CŒLENTERATES.

No special attention was paid to the Protozoa of the lake; only those forms were noted which thrust themselves upon the attention.

The protozoan life of the lake is not conspicuous except for a few forms which are found in such abundance as to attract attention.

The list of species identified is a short one, not because these organisms are rare at the lake, but because no one of the party engaged in the study of the lake was especially interested in or familiar with them. An attempt was made to collect and preserve all forms that attracted the attention, but these were naturally only a small proportion of the species present. Whenever time from our other multifarious and more pressing duties permitted, attempts were made to collect these organisms, and at one time, stimulated by the handsome figures of some of the more ornate forms figured by Leidy and Kent, an especial attempt was made to obtain some of the more striking forms, but the search was rather fruitless. It so happened that the plankton, which should have contained a number of these organisms, was submitted to two different experts, one interested in Algæ, the other in Crustacea, with the result that such Protozoa as there were went by default.

Forms of doubtful affinity, by some placed among Algæ and by others as animals, such as *Peridinium*, *Ceratium* and *Volvox*, are included, *Volvox* especially exhibiting characters which strongly suggest a position in the animal series.

Following are our notes upon the few species identified:

1. *Arcella vulgaris* Ehrenberg

Upon examining the stomachs of a number of tadpoles caught at the edge of Aubeenaubee Bay in August (1906), a goodly number of *Arcella vulgaris* were obtained. The tadpoles when caught were busy sucking the surface of weeds and sticks, as is their habit, and from these they probably obtained the Protozoa. It is probable that Protozoa form an important part of the food of young tadpoles. On other occasions we have seen them taking in large numbers of Paramœcium.

Arcella vulgaris was abundant September 3 (1906), with other material (*Paramœcium*) forming a scum over water in a tumbler where some duckweeds were kept. It was also present in hand-gathered material obtained at the dam in the Outlet, October 30, of the same year.

2. *Centropyxis aculeata* Stein

Taken occasionally in the summer and autumn of 1906 in gatherings in shallow water near shore.

3. *Euglypha alveolata* Dujardin

Obtained in collections near shore, summer and autumn of 1906.

4. *Dinobryon* sp.

Found occasionally near shore in Lost Lake, but not abundant. In the small lakes about St. Paul, Minn., where it is very abundant, it furnishes an important item in the food of the fresh-water mussels.

5. *Euglena viridis* Ehrenberg

Some found in a scum in pools in Green's marsh. The great amount of vegetation makes the water almost as rich as an infusion. Obtained August 22 (1906). *Euglena* formed a bright green scum over the small pools.

6. *Volvox aureus* Ehrenberg

Not found by us at all in the lake, but exceedingly abundant in Farrar's Pond and a pond east of the lake, in the spring of 1901, large swarms being seen there, a single dip of a common dipper always containing several examples. A large number of examples obtained from a small pond near the lake April 24 (1901). Its favorite habitat is in shallow pools, easily warmed throughout and containing in the bottom an abundance of dead leaves or similar fertilizing matter. This species was exceedingly abundant in the shallow, well-fertilized carp ponds at Washington, D. C., in the spring of 1906.

7. *Peridinium tabulatum* (Ehrenberg)

Taken rather less frequently in the vertical hauls than its relative, *Ceratium macroceras*, and apparently not very common. One might naturally expect it to be more common near shore. It was not noted often in surface hauls. It is a species of world-wide distribution, and probably is abundant where conditions are favorable.

There is very little difference between the genera *Ceratium* and

Peridinium, the horns or projections, which are the distinguishing characteristics, occurring in all degrees of development.

8. *Ceratium macroceras* Schrenk

Common in the vertical plankton hauls, occurring in the great majority of hauls, but not common in the surface towings. A similar form, *C. tripos*, was collected in towing near shore at Eagle Lake. The long horns or projections of this species are developed perhaps as much to give buoyance to the form as for protection. The Peridinales, represented by this and the two preceding species, are claimed by both botanists and zoologists.

9. *Stentor caeruleus* Ehrenberg

While raking up weeds through a hole in the ice at the Weedpatch, January 15 (1901), it was noted that the water dripping from the plants turned the snow a vivid green. The snow thus colored was taken home and examined, and the green color was found to be due to multitudes of green stentors. These were kept in a vessel for some time. On January 6 they began to gather on sticks, on snail shells, on the sides of the vessel, and on the under surface of the water, assuming a globular form. The species was probably *caeruleus*.

On February 7, on looking through the ice on Outlet Bay, it seemed full of a reddish fine material like stirred-up mud. Examination revealed the presence of small diatoms and many green stentors.

10. *Stentor* sp.

Among our notes mention is made of another *Stentor*, larger than the green one, brownish and with a large, flat peristomal disc, circular, with a side cleft, like a water-lily leaf.

