Original: Fish Division
cc: Mr. Goslin
Mr. Ruhl

INSTITUTE FOR FISHERIES RESEARCH
DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
UNIVERSITY OF MICHIGAN

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December 11, 1939

REPORT NO. 566

A SURVEY OF THE WATERS OWNED BY MR. B. G. GOSLIN

by

James Moffett

This report concerns the water owned by Mr. B. G. Goslin of Battle Creek, Michigan. In accordance with an agreement between Mr. Goslin and the director of the Institute for Fisheries Research, a survey party was detailed to study the waters on Goslin holdings. Members of this party were James W. Moffett, leader, David Anderson and Frederick Locke, biologists and Pat Galvin, assistant. Investigation began September 2 and ended September 6, 1939. The primary purpose of this work was to determine the extent of possible trout water, make an inventory of waters on Mr. Goslin's property and to offer suggestions for improvement and management.

This property is located in the adjoining corners of sections 2, 3, 10, and 11 of Ross Township, Kalamazoo County (T1S, R9W, Sec. 2, 3, 10, 11). Water on this property lies in, or courses through, a swampy peat area which might well have been a lake basin at one time. The main stream flowing into Augusta Creek drains from Hamilton Lake in Sections 1 and 12 of the same township. It is part of the Kalamazoo River drainage. Tributaries to this stream which are wholly or partially on Mr. Goslin's property are two in number. One, entering the stream below the lakes, is quite small (75 gallons per minute) and drains from the north. Its origin is off Goslin's property. The other tributary enters the main stream

just upstream from the lakes and drains from two forks which have been cleaned by Mr. Goslin. At the head of one of these forks a small pond has been dug out of the peat and several small springs developed therein. The pond now contains some brook trout and is intended to be a rearing pond for the creek below. The flow from the combined stream forks is not over 25 gallons per minute. Three lakes are on this property. Two of them are small and such integral parts of the main stream that they are regarded as large pools. The remaining lake, herein referred to as Goslin's Lake, has an area of 5.1 acres. A map, accompanying this report, was made of this lake.

Goslins Lake. This body of water is a remnant of a lake which has been much greater in extent than it is now. An encroaching mat of vegetation surrounds the entire lake and the shore is hardly approachable except on planks or by boat. No definite inlets feed the lake but some unconsolidated seepages reach it under the mat. It is roughly flask-shaped as the accompanying map indicates and has a maximum depth of 12 feet. The entire bottom is composed of fibrous brown peat. No suitable grounds for bottom spawning fish are in the lake. At the shoreline the water is 2 feet deep and probings through the mat at various distances back from the shore show that water goes back under the mat from 50-100 feet. The lake has a broad outlet at the north end which opens into the main stream through one of the small ponds in the stream's course. Water in the lake is a light brown and there is enough organic material in it to obscure a Secchi disc at 4 feet. (This means that the water is quite murky). The lake is not disturbed by high winds and consequently has a temperature gradient from top to bottom. Between 7 and 9 feet this gradient is great enough to be called a thermocline layer (a layer of water in which the temperature drops rapidly, about 1.8° F. per 3 feet of depth). On

September 5, 1939, when the air temperature was 65°F. the water was 70.5°F. at the surface, 70°F. at 6 feet, and 65.5°F. at 10 feet. The reason for the water temperature being higher than the air is that the temperatures were taken after a cold rain which cooled the air faster than the water.

Chemical analyses of the water were made at the same time the temperatures were taken. These analyses show 5.0 parts of dissolved oxygen per million parts of water at the surface, 4.7 parts per million at 6 feet and no oxygen at 10 feet. Decomposition of bottom material had removed all available oxygen at the 10 foot depth. Carbon dioxide was present in a concentration of 4.0 parts per million at the surface and 20 parts per million at 10 feet. The water contained between 198 and 205 parts per million of bicarbonates which means that it was quite hard. The pH was 7.6 at the surface and 7.0 at 10 feet. This pH is a measure of acidity and alkalinity and is graded on a scale of 14 points. Zero, at the bottom of the scale, shows an acid content equivalent to a normal solution of any acid and 14, at the top of the scale, shows a basic content equal to a normal solution of any alkali or base. The point 7.0 on the scale indicates neutrality of a water where neither alkalinity nor acidity is present in overbalanced amounts. A pH of 7.6 means that there is a slight tendency toward alkalinity.

