2. It is the richest in plankton of any of the North American lakes which have so far been examined, and compares favorably with what are termed "plankton rich" lakes.

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Physical Survey of Lakes Tippecanoe, Eagle, Webster and Cedar. By Thomas Large, Assisted by C. O. & A. D. Fisher.

The method of measurement in this work was the same as that employed by Messrs. Juday and Ridgley and myself last year in the survey of Turkey Lake, differing only in an attempt to follow such established lines as section lines, quarter and half-section lines, which are usually indicated by farm fences, and, therefore, can be readily found, and are thus permanently marked. Profiting by the experience of the previous year, we made but few cross lines, as they are very confusing, particularly when made in rough weather.

Three of the lakes sounded this year are parts of the Tippecanoe drainage system—that river flowing through Lakes Webster and Tippecanoe, and being connected with Eagle Lake by a small stream. Cedar Lake has for its outlet a small stream flowing to the Kankakee River. Of these lakes Tippecanoe is the largest,

least known and retains most nearly its primitive condition. No damming or draining have in any way affected it. The principal alterations by man being the removal of the largest trees from its shores for lumber, and clearing of eight tracts for farming, which border it in its twelve and three-fourths miles of shore line. Did we know that the government surveyors in 1834 had followed the shore faithfully, we could now draw some conclusions of value concerning the rapidity with which this basin is filling. I have good reasons to believe, however, that those surveys can not be depended on for such work. The area, as computed for the lake by the "weighing method" used last year, is 1.41 square miles.

The amount of marsh land about the shore is very much less, comparatively, than that about Turkey Lake. This may be accounted for by the fact that Tippecanoe lies in the middle of a system rather than at the head, as in the case of the former. The low wooded hills come quite close to this lake at almost all points excepting the eastern end on the north and south sides. It is in three basins: James Lake, of about a half square mile area at the east end connected by a channel through swamp to the main lake, which is of about one and one-half square miles in area, and Oswego Lake, below, also connected by a channel, and having an area of about thirty acres. The channels are usually about four feet in depth and are much frequented by minnows and young fish. Here and in the mouths of streams are found the pond-lily plants (*Nymphea*) and spatter-dock (*Naphur*), the root-stalks being in many instances four or five inches in diameter and usually washed bare and shining. They were roasted and used for food by the Indians; remains of pits lined with boulders and used for this purpose are yet found on the south shore near "Indian Furnace Point."

This lake being greater in general depth (the greatest depth found is 121 feet in the main lake) than any of the others, Turkey included, has less of the aquatic vegetation than they. Bullrushes and bladderwort (*Utricularia*) not seeming to thrive in water more than eight or ten feet in depth, and these are usually the advance guards of the vegetable encroachments.

Eagle Lake being second of those under consideration in general depth stands next to Tippecanoe fewest in water plants. As Prof. S. Coulter is investigating the conditions of life there I gladly leave that in his hands.

The measurements of Eagle Lake are as accurate as those of the others, but owing to a flood at the time the work was done much that would be of interest was inaccessible. It will be noticed from the map that the lake consists of a main body of water of almost a square mile in area and a small bay on the west side connected by a shallow channel. The outlet is a small stream from the south end of this bay. Two creeks and several springs on the east shore contribute water to

this lake. The amount of marshy land is small, lying principally at the southeast end near the outlet.

The margin of the lake, according to the government survey (1834), is at some distance from the present shore line, but I am inclined to think that that only marked the edge of marshy ground, since at many points within this line are quite large trees growing. I have not been able to obtain accurate information concerning this matter. The greatest changes made in the form of this lake are by the construction of a race-track by filling in a part of the lake on the east side and excavation of a canal from the northwest part of the bay to a point near the railroad depots. We are indebted to the members of the Winona Summer School for boats for our work and admission to the grounds at the time we were making soundings. The area is .987 square mile.

Webster Lake has been more changed than either of the others by human agencies. It was formerly a group of two or three lakes of about thirty-five feet at their deepest point, lying in the positions indicated by the dotted lines on the accompanying map, surrounded by a marsh of about the extent of the present lake. A dam was constructed for water power for a flouring mill, and this raised the water to seven feet above its former level. In the north part of the lake numerous stumps of various sizes indicate the position of a shore line. "The Backwater" was entirely produced by this dam. The total area at present is 1.057 sq. miles.

