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INSTITUTE FOR FISHERIES RESEARCH

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A FISHERIES SURVEY OF BIG STAR LAKE, LAKE COUNTY

by

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Big Star Lake, often referred to as Star Lake, is located in the extreme southwestern part of Lake County (T. 17 N., R. 14 W., S. 23, 24, 25, 26, 27, 34, 35). It is only 8 miles by good gravel road (five air miles) southwest from Baldwin. The lake is situated on a broad sand plain extending between the main Pere Marquette River and the South Branch. Although the lake has no inlets or outlets, it lies within the Pere Marquette drainage area.

The outline contour map used as a basis for the biological studies was prepared by the U. S. Forest Service. The regular inventory* was made by the Institute June 23-26, 1937. Part of the expense and traveling facilities were furnished by the United States Forest Service.

We have no information on the use of Big Star Lake in lumbering operations or other industries. Its location in the center of a large jack pine plane would make its use as a lumbering center very improbable.

In recent years there has been a great deal of cottage and resort development on the lake. This was described by Mr. E. R. Kuhne in a

* The personnel of the Inventory Party was as follows: Horace Telford, leader; Joseph Bailey and L. E. Shettles, assistants.

report of the Forest Service September 12, 1936. He says, "---the actual value of the resort development must run into hundreds of thousands of dollars. There are 133 cottages on the lake besides stores, lodges, dance halls and the like. Some outfits owning a dozen cottages have in addition to the boat for each cottage, 32 boats for rent. There are easily 300 boats on the lake." Although we have no information on the present status of cottage and recreational facilities, it is highly probable that there has been a considerable increase since 1936. There is little doubt but that Big Star Lake has a very high recreational value. It is one of the most important lakes in the Manistee National Forest.

Fishing was reported as very good at the time of the survey. Both large- and smallmouth bass were abundant as well as bluegills and perch.

Big Star Lake is very irregular in shape. The long axis runs approximately in a northeast-southwest direction. One prominent bay or arm of the lake extends northward. There is only one depression which is shallow and regular. This extends into all three arms. It has a maximum depth of between 25 and 30 feet.

According to I. D. Scott in his book "Inland Lakes of Michigan", Big Star Lake is definitely a glacial lake of the "pit type", much altered by subsequent shore adjustment. A quotation regarding this lake follows:

"The nature of the Star Lake depression is very easily recognized for one may almost fall from the edge of a most monotonous sand plain to the lake shore, so sharp are the bluffs which surround the lake. It is clearly a pit but is large and much more irregular than the present crooked outline of the lake. This disparity between the outline of the pit and the lake is due to the adjustments of the shores at a higher level, the greatest changes having been caused by the deposition of bars across the mouths of bays. Such adjustments are best defined on the south side and are well illustrated along the southwest shore where a bar completely closes a narrow lagoon. Similar forms, but not complete at the larger embayments, may be found on the south shore. The source of the material of these bars is the numerous sand cliffs which rise nearly twenty

feet above the lake. Apparently a small amount of recession of the cliffs was sufficient to supply the material inasmuch as the off-shore terrace, although well defined, is narrow, and the strip exposed by the recession of the water has been removed from the foot of the cliffs.

"The north shore consists of broad bays and headlands, and currents have developed along the shores of the bays rather than across the entrances, eventually dissipating in the lake off the ends of the points. Thus the changes in the outline on this shore are less striking than on the south side."

The surrounding country is mostly wooded, being as already described a more or less typical jack pine plain. The soil is largely of sand.

The drainage area of Big Star Lake is small since it has no tributary stream. Its water supply must be largely from very local springs or seeps, and run-off. The water fluctuation is probably not very great, although we have no definite information on this point. Since there are no inlets or outlets, any water fluctuation is the result of evaporation and local precipitation.

Big Star Lake has a surface area of 912 acres and a maximum depth of about 25 feet. The deepest water is found as a narrow strip following the main axis along the center of the north arm. This is the bottom of a three-prong depression or basin which includes the whole lake. Practically the entire lake bottom is inhabited by aquatic plants and may be considered as shoal. Most of the bottom under water less than 5 feet is of sand with scattered patches of gravel. The bottom beyond the 5-foot depth contour is composed principally of pulpy peat over sand. The lake has a shoreline development of 2.12, which means that the shoreline is 2.12 times longer than it would be if the lake were perfectly round and of the same area.

The water in Big Star Lake is colorless and the transparency is about average for southern Michigan lakes. A Secchi disc was visible down to 9 feet at the time of the survey.