On October 14 (1907) it was noted that brown stentors were attached to the under side of lily pads in Hawk's marsh.

11. *Vorticella chlorostigma* Ehrenberg?

On June 26 (1901) white, fluffy little globules, which shrank to minute size when touched, and which proved upon examination to be composed of colonies of *Vorticella*, were found very abundant on the submersed tips of *Ceratophyllum* leaves at the Inlet. Late in the autumn of 1904 (October 31, November 2 and 16), the same objects were noted, but in considerably longer and larger patches, on various weeds, such as *Myriophyllum*, etc., in the vicinity of Winfield's. Again, in the autumn of 1906, they were exceedingly abundant in various weeds, especially dying leaves of *Vallisneria*, in Outlet Bay. So far as we have observed, these organisms seem to increase greatly during the autumn. Both white and green colonies were found, alike in everything except color, and it is probable that they were the same species under different conditions. The green forms showed distinctly against the dead *Vallisneria* leaves, which had faded to a papery white. It may be

it was common during the summer, but concealed by its green substratum. June 22 (1906) it was plentiful on the weeds in Lost Lake.

In a note of June 26, concerning this species, occurs the remark, "This is a larger sort; there are also other smaller isolated ones present." On July 25, and previously, it was common in both lakes in weedy, stagnant places, forming a white halo along stems, not in balls. In addition to these there are minute free Vorticella-like organisms attached to the parasitic copepods on the gills of fishes, and on August 28 (1908) a number of minute clear Vorticellas were found on the body of a Cyclops. A species of *Vorticella* was abundant July 31 (1906) on *Anabæna* in plankton scum. Small Vorticellas are found in myriads on objects in Hawk's marsh. They can be found there more abundantly than anywhere else about the lake.

12. *Epistylis* sp.

A species of *Epistylis*, probably *plicatilis* Ehrenberg, was observed forming a dense growth on the shells of a small *Planorbis*, March 25 (1901) near Chadwick's pier.

The copepods of the same region at that time presented a very fuzzy appearance, and upon examination were found to be thickly overgrown with the same or a similar protozoan.

13. *Opercularia irritabilis* Hempel

Abundant during the summer and autumn of 1906 upon the lower surface of the shell (plastron) and also on the skin of various turtles, especially the painted and snapping turtles, making a close, short, brown fuzzy growth. The turtles were botanic gardens above and zoological gardens below. The organisms seemed to do them no injury, and were gotten rid of when the turtles shed their scutes. It sometimes forms a halo about the heads of small turtles, in which case it was at first mistaken for *Saprolegnia*. It is usually the head of the Musk Turtle that is affected. In this case it appears to do no harm, as the turtles are quite lively.

Something very like this, probably the same thing, was observed abundantly (August 6, 1907), on the shoulders of a dragonfly larva.

14. *Vaginicola leptosoma* Stokes

A species of *Vaginicola*, perhaps *leptosoma*, was rather common along the shore of the lake by Overmyer's hill, attached to algæ, October 28 (1906). There were at least six examples on one small bunch of algæ. The sheath was brownish and transparent. When jarred, the animal retracted into the sheath, usually doubling up somewhat into a sigmoid curve.

15. *Tokophrya quadripartita* (Claparède & Lachmann) Butschli

Common, intermixed with *Opercularia irritabilis*, on the ventral scutes of a Musk Turtle, September 12 (1906). It was also found to some extent on the back.

16. *Ophrydium* sp.

By far the most abundant and conspicuous protozoan in the lake was a species of *Ophrydium* which formed large blue-green gelatinous colonies about the size of a hazelnut, or larger. These semitransparent blue-green balls remain in about the same condition the year round. They are found abundantly wherever the carpet *Chara* grows, and are usually attached to it or to pebbles; or, quite frequently, to mussel shells either alive or dead. Clear colonies, remarkable for their unusual transparency, were found on submerged pieces of tile, August and September (1907). At certain times, as August 1 (1906), and August 1 and October 12 (1907), great quantities are washed ashore. The colonies are sometimes hollow, as were many of those washed ashore August 1 (1907).

17. *Hydra fusca* L.

Not frequently encountered in the lake. On October 31 (1906), however, multitudes were found under leaves at the water's edge on the east side, and on November 13 more were found in a similar position. November 18 one was found attached to floating *Wolffella* in Norris Inlet.

THE WORMS.

Our notes on this group are few and very unsatisfactory. We give here only such of them as seem to possess some value.

The attention we were able to give to these forms was so little that we are unable to say much regarding their relative or actual abundance, their distribution, or their relation to the biology of the lake.

Flat-worms or Planarians, small, soft, flat objects, gray above, white below, and oval in outline, were common on rocks and among weeds in the lake. In certain material (*Vorticella*, etc.), obtained near Norris Inlet, they were quite common. They were often abundant on *Ceratophyllum* also. They were so soft that they often pulled apart when attempts were made to remove them from the rocks.