This lake presents a greater diversity than either of the others; being shallow, it has great abundance of water plants, the "Backwater" being literally crowded with splatterdock and pond lilies. It has eight wooded islands and shore with variety of meadow, wood, marsh and hill. On the shore also is a variety in vegetation. The edge of the backwater in many places is crowded with cat-tails, while a bog of about five acres in extent at the most northern part of this bay was covered with pitcher plants (*Sarracenia purpurea*), and on a ridge somewhat farther east was found a considerable diversity of fungus growth. The marsh at the northeast part of the main lake was peculiar because of the height of the quaking, grass-grown bog. In two places it was almost twelve feet in height and quite near the lake. Lying behind this was bog lower than that mentioned. I can not account for this formation satisfactorily, unless it is caused by powerful springs of water beneath making deposits there.

An instance where springs have built up bog to a greater height is to be seen at the northeast of "the backwater" on either side of a gravelly ridge, but here the water may follow the ridge out from the higher ground.

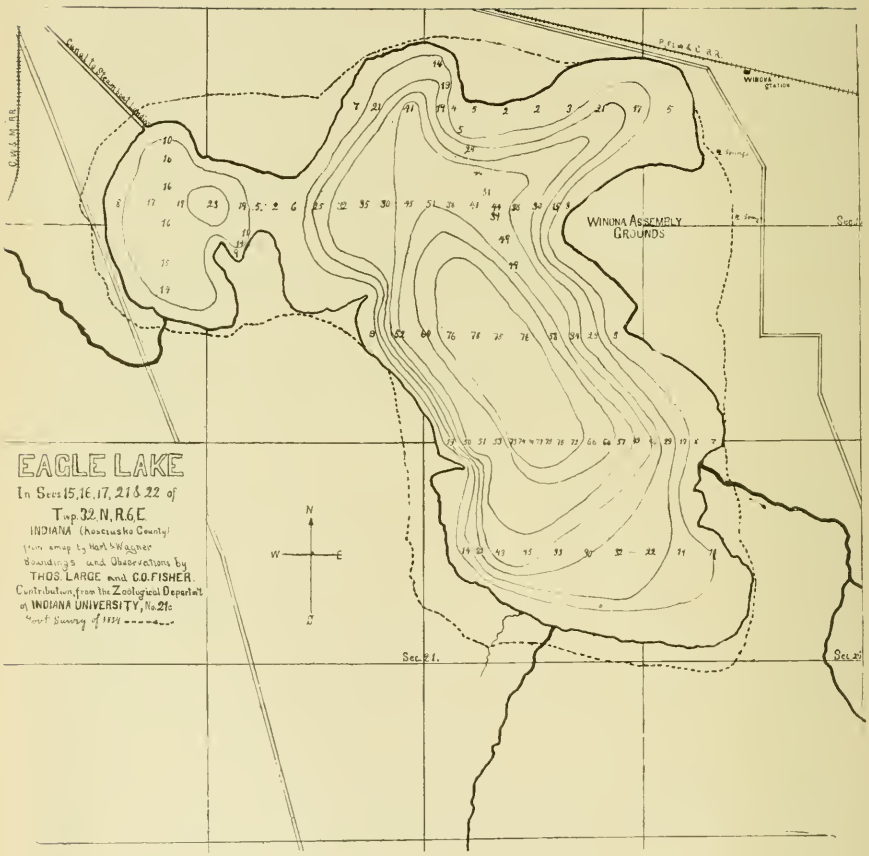
A noticable thing about all of the Tippecanoe lakes in contrast to the Turkey Lake is the amber appearance of the water, given, perhaps, by the bogs from