The orientation of this lake is favorable to high productivity. The prevailing northwest winds cross the lake almost at right angles to the long axis. As a result the sweep is short and the wave action of inconsequential proportions. The only part of the lake affected by wave action and bottom movement is a narrow band near shore along the shallow sandy beaches. The three long, narrow arms and shallow basin make conditions favorable for extensive and abundant plant beds, and the clear nature of the waters permits aquatic vegetation to inhabit even the deeper water.

Temperature and Chemical Conditions

A limited amount of temperature and chemical information was secured on Big Star Lake during the survey. This was taken during the last of June (6/23/37) and certainly does not represent maximum summer conditions. The temperature at the three stations was almost uniform from top to bottom in the lake. There was only a three-degree variation at any station (70°-73°F.). Even though temperatures were taken at the beginning of summer, it is almost certain that this lake has more or less uniform temperature conditions, i.e., from top to bottom, throughout the year.

Chemical analyses show adequate oxygen (5.3-6.0 p.p.m.) in the deeper water at the three stations where tests were made.

The water in Big Star Lake is moderately soft (58-61 p.p.m. Methyl Orange Alkalinity) and yet strongly alkaline (pH 8.2-8.4).

From these temperature and chemical studies, it is safe to say that Big Star Lake has favorable conditions, with respect to these factors, for warm-water fish. The entire lake is warm during the growing season and oxygen probably remains in sufficient quantities so that fish and other forms of life are not restricted.

Biological Characteristics

Aquatic Vegetation

The variety and abundance of aquatic plants in a lake is one of the best indicators of productivity yet known. From the fisheries point of view, numerous plant beds are essential in harboring food and furnishing cover for fish. As already stated above, Big Star Lake has an abundance of aquatic vegetation dispersed over most of the lake bottom.

Twenty species make up the bulk of these plants. The bulrush and pondweeds were the most abundant. Water milfoil, arrowhead and musk grass were widely distributed and fairly abundant. A summary of the plants collected or reported for Big Star Lake is given in the table below. Some of the identifications were made in the field and may not be correct to the species. The factor of abundance is an approximation arrived at after studying the survey notes and map. This should not be relied on too heavily.

Common name	Scientific name	Abundance
Needle rush	<u>(Eleocharis acicularis)</u>	Common
Spike rush	<u>(Eleocharis calva)</u>	Common
Pipewort	<u>(Eriocaulon septangulare)</u>	Common
Bushy pondweed	<u>(Najas flexilis)</u>	Common
Smartweed	<u>(Polygonum amphibium)</u>	Common
Large-leaf pondweed	<u>(Potamogeton amplifolius)</u>	Abundant
Pondweed	<u>(Potamogeton angustifolius)</u>	Common
Pondweed	<u>(Potamogeton gramineus var. myriophyllus)</u>	Common
Whitestem pondweed	<u>(Potamogeton praelongus)</u>	Abundant
Pondweed	<u>(Potamogeton pusillus)</u>	Common
Flat-stemmed pondweed	<u>(Potamogeton zosteriformis)</u>	Abundant
Arrowhead	<u>(Sagittaria graminea)</u>	Common
Arrowhead	<u>(Sagittaria cuneata)</u>	Common
Bladderwort	<u>(Utricularia cornuta)</u>	Rare
Musk grass	<u>(Nitella)</u> or <u>(Chara)</u>	Common
Bulrush	<u>(Scirpus)</u>	Abundant
Yellow water lily	<u>(Nuphar)</u>	Common
White water lily	<u>(Nymphaea)</u>	Rare
Water milfoil	<u>(Myriophyllum)</u>	Common

Fish Foods

An effort was made to find out the approximate abundance of fish food organisms in Big Star Lake. Obviously no careful study could be made in the short period of two or three days. Plankton (small, free floating, microscopic plants and animals) was present in moderate amounts and was composed mainly of phyto (plant) species. Dragonfly nymphs, burrowing mayflies and midge larvae were numerous on the bottom. Fingernail clams were abundant. There must also have been a great number of snails and aquatic insects on the extensive plant growths, although none were reported. One would certainly expect an abundance of fish food organisms in this lake.

Fish

Seven species of game fish, eight species of forage fish and two species of coarse fish have been either collected or reported from Big Star Lake. The following table gives a list of the species, with an estimation of their abundance at the time of the survey (1937) and the fish plantings made from 1933 to 1940.

