Lake Maxinkuckee Soundings. By J. T. Scovell.

Lake Maxinkuckee is situated in Marshall County, Indiana. It occupies parts of sections 15, 16, 21, 22, 27, 28 and 34 of township 32, north of range 1, east of the second principal meridian. The lake is a little more than two and a half miles long from north to south, and is a trifle over one and a half miles wide. It has an area of about 1,906 acres. The lake is quite uniform in outline, Long Point, on the west, forming the only acute angle in its gently-curving shore lines. There are three small inlets on the east, and its surplus waters are drained into the Tippecanoe River through a sluggish outlet from the west side of the lake. On the north and east there is considerable boulder clay, but in general the soils and subsoils are sand and gravel. Nearly one-half of the shore line is low, the balance rising abruptly into low hills which in some instances reach an elevation of 50 or 60 feet above the waters of the lake. The low lands along the lake are not extensive; in fact, the drainage area is scarcely larger than the lake itself. The "Inlet," a small stream which enters the southeast angle of the lake, is only about three miles long, and its valley is generally narrow. The little creek that comes in from the northeast drains but a small area. Except along these streams the lake divide is seldom more than a half mile from the lake. While the shores are sometimes low and the water shallow, the bottom along shore is generally hard sand or gravel. The boulder clay, the hills of sand and gravel, the granite boulders and the numerous kettle holes signify that the surface features of the region about Lake Maxinkuckee are due to glacial action. Is the lake a series of great kettle holes or is it part of an old drainage channel? What is the form and substance of its bed? What kinds of vegetation and animal life occur in its waters, and what is its capacity for the support of food and game fishes? A systematic sounding of the lake seemed necessary to an answer of these questions.

In 1896 I drew an outline of the lake from the meander notes of the original survey, on a scale of 8.8 inches per mile or 60 feet to the inch. Early in August, 1897, when I went to the lake to commence sounding, I found Professor C. H. Drybread, with Mr. W. A. Denny and Mr. Delaskie Smith, from the State University, already at work locating lines preliminary to the actual work of making the soundings. They made seventeen lines of soundings across the lake, ten from east to west and

seven from north to south. In general the soundings were along land survey lines 80 rods apart. The distance between soundings along these lines was fifteen oar strokes. In sounding they used a block of iron for a sinker and a fine wire for a line. The wire was wound upon a wheel of known circumference, and measurements were calculated from the number of turns made in winding up the line. While sounding Professor Drybread did the rowing, Mr. Smith made the soundings and Mr. Denny kept the record. Professor Drybread made a sketch map and platted in the work from day to day, making profiles of the lines, which frequently suggested mistakes, so that several lines were worked over a second time. In all, the party made nearly five hundred soundings. The party worked carefully, and the sounding was done as accurately as possible under the circumstances. A study of their work reveals some of the difficulties which hinder accuracy in such lines of work. Knowing the length of the line and the number of stations, it was easy to calculate the average distance between stations. This distance varied on the different lines from 190 feet to 300 feet and Professor Drybread's oar strokes varied from 13 to 20 feet in length. This was doubtless mainly due to rough water and wind, perhaps partly to the length of some of the lines. On the line running north across Long Point the distance between stations on the south was 267 feet where the water was quiet, while north of the point in rough water the average distance was 233 feet. The longest strokes were on the north line of section 34, where the water was quiet and the line short. In rough water it was difficult to hold the boat in position while the sounding was made. If the strokes were uniform for the whole length of the line there would be no difficulty, but the irregularity might reach each extreme of variation along any one of the longer lines, involving variations of at least 50 feet from the average. We found places in Lake Maxinkuckee where a distance of 50 feet meant a difference of 25 or 30 feet in depth. Another source of error was in the difficulty of following the lines. The lines were so long that it was not possible to see the flags or signals, and it is not easy to follow a line closely when rowing by a compass, especially when a stop and start must be made every 250 feet. This method of sounding, of course, does not aim at the accuracy attained by the coast survey, with their refined instruments and methods, but it should be accurate at least within 50 feet in distance. To insure this degree of accuracy the work must be done on quiet water and along short lines, so that the man at the oars