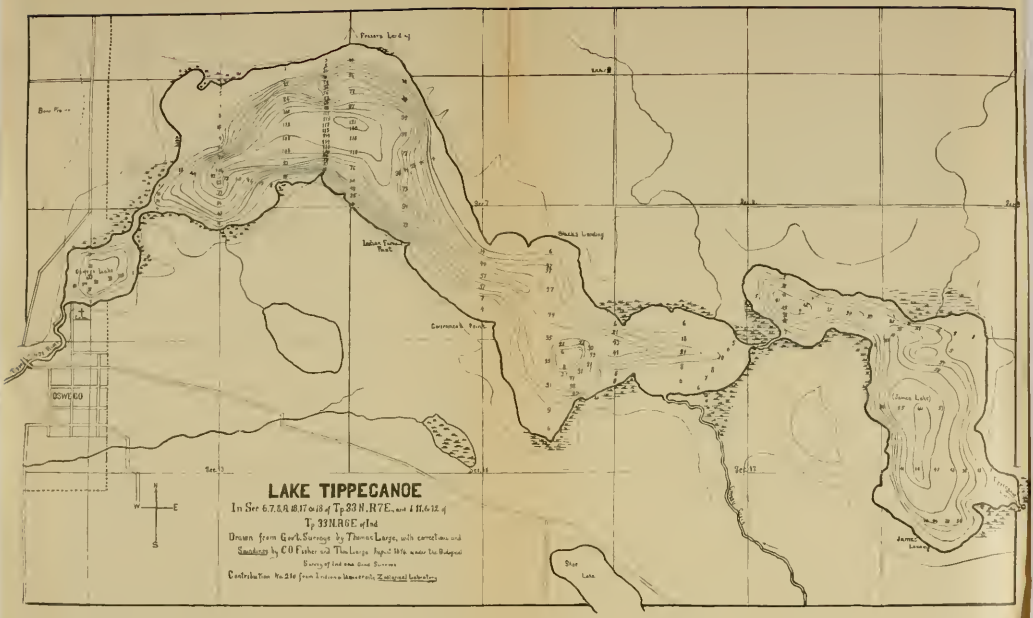
whence it flows. In Turkey Lake the water has a clear, almost greenish appearance. The measurements of inflow and outflow taken will have no value, because of the swollen condition of the streams at the time they were taken.

Cedar Lake (or Clear Lake of the Government Surveys, also "The Lake of the Red Cedars") is a shallow, regular body of water having a more than ordinarily uniform slope of basin, and in no place exceeding twenty feet in depth. About its shores are wooded hills which in almost every part come very near the shore, the south end excepted. Here there is some marshy land. At the north end the hills reach a height of sixty feet. They are a part of the moraine which separates the Mississippi and St. Lawrence valleys. Within a fourth of a mile from the north end of the lake is a narrow ridge 150 feet in length, 30 feet wide and 8 feet high, in appearance very like a railroad embankment, which crosses a narrow hollow and divides the waters which flow into these two systems. To the north of it is a swamp of perhaps fifty acres in extent, extending to the ridge. On the south side a narrow channel twenty feet in width, choked with grasses, etc., but still with stagnant water in it, starts a few feet from it; further down the soil has washed in and closed it, except for a narrow stream. The whole appearance of the ridge is that it is very recent formation, but I am informed it was there when the white men came. The moraine at the north, the appearance of a wide valley to the southward and the shallowness of the lake make the conclusion almost irresistible that this lake basin has been formed by the washing of the water of the melting glacier which has rested on the north of it, as the water found its way to the Kankakee. The present outlet is by a small stream flowing past the town of Lowell to the southeast into the Kankakee.

The ice beaches on this lake are larger than those of any other I have noticed. On the north is a ridge of sand, probably formed in this way, 1,000 feet long, 35 feet wide, and about 7 feet high in the highest part. On the east side are two others, but much less conspicuous. The bottom of the lake is generally sand. Vegetation is less abundant than generally in the shallow lakes in the eastern part of the State. The muskrat is very abundant, building, according to its habit, reed houses in the fall in great numbers at a little distance in the lake. At the northwest side near the end of the great sand ridge was found an Indian mound. This had been opened and a number of skeletons found in it. On top of it grew formerly an oak tree showing almost 200 "growth marks."