Small pinkish parasites (probably a species of *Distomum*), resembling minute leeches, were found quite common in the stomachs of fishes, particularly the Straw Bass (*Micropterus salmoides*) and the Skipjack (*Labidesthes sicculus*). Usually during the winter the stomachs of these fishes contained little or no food, but in most cases from one to several of these parasites were found in each.

Round-worms, resembling *Ascaris*, are frequent intestinal parasites of the snakes of this region, and one small form was found in the intestine of a mussel.

Tapeworms were almost invariably present in the several shrews (*Blarina brevicauda*) examined. They were also common in the yellow

perch and walleyed pike, and practically every dogfish (*Amia calva*) examined was heavily loaded with them. Many duck stomachs examined, especially those of the ruddy duck, contained from a few to many tapeworms.

Angleworms or Fishworms are not abundant in this region. The country about the lake is chiefly sandy, a soil not favorable to angleworms. At the edges of ditches, marshes and woodland ponds, where the soil is a black loam with some admixture of clay and decaying vegetation, a rather small species of *Lumbricus* is fairly abundant. Fishermen who know these places are usually able to secure all they need for bait. The farmers and farmers' boys and the boys of the village are the ones who make most use of fishworms in their angling.

On December 7 (1904), worms which resembled angleworms were observed in considerable numbers coiled up under a submerged water-soaked board at Long Point, where they evidently were passing the winter in that condition. These worms, however, possessed no annular ring. In alcohol they display a fine opalescent iridescence in reflected light. One seemed to be dividing by a constriction near the middle.

Some very small worms, resembling fishworms in general appearance when alive, were seen at the mouth of a ditch April 19 (1901).

Cotylaspis insignis Leidy is a common parasite of the mussels of Lake Maxinkuckee and Lost Lake. To the naked eye this parasite looks like a minute yellowish leech. Its position in the mussel is close up in the axils of the gills. It was found in *Lampsilis luteola* and also in *Anodonta grandis footiana*, from one to several being found in nearly every example of these species examined August 23 (1906). It was also found in mussels taken on September 28 following, in Little River near Fort Wayne.

The so-called Horsehair Snake or worm (*Gordius* sp.) is very abundant in and about Lake Maxinkuckee. According to anglers, many of the grasshoppers used by them for bait are infested with this parasite. On August 2 (1906) large numbers were seen writhing about in mud among snails along the Outlet where it had been suddenly lowered by a dam at the railroad bridge. We suspect that they may be parasitic in this snail also. They were frequently found in fishes, either free in the lower intestine or encysted and coiled up in some of the internal organs. The bluegill appears to be especially liable to infection by *Gordius*. It may be that the fish become infected through the grasshoppers they devour. On August 6 (1906) these worms were noted in considerable numbers in shallow water on the east side of the lake.

A long, slender, brownish worm, probably a species of *Tubifex*, was found in considerable numbers projecting up into the shallow water from the soft mud bottom of Lost Lake. These were first observed June 8

(1901), when the bottom near the shore was seen to be covered with small whitish mounds about the size of buckshot, which gave a peculiar mottled or dappled appearance. When some of this mud was dipped up and examined the small mounds were seen to be small sand tubes in which the worms were and from which they waved about in graceful undulations. They were observed again at the same place on June 15. On June 18 many were seen in the creek under the railroad bridge, and on June 25 some were noted at the south end of Lake Maxinkuckee. And finally, on November 4 (1904), numerous burrows were seen in shallow water near shore in Lost Lake.

Thorn-head worms (*Acanthocephali*) were found to be common intestinal parasites of various fishes and turtles. Among fishes the redeye appeared to be most affected. The carnivorous turtles, such as the soft-shelled and the snapper, were especially subject to them, while the herbivorous species, particularly the painted turtle, were comparatively free.

Record may here be made of a Bryozoan, *Plumatella polymorpha*, possibly related to the Gephyrean worms. *Plumatella polymorpha* is a compound animal, many individuals budding off from one another, as in plants. The moss-like colonies of this species were very common in the lake among the *Chara* and other plants. They were noted in the *Chara* near the depot pier, off Long Point, near Winfield's, and at the south end near the Farrar cottage. Indeed, it appears to be distributed generally through the lake wherever there are patches of vegetation. Among the *Charas* it forms a brown, upright, bushy growth. In the Weedpatch it was common on the leaves of *Potamogeton amplifolius*. On October 23 (1900) it was found to be abundant on *Ceratophyllum* in rather deep water. A week later (October 29) a good deal was gotten on *Myriophyllum*. Early in the spring (March 1, 1901), it was seen growing on *Potamogeton robbinsii*, and a little later it was found in abundance in front of Arlington station. It was often found on *Chara* and other aquatic plants dredged at various times. It was also found growing on tile piles September 1 (1906).