may do uniform work. All the lines in both directions should be well marked with flags and buoys, so that there may be a check on the distance and alignment every 80 rods. Or the alignment might be directed by a man from the shore, who, standing on a little elevation, could guide a boat over a line from one to two miles long. The check in distance at every quarter-mile line would, I think, insure sufficient accuracy. After sketching in the work of Professor Drybread's party I made about 100 five and ten-feet soundings between those made by Professor Drybread, so that the five and ten-feet contour lines were run in from soundings that were only about 40 rods apart.

At first thought one would suppose that 600 soundings would be sufficient to show well the topography of the lake bed. With this data Professors Eigenmann and Drybread attempted to draw contour lines that would represent the lake bed, but they found many questionable points. Almost every one of the quarter-mile areas not sounded furnished doubtful regions. In exploring these doubtful regions I made about 100 deep-water soundings and recorded about 75 shallow-water soundings, made while running out the outlines of sand bars. In work on the sand bars record was made of stakes located, and not of the hundreds of trial soundings necessary to follow the edges of the bars. The question-points for the north half of the lake are nearly all answered. But the record made by the sounding rod or line is not quite satisfactory. I discovered mistakes enough in the work done to make me wonder if there were not mistakes that I did not discover.

During the summer the lake water is more or less turbid with vegetation and animal life, so that even in shoal water one can gain but little information through the sense of sight. In the autumn or early spring the water is clear and the shallow water can be traced easily by the eye. I shall not feel satisfied with the work until I can confirm all shallow-water work by the sense of sight. Nearly 800 soundings have been made and doubtless 200 more will be necessary to give a satisfactory idea of the irregularities of the bed of Lake Maxinkuckee.

The deepest water found was 85 feet, in the northwest quarter of the southwest quarter of section 22, and the water over the west half of the northwest quarter of section 22 is for the most part over 60 feet in depth, and the east half of the southeast quarter of section 21 seems to be covered with water over 60 feet deep, the deep basin of the lake being the west half of the west half of section 22 and the east half of the southeast

quarter of section 21—something over 200 acres. Probably more than one-half the area of the lake is less than 12 feet deep. Much of the bed of the lake is hard sand and gravel, much is fine black mud and some is white mud. The mud is sometimes from four to six feet deep and very thin. Much of the bed is covered with chara, sometimes of stunted growth, but often the growth is luxuriant, stems two and three feet long being common. The bar in the center of the west half of section 22 is covered with from 10 to 12 feet of water and the surface of the bar is covered with a mat of chara from 12 to 18 inches thick, that was so firm as to make the work of sounding difficult. There are several different species of potamageton growing in the lake. They grow in water of different depths, so that my oarsman could tell about the depth from the kind of weed. Large areas are covered with different species of bullrushes; pickerel weed is abundant and so is Vallisneria spiralis and Peltandra undulata. I was able to make a list of 163 plants and trees found in and around the lake.

Photometric Measurements of Different Samples of Oil.

By Charles T. Knipp.

It was a question in my mind for some time whether the difference in the different grades of oil warrants the difference in the price—whether White Seal oil is worth five cents more per gallon than Eosene oil, and if so, what particular quality gives it its value.

The test was a simple one, yet it required care and time in taking the observations to insure accurate results. Five samples of oil were furnished by the local dealers. The oil was taken from large storing tanks and can be considered quite pure. Each sample was tested for its quality and quantity of light, its specific gravity and its "flashing point."

The photometric test was made on a Bunsen photometer bar adjusted to 100 inches between centers. The oil was burned in a student's lamp and balanced against an incandescent lamp burning at 110 volts. The voltage was controlled by a rheostat. A new wick was used for each sample and the lamp was allowed to burn for a few hours before the measurements began. In order to keep the lamp burning at a constant candle power, readings were taken on the bar at intervals of fifteen minutes. The test for each sample extended over from five to seven hours.