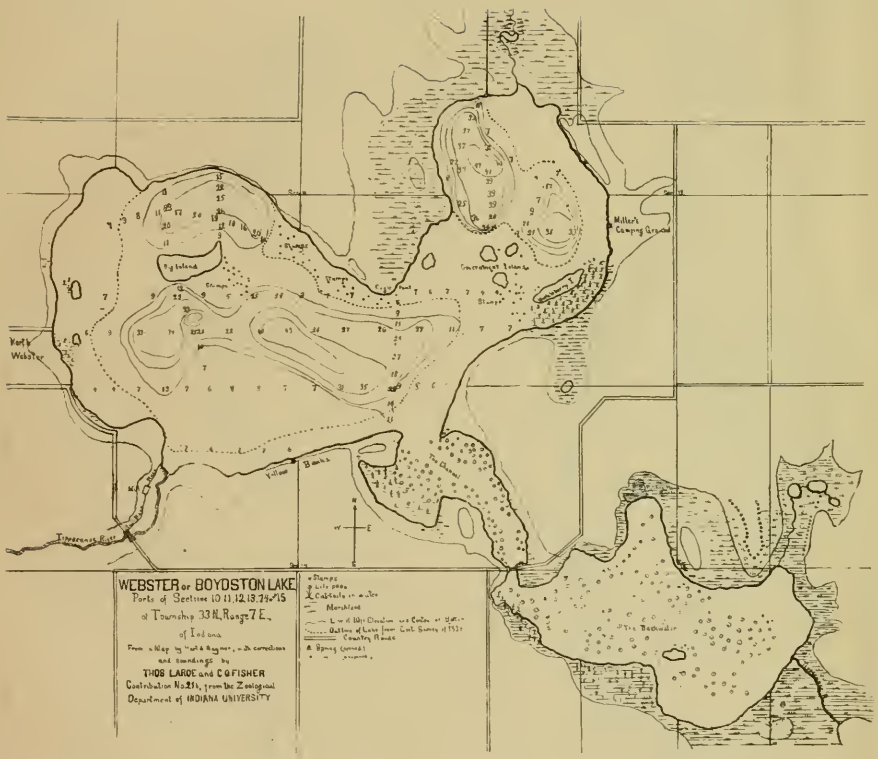
I am under obligations to Rev. Timothy Ball, of Crown Point; Dr. Herbert S. Ball, of Crown Point; Mr. A. D. Fisher, of Indiana University, and the Monon Railroad Company for valuable assistance, information, etc. My report of this lake would be very meager indeed had I not received the assistance from the gentlemen at Crown Point.