Goslin's Lake is not a good producer of fish food. Quantitative bottom samples taken in two separate areas were very scant. The main organisms living there are Corethra, larvae of a midge (gnat) fly, and Oligochaeta, fresh-water earthworms. The bottom is poor for food production because of its flocculent peaty nature. No sample of plankton was taken because of the murky water. Plants are abundant. The lake is almost full of Ceratophyllum, coon-tail. This plant in itself produces very little food. It acts as a place of attachment for midge larvae,

fresh-water shrimps and caddis fly larvae. At the north end of the lake water lilies are predominant. These plants shade others out by their large floating leaves.

Fish are quite abundant in the lake. Listed as abundant are: bluegills, black crappies and large-mouthed bass; as common are: pumpkinseed sunfish, common shiners and golden shiners, and as rare are: northern pike, common suckers and dogfish. The fish are not heavily parasitized. There is no record of this lake ever having been stocked.

Results of scale studies on 16 bluegills showed what is believed to represent an average growth rate for this species in Goslin's Lake. Fourteen specimens were in their fourth year, having 3 year marks in their scales. One specimen was in its fifth year and another in its eighth. The size range, as based on total length, for the 14 specimens was 5.6-6.8 inches. They had an average length of 6.18 inches, which is just over legal size. The weight range for these fish was 2.05-3.74 ounces with an average weight of 2.86 ounces. Studies on 7 black crappie in their fifth year showed a total length range of 7.28-8.22 inches with an average of 7.01 inches. The weight range for these fish was 3.61-4.65 ounces, averaging 4.05 ounces. The growth of these fish is slightly below what might be considered normal. Two crappies, one 5 and another 7 years old were 7.95 and 7.67 inches long and weighed 4.47 and 3.95 ounces respectively. If these fish can be considered as representing the older age groups, crappies in Goslin's Lake do not grow much after their fourth year of life. Why this should be so cannot be explained. Three large-mouthed bass were taken. One was over 2 years and the rest were over 3 years of age. The 2 year old bass was 9.41 inches long and weighed 6.7 ounces. Those fish of the 3-year class were 8.34 and 10.55 inches long and 4.35 and 8.91 ounces in weight, respectively. This information, if it can be considered sufficient, shows that large-mouthed bass grow well in this lake.

The possibility of making this lake into a trout lake is very remote. All conditions listed above are adverse to trout in some way. Foremost among these conditions is the water temperature. Trout cannot tolerate temperatures above 80°F. and do not do well where they exceed 70°F. Although the temperatures recorded are below this maximum, all indications that the water warms up to a point beyond the limit are present. Even though the water temperature remained below 80°F., the amount of oxygen in the water is not sufficient for trout demands when temperatures reach or even approach this figure. The presence of relatively large amounts of carbon dioxide and the lack of sufficient oxygen in the deeper waters would prevent migration into them to escape high surface temperatures. Competition with fish already in the lake would be too great for trout. Trout, especially small ones, might be utilized as food by certain other species of fish in the lake.

It is suggested that this lake be used as a bass and bluegill lake as it now stands. Should it be desired to remove some of the peat in the bottom to deepen and clean it, there are outfits called ooze suckers or pumps which could be brought in to do the job. This might be prohibitive because of cost. There will be a comprehensive survey of plant control methods appearing in a future issue of "Michigan Conservation," a State Conservation Department magazine, and the suggestions therein contained can be followed should it be wished to control or remove plant growths from the lake. There is no reason to improve conditions for bottom spawners in this lake. A slight increase in spawning might overpopulate the lake and result in a reduction of growth-rate due to greater competition between the individuals of an increased population for the none too plentiful food supply now in the lake. The end result would be a stunted population of fish, few if any of which would ever reach legal size. Fish can move out of the lake and find suitable nesting areas in the adjoining stream.