During the autumn of 1900 the stadioblasts were frequent in plankton scum along shore, often being present in great abundance. They somewhat resemble floating sand grains, but are lighter in weight, being minute circular brown discs, uniform in shape and size. Under magnification they show series of facets like the compound eye of insects.

On October 18 (1900), one of the buoys which had been for some time anchored out in the lake was found to be covered with a flat, creeping growth of this species.

As *Plumatella polymorpha* occurs in this lake it is highly worthy of its specific name, as it shows great variation in form and general appearance.

The leaves upon which it grows are often eaten by fishes, probably for the sake of the *Plumatella*. The yellow perch and bluegill are the species in whose stomachs we found it most abundantly. The stomach of a bluegill caught at the Weedpatch October 26 (1904) was full of stadioblasts. During the autumn of 1904 it was noted as exceedingly abundant.

So far as we know, *Plumatella polymorpha* is the only Bryozoan in this lake.

THE SPONGES.

Sponges are not especially abundant in the lake. In some of the not far distant lakes, as Winona Lake, they frequently form a thick coating around the submerged portions of bulrushes growing out in the water, but at Lake Maxinkuckee this was not observed. They are not common on the rocks. On September 9 (1906) some were found forming a coating on submerged rocks on the east side, and some of these were collected a few days later. On November 5 (1906) some flat ones found on rocks on the east side were apparently being eaten by insect larvæ. On September 22 (1907) Prof. U. O. Cox of the Indiana State Normal found some flat sponges covering a rock where the lake enters the Outlet at the wagon bridge, and there were more on a rock farther down between the wagon and railroad bridges. This completes the record for the flat sponges.

A long, green, string-like form found hanging among the weeds at the lake, especially at the Weedpatch, was much more common. This was observed quite frequently and often obtained when collecting aquatic plants. Occasionally these long strings were washed up near shore. On October 27 (1900) these sponges were observed forming stadioblasts on the weeds in Lost Lake.

Occasionally the sponges form small, blue-green, spherical masses, like bullets, around the stems of *Chara*. On January 22 (1901) some of these spherical sponges were observed on carpet chara about five feet out from the Arlington Hotel.

Sponges are quite common in creeks and ponds near the lake. The long form is common in Twin Lakes. There are long, finger-like forms in Yellow River, and they were abundant in the Outlet about the bridge below Walley's.

The sponges were submitted for identification to Mr. Edward Potts, of Media, Pa., who in a letter dated May 24 (1905) writes so interestingly regarding the material that we here quote his letter in full:

Yours with package of material was received by first mail yesterday A. M.; and having nothing important on hand, I examined the vials at once, with the following results:

First, I must express my pleasure in finding that you had sent only *Sponges*; that is, remembering that frequently even workers in other lines of science are utterly unfamiliar with these forms, and hence send one gelatinous and otherwise incongruous articles. I was glad to learn that you know a sponge when you see it. The only possible exception is in your No. 5, which, as you supposed, is not a sponge but only a puzzle, which may perhaps be explained by considering the fibres to be a form of alga, or more probably, the stems or stipes (as the "Micrographic Dictionary" calls them) of some, possibly all, those Diatoms now found at the outer surface of the sub-spheres. I have frequently found Diatoms so growing.

No. 1 is *Carterius tubisperma* Mills, and is, I am sorry to say, the only sponge in satisfactory condition for safe determination. Nos. 2 and 4 are, I fully believe, of the same species as No. 1, and they have plenty of gemmules or statoblasts; but these are so far from maturity that, if the same species, the chitinous coat is extremely thin and it apparently has not yet developed the foraminal tubules, the granular crust, and protective birotulate spicules which should be the determining points. I do not understand why this should be so with the date given (November 15 and later); but I suppose it possible that cold spring water or its unusual depth may have retarded development to a date later than that with which I have been familiar. This is further suggested by No. 3, in which I have failed to find any gemmules, and which reminds me of the appearance and condition of forms that I have sometimes called perennial or evergreen sponges, which apparently continue their growth all through the winter, at least in deep water.²

No. 3 is clearly a different sponge from the others, as shown by its shorter and more robust spicules (skeletal), which, as you will see, are covered with very minute spines. I should have been much pleased to find the stadioblasts of this sponge. The skeleton spicules suggest *Meyenia leidyi* Carter, although in that species they are rarely microscopical. You may meet with it again under more favorable circumstances.³

Although I fear they are too soft for safe transportation, I propose to pack with the vials returned, two trial slides, No. 1, showing *Carterius tubisperma*, in which you may see the foraminal tubules before mentioned and the armature of radial birotulate spicules, beside the skeleton and dermals; and No. 2, showing separated spicules of the same.

² See my Monograph, pp. 245 and 246.

³ See fig. 1, plate X, of my Monograph.