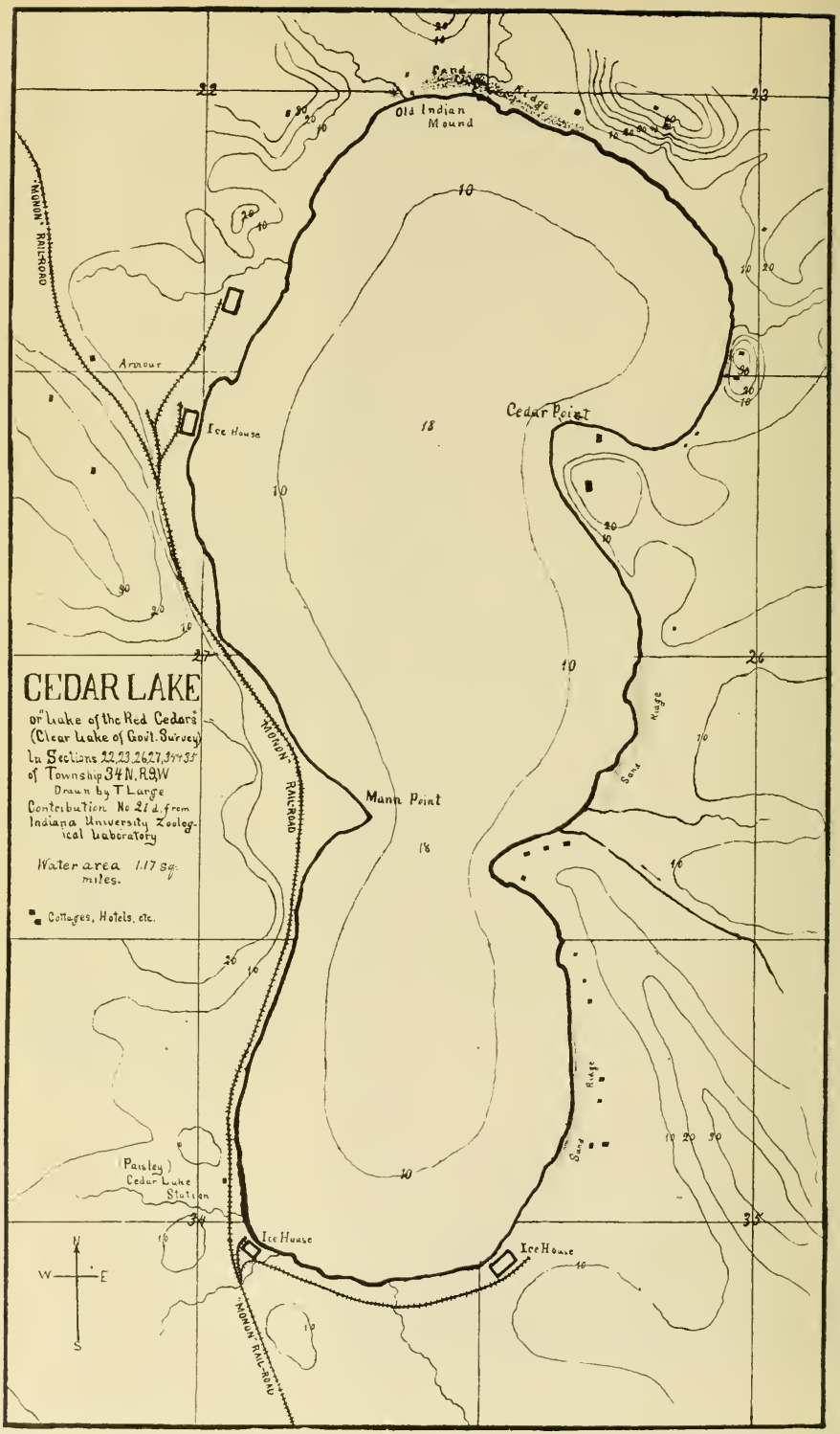

EAGLE LAKE
In Secs 15, 16, 17, 21 & 22 of
Twp. 32 N, R 6 E
INDIANA (Kosciusko County)
from a map by Karl S. Wagner
Soundings and Observations by
THOS. LARGE and C.O. FISHER.
Contribution from the Zoological Dept. of INDIANA UNIVERSITY, No. 21.
Govt Survey of 1834
N
W
E
S
WINONA ASSEMBLY GROUNDS
WINONA STATION
Sec. 21.
Sec. 22



LAKE TIPPECANOE

In Sec 6, 7, 8, 9, 16, 17 & 18 of Tp 33 N., R 7 E., and 1, 11, & 12 of
Tp 33 N. R 6 E. of Ind
Drawn from Gov't. Surveys by Thomas Large, with corrections and
Soundings by C. O. Fisher and Thos Large August 1896 under the Biological
Survey of Ind and [illegible] Surveys
Contribution No. 210 from Indiana University Zoological Laboratory


WEBSTER or BOYDSTON LAKE
Parts of Sections 10,11,12,13,24,25
of Township 33 N. Range 7 E.
of Indiana
THOS LAROE and C G FISHER
Contribution No. 21, from the Zoological
Department of INDIANA UNIVERSITY
Miller's Camping Ground
Fly Island
Yellow Banks
The Bachelor


CEDAR LAKE
or "Lake of the Red Cedars"
(Clear Lake of Geol. Survey)
In Sections 22,23,26,27,34,35
of Township 34 N, R 9 W
Drawn by T Large
Contribution No 21 d from
Indiana University Zoological Laboratory
Water area 1.17 sq. miles.
Cottages, Hotels, etc.
Sand Ridge
Old Indian Mound
"MONON" RAILROAD
Armour
Ice House
Cedar Point
Mann Point
Sand Ridge
(Paisley)
Cedar Lake Station
Ice House
Ice House
22
23
27
26
34
35
N
S
W
E