The main stream meanders from east to west for about one mile on Goslin's property. As previously stated, this stream drains Hamilton Lake and empties into Augusta Creek. Its course lies in a boggy basin and peaty banks limit it. Most of the immediate banks are a jungle of tamarack, alder and sedge. The stream is difficult to traverse in its upper reaches except by boat. Below Goslin's Lake, the stream runs through an open flat which, although still boggy, is not shaded except by banks and tall grass. Toward the western limit of Goslin's property gravel is in the stream bottom but it is covered by a layer of muck in most places. About 200 yards eastward from the road which crosses this stream at the west limit of the property, a rock dam about 1.5 feet high has been constructed to create a pond alongside a shelter house built by Goslin. This dam is passable for fish. Farther upstream from this point, two open V-type deflectors have been built in an effort to narrow the stream and speed up the current. Despite these attempts, the stream still runs very slowly, about 0.33 foot per second. The gradient or fall is not great enough to make improvement devices work whose functions are dependent upon current. The stream averages 14-16 feet in width and 1.1 to 1.5 feet deep. At the time of the survey, this stream was flowing about 7.0 cubic feet of water per second. Reports by the caretaker and observations on the stream banks show that a 1-foot seasonal fluctuation is usual. The water is slightly brown, somewhat cloudy and appears to be laden with suspended organic matter. Temperature recordings showed, in one place, 75°F. at an air temperature of 78°F. and in another, 70°F. at an air temperature of 65°F. The latter reading was taken following a cold rain. On August 1, 1939 the creek had a temperature of 79°F. at an air temperature of 86°F. At the east boundary line of Goslin's property the creek water

temperature was 73°F. at an air temperature of 85°F. A spring tributary near this boundary had a temperature of 58°F. at the same time.

Chemical analyses of the water at two stations gave the following results: Oxygen, 4.4 and 6.6 parts per million; carbon dioxide, 9.0 and 8.0 parts per million; bicarbonates, 184 and 202 parts per million, and a pH reading of 7.2.

This stream contains great beds of aquatic vegetation--coon-tail, pond weed, water lilies, smartweed and duck weed. In areas near and above the lake, the stream is literally choked with plants. Large amounts of this vegetation have been removed by Mr. Goslin to allow boats to pass up and down. The two small lakes included in this discussion are entirely covered over by vegetation and a boat lane has to be cleared through them periodically. These plants produce large quantities of fish food by acting as a source of food directly or as a place of attachment for the organisms. The stream bottom is highly productive wherever it is hard enough to remain stationary. In a 1/2 square foot sample there were 224 organisms. Predominant in the bottom sample were fresh-water shrimps (scuds), midges, mayflies, snails, dragon fly nymphs, caddisfly larvae and finger-nail clams. The combined volume of this sample was 1.5 cubic centimeters, which is considered very good. Seining in the stream at two points netted pumpkinseed sunfish, large-mouthed bass, bluegills and common suckers. One striking thing in this population is the lack of forage fish--small minnows which usually inhabit creeks of this type. Several schools of these minnows were noted downstream from the small dam and it is wondered whether the dam acts as a barrier to their migration. However, they normally would have been above the dam before it was constructed.

Efficient management plans for this stream are difficult to formulate from the rather meager data of one inventory. It is suggested that the stream be shaded in spaces now open by planting willows or alders on the bank. Such shading will reduce plant growths and have a tendency to cool the water. Improvement structures are not advised because of the slight gradient which doesn't generate enough current to cause the beneficial washing or digging desired. The suitability of this stream for trout is very dubious. Water temperatures are too high and it is doubtful whether anything within reason could be used to lower them sufficiently to be on the safe side. At the higher temperatures habitable by trout, water must contain large amounts of oxygen which it doesn't in this stream. Fish are cold-blooded animals and their temperature is regulated by the conditions surrounding them. As their body temperature is raised by an increase in water temperature their life processes are speeded up in proportion. This increased rate of living demands more oxygen and more food the higher it goes. If one or the other is absent, the fish must die. Conversely, the demands of fish for food and oxygen decrease and the fish practically hibernate, becoming docile and almost dormant. Bass, bluegill, sunfish and minnow spawning might be increased in the stream by additions of gravel to the stream bed or removal of muck to expose the gravelly stretches in the west end of the stream.