Name	Abundance	Stocking (1933-1940)
GAME FISH		
Smallmouth bass	Common	6,760 (3-5 mo.)
Largemouth bass	Common	2,350 (3-12 mo.)
Walleyed pike	...	710,000 (fry)
Yellow perch	Abundant	41,000 (6-8 mo.)
Bluegills	Abundant	68,000 (3-5 mo.) 800 (adults)
Pumpkinseed	Reported	...
Crappie	Reported	...
FORAGE FISH		
Black-nosed shiner	Abundant	...
Mimic shiner	Few	...
Straw-colored shiner	Abundant	...
Blunt-nosed minnow	Common	...
Tadpole cat	Few	...
Mudminnow	Few	...
Menona killifish	Abundant	...
Creek chub	Rare	...
COARSE FISH		
Yellow bullhead	Common	...
Common sucker	Few	...

Growth Rate

Because of the small number of fish taken, growth rate studies had to be confined to one series of perch. This species apparently reaches legal length during its second summer--about the same as the average for this species in Michigan. A summary of the ages and size of perch can be found in the following table.

Name	Age group	No. of individuals	Average total length (inches)	Average weight (ounces)
Yellow perch	II	2	7.6	2.5
	III	3	9.1	4.9
	IV	17	10.1	6.4
	V	8	10.5	7.1
	VI	6	10.8	7.7
Largemouth bass	IV	1	11.4	12.6

Scale examinations from one largemouth bass show this 11.4-inch fish to be in its 5th summer. The average largemouth bass in Michigan reaches legal length in its third summer. One specimen, however, is of little value in determining the growth rate of all the bass in the lake.

Creel Census

Creel census taken by the conservation officers since 1928 show a preponderance of bluegills. This species made up 86 per cent of the total legal fish taken. Perch made up 7.8 per cent, largemouth bass 4.2 per cent and smallmouth bass 1.5 per cent.

The catch per hour was 1.87 fish, or about twice that of the state average for all waters.

A summary of the creel census data is given in the table below.

Year	Number of fishermen	Number taking no fish	Number hours fished	Number legal fish caught	Catch per hour	Catch per fisherman	Number illegal fish caught	Ave. number hours per fisherman per day
1928	...	...	39.00	35	0.89	...	30	...
1929	...	...	8.50	33	3.88	...	7	...
1932	...	...	38.00	96	2.52	...	30	...
1933	2	0	8.00	26	3.25	13.00	18	4.00
1934	43	1	195.00	282	1.44	6.55	98	4.53
1935	141	18	547.00	1,285	2.35	9.11	154	3.88
1936	46	17	115.50	205	1.77	4.46	21	2.51
1937	77	42	119.75	92	0.87	1.19	23	1.56
1938	24	16	38.00	18	0.47	0.75	23	1.58
1939	60	0	141.75	314	2.22	5.23	316	2.36
1940	4	0	20.00	19	0.95	4.75	27	5.00
Total or Average	397	94	1,270.50	2,405	1.87	5.63	747	3.18

Number of Each Species for Each Year

Year	Smallmouth bass	Largemouth bass	Bluegill	Perch	Bullhead	Common sunfish	Calico bass
1928	...	13	...	21	1	...	...
1929	3	4	...	26	...	...	...
1932	2	1	93	...	...	...	...
1933	8	...	18	...	...	...	...
1934	6	11	252	9	4	...	...
1935	11	23	1,214	35	0	2	...
1936	0	9	188	8	0	...	...
1937	6	13	54	19	...	...	...
1938	0	1	16	1	...	...	...
1939	0	20	226	68	...	...	2
1940	0	5	14	...	...	...	...
Total	36	100	2,075	187	5	2	2
Per cent	1.5	4.2	86.0	7.8	0.2	0.08	0.08

Management Suggestions

Big Star Lake is classified at present in the "all other lakes" group and the investigations made on this lake have shown no reason why this classification should be changed.

Creel census reports indicate the suitability of this lake for bluegills, perch, and largemouth and smallmouth bass. Spawning facilities are abundant and without question adequate for all of these species. Natural propagation, barring unusual epidemics or winter kill, is certainly sufficient to stock the lake to its capacity. Stocking of all species should be discontinued.

Cover conditions in Big Star Lake are good. The abundant plant beds and numerous deadheads provide hiding places for most of the fish. No additional shelters seem necessary.

Water levels are determined by the fluctuation in the water table, since the lake has no inlets or outlets. Therefore no regulation is possible or necessary.

On the whole, Big Star Lake seems to be one of the more productive warm water fish lakes in Michigan. While fluctuations in the catch of the different species will occur from year to year, due to the natural cycles of fish populations, there should always be a return to balance between the species present. Bluegills and perch will probably always be the chief components of the catch, but both large- and smallmouth bass will remain in sufficient numbers to make these species important in the catch. A lake of this kind can best be managed by leaving it strictly alone. Plantings of those species already present probably have no effect on the population and the successful introduction of other species

such as walleyed pike would very probably disturb the present balance and spoil the good bluegill and bass fishing which now exists.

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