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FISHERIES SURVEYS OF TIE, TEMPLE, MAN AND McCOMB LAKES, ALGER COUNTY

by

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Introduction

This group of lakes in Alger County is within the boundaries of the Hiawatha National Forest. All are in T. 44 N., R. 19 W. Tie and Man lakes, owned by Mr. Burt K. Chaffee, are located in Section 23. McComb Lake is in Sections 23, 26 and 27; Temple in Sections 14 and 23. None of the lakes has inlet or outlet. A ditch constructed by Mr. Chaffee connects Tie and Temple lakes during high water.

Marginal surveys and soundings were made by the U. S. Forest Service. The Institute has used these base maps for recording bottom type, weed beds, etc. on its maps of the lakes.

The survey was requested by Mr. Chaffee, who paid $100 to the Conservation Department for the cost of the investigation of Tie and Man lakes and who supplied board and living accommodations for the survey crew* during the work on all four lakes. Boats and some assistance from his caretaker were also provided.

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* The survey party consisted of Hugo Kilpela, leader, and David Anderson, Fred Locke and Pat Galvin, assistants.

The investigation was carried on from July 27 to August 6, 1939. This period of the summer is exceptionally favorable for a fisheries survey since if any oxygen depletion exists at any depth it will be readily apparent. Also, aquatic plants are generally at their peak of development and can be readily observed and identified.

The country surrounding the lakes is rolling with frequent hills and depressions. The soil is dominantly sand and originally supported fair stands of white and Norway pine. Fires followed lumbering, robbing the soil of most of its rather scant organic content. During the past fifteen years fire has been controlled and second growth, dominantly aspen, has come in. No industries, except minor lumbering operations are found in the region. The soil is so poor that agriculture has not been attempted. No settlements exist except the decadent remains of lumbering towns. Probably the only future for use of the land in this light soil region lies in recreation and much of the country appears submarginal even for this type of utilization.

Since there are no connections with any river system, it is possible some or all of the lakes were originally barren of fish life. Evidence for this may be found in the list of fish collected (Table 2), which shows a very limited number of species for any lake. McComb and Tie (the most accessible lakes) were found to have the greatest variety, but all of these could have been introduced by plantings or, in the case of coarse and forage fish, by escape of bait.

It is our opinion that the quality of the fishing in these lakes has been much over-rated and over-advertised by Mr. Chaffee. The following is quoted from his 1938 folder advertising Chaffee's Cabins:

> "For years we have stocked its four lakes regularly, and today we honestly believe that it offers the best fishing in the Northern Peninsula. Small mouth bass that run six pounds, perch by the dozen from eight to twelve inches, bluegills that tip the scales at better than a pound are waiting to test your skill and cunning."

Mr. Burt K. Chaffee of Munising operates a resort consisting of ten cabins, a lodge and a boat livery located on the ridge separating Tie and McComb lakes. He owns the land which surrounds Tie and Man lakes and restricts fishing on these lakes to his guests. Temple and McComb are open to public fishing. We understand that at least part of the frontage on these lakes is owned by the federal government. Considering that there are many lakes in this region to which the public has access (including two of this group being discussed) and since neither Tie nor Man lakes offers exceptional fishing, there does not appear to be any immediate desirability of obtaining frontage on Tie or Man lakes if it were made available for purchase by the state.

Physical character of the lakes

All four lakes appear to be of the glacial "pit" type, having steeply sloping shores and lacking stream connections. According to Scott,* this type of lake was caused by a chunk or portion of a glacier which became buried by debris. When the ice melted, a depression resulted which, if below the ground water level, became a lake. The rather uniform depth and shape of the lake basins give further proof of the method of origin. Such lakes generally have very limited drainage basins, as in the case of the lakes under discussion, limited to a few acres of steeply sloping shore. As a result, very little organic and mineral material is brought into the lakes including that contributed by wind and by bank erosion. This has a marked effect upon the chemistry and biology of the lakes, as will be discussed later.

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* Scott, I. D. Inland Lakes of Michigan.

Since the lakes have neither inlets nor outlets, the water levels are relatively constant, varying from a few inches to a foot or so as the ground water level raises or lowers. A short ditch constructed by Mr. Chaffee connecting Tie and Temple lakes permits some fish movement during period of higher water levels.

Table 1 lists certain physical and chemical characteristics of the lakes which will be discussed in this section. As will be noted, the lakes are very similar in many respects. They are of moderate size (from 16 to 59 acres) and depth (maximum depth from 20 to 40 feet) with rather regular shore lines, narrow shoals, and with a bottom of sand or fibrous peat on the shoals and pulpy peat in deep water. The water is light brown or colorless and has relatively little suspended matter in it, since the Secchi disc (a white enamelled plate 6" in diameter) can be seen at ten feet or more except in McComb Lake, where it was not visible at more than five feet. The relative clarity of the water is an important factor in fish production since the distance to which light can penetrate determines the zone of plant activity providing other conditions are favorable. Turbid water carrying a heavy load of silt, etc. or deeply stained bog water can support little plant or animal life. On the other hand, extremely clear water is also unproductive because it lacks mineral and (or) organic foods of plants.

The amount of shoal (shallow water capable of supporting rooted plants--in these lakes water ten feet or less in depth) is very limited. Since the major fish food supply develops in weed beds on shoals, fish productivity depends largely on this factor. Of equal importance, however, is the type of bottom found on the shoals. Shifting sand or deep, soft peat can support few plants or fish food organisms at any depth. Since much or all of the shoal water in these lakes is either sand or peat,

productivity in this zone is low. The amount and direction of wind, while very important on large lakes, is not so significant on the lakes here referred to. Being small and lying in depressions in the plain, the waters are little affected by even the strongest winds. If shallow and exposed to wind action, the inland lakes of Michigan are generally of about the same temperature from top to bottom during the period of open water. Heavy winds mix the water at all depths. The deeper or sheltered shallow lakes, like those being discussed, become stratified during the summer months. A stratum of water in which the temperature drops rapidly (called the thermocline) had developed in the Chaffee lakes at the depths shown in the table. The water above the thermocline (called the epilimnion) varies in depth from 9 to 12 feet in these lakes. This zone is constantly being mixed by the winds. Below the thermocline is the bottom layer or hypolimnion, in which the water is generally cold and if it is of sufficient extent and contains enough oxygen, the hypolimnion will support trout and other cold water fishes. Wind never affects this lower stratum during the summer months. Except for its part in making possible the production of cold water fishes, the presence of a thermocline may be considered a liability. If the oxygen becomes depleted below this zone, as in Chaffee's lakes, fish cannot live in the deeper water in summer and the fish food production is also limited. For example, in Man Lake all of the deep water area included within the 20' contour line (roughly 50 per cent of the lake) is deficient in oxygen. Fish may range the upper layer of water in this lake, but the lower layer is uninhabitable as long as it remains stagnant.

Although water temperatures in the surface layer are lower than found in the better southern lakes at this time of year, they are tolerable by warm water species. Only Man Lake has an extensive area of deep, cold water which would be suitable for trout, but unfortunately oxygen is not

present in sufficient amounts at these depths.

Free carbon dioxide, a product of decomposition and respiration is present in limited quantities in the upper waters of all but McComb Lake and in fairly large amounts in the deeper waters of the entire group. However, the amounts present are normal and probably beneficial rather than otherwise since aquatic plants need carbon dioxide in photosynthetic processes.

The water in Temple and Man lakes is exceptionally soft--in fact, contains the lowest methyl orange alkalinity found so far in our survey of Michigan lakes. Tie and McComb lakes are also deficient in dissolved salts and would be classed as soft-water lakes. Limited drainage areas low in lime and other minerals are presumably responsible. The low alkalinity is also reflected in the pH (a measure of the intensity of acidity or alkalinity) which is neutral or acid. The significance of these readings for the Chaffee lakes is found in studies of fish food supplies which have shown alkaline waters with a moderately high solution content to be the most productive. It has long been known that a soil deficient in organic and mineral matter yields poor crops to the farmer. It is therefore not surprising that waters deficient in basic fertility should produce poor fish crops since fish are directly or indirectly dependent upon plant life grown in the water.

Biological characteristics of the lakes

Aquatic plants

As indicated above, plant and animal abundance in water is governed by the physical and chemical conditions present.

Aquatic plants are highly important in the economy of a lake since they furnish food (directly or indirectly), shelter and spawning places for many important fishes. Plant abundance is generally associated

with high fish productivity; plant scarcity with low fish productivity. As previously discussed, unsuitable and limited shoal bottom and low solution content prevent rich growths of aquatic plants. In all of the lakes plants are restricted to the narrow margin of shoal water generally in scattered patches which afford little shelter for fish and which are not dense enough to harbor much food. In Tie Lake the following plants were found: white water lily, yellow water lily, smartweed, bur-reed, bulrush, and pondweed. Temple Lake contained only yellow water lily and a few stocks of wild rice, introduced by Mr. Chaffee. In Man Lake only a few, scattered plants of yellow water lily and bur-reed were seen along the very narrow shoal. McComb Lake contained the most plants of the group, chiefly white and yellow water lilies and watershield with some bur-reed and pondweeds. However, even in this lake vegetation would not be considered plentiful. As indicated later under recommendations for improvement, planting aquatics at present is not the answer. Chemical and physical conditions must be made more suitable first in order for the vegetation to survive.

Fish foods — Fish foods may be considered as belonging to three general types: plankton (free-floating or free swimming plants and animals, e.g. water fleas), bottom foods (living in top few inches of soil or on aquatic plants, as crayfish and snails), and forage fish, such as the various minnows or young of game fish.

Plankton varies greatly in kind and quantity from week to week and even from day to day, so that samples taken during a survey such as this do not mean very much. Vertical and horizontal hauls with the fine (No. 20) silk net showed a relative scarcity of both plant and animal plankton in all the lakes. Temple and McComb yielded the richest samples, from 12 to 16.7 cc. per cubic meter and from 8 to 12 cc. per cubic meter respectively.

Bottom fauna