Tributaries to the main stream are small and in the case of two of them have been artificially enlarged and cleaned. As stated in the introductory description, one stream (tributary 1) arises off Goslin's property. This water is suited to trout culture. Any dam constructed in its course would have to be passable for fish. The other tributary (tributary 2) can be handled as the owner sees fit because it originates on his property. Tributary 1 was not worked except for taking temperatures

(62°F. at 70°F. air temperature). A few trout could be kept in it, but ponding would be necessary to hold them successfully. Construction of such a pond would have to consider free migration of fish up and down stream.

Tributary 2, composed of two branches, locally referred to as "bubbling brook" for the west branch and "orchid brook" for the east branch, is suited for trout. Brook trout are now in this stream but they are young and have not yet become fully established. The size of this stream (about 0.1 mile long, 1-2 feet wide and 2-6 inches deep) limits the number of fish which could be placed in it. Most other factors are satisfactory. The water temperature was 56°F. at an air temperature of 70°F. There were 6.7 parts per million of dissolved oxygen, which is adequate at that water temperature. Carbon dioxide, which is a suffocating gas at high concentrations, was present at a concentration of 4.0 parts per million. This much is not detrimental. The pH was 7.4, indicating that the water was slightly alkaline. Bicarbonate content was 249 parts per million, which makes the water rather hard but is not adverse to good food and fish production. Bottom conditions are poor. Peaty surroundings make the natural presence of any other bottom material almost impossible and peat doesn't offer a very good substratum for production of certain foods because of its flocculent nature. When the streams are enlarged to the desirable size, it might be advantageous to add gravel to the bottom. Shade and cover are satisfactory, but some cress beds might be introduced to afford additional cover. Potential fish food was plentiful at the time of the survey. Predominant were fresh-water shrimps, aquatic earthworms, dragon fly nymphs and finger-nail clams. All of these organisms, except the earthworms, are able to crawl or clamber over the bottom surface and do not require a firm substratum. In 1/4 square foot of bottom, 0.5 cubic

centimeter (0.03 cu. inch) of food was found. This is well above average when compared with other trout streams. The only fish found there were brook trout which had been planted by Mr. Goslin.

Maintenance of trout on the property of Mr. Goslin can be accomplished by pond culture. At present, one small pond has been developed at the head of the west branch of tributary two. It is about 10 x 30 feet and is fed by small springs developed at the time the pond was dug. The pond lies in a peat mat and is difficult to enlarge because of the flocculent nature of the peat which runs out from under the mat almost as fast as it is removed. As a result, the pond is not deep enough to be efficient as a rearing pond, except for small fish. It is suggested that a series of ponds be constructed at the base of the hill just north of this present pond. The ponds could be arranged in a terrace down the face of this hill, or one large pond could be built right next to the hill. Water for these ponds would have to be developed by wells or pumped from the springs now running. Nothing can be stated concerning the location or depth of wells needed to bring in a sufficient water supply. Conversation with geologists at the University of Michigan gave no specific information except the recommendation that Mr. Goslin speak with local well drillers who would be able to give some idea as to the location of underground water in the region. Should it prove feasible to develop wells on this property, construction of ponds near the shelter house where they could be taken care of easier might be the better suggestion. Since the slope of the gravel rise, on which the shelter house is located, is gradual and toward the river, ponds built one above the other could be supplied with water from one source. These ponds could be shaded by planting willows and shrubbery on their banks. The addition of this vegetation could be done so as to beautify the grounds at the same time.

The rearing of trout in this manner would necessitate feeding a certain amount of artificial food to supplement the natural food produced in the ponds. The amount of feeding necessary would depend on the number of fish kept and their concentration in the ponds. Should this method of culture be adopted, it might be better to raise rainbow or brown trout rather than brook.

INSTITUTE FOR FISHERIES RESEARCH

December 12, 1939

STATEMENT OF ACCOUNT

Due the Michigan State Conservation Department for services rendered in study of waters owned or controlled by Mr. B. G. Goslin.

Salaries:

6 man days at $5.00 per day	$30.00
6 man days at $4.33 per day	25.98
3 man days at $2.66 per day	7.98
	$63.96

Transportation:

186 miles at 5¢ per mile	9.30
Drafting and blueprinting of map	3.50
Total cost of survey	$76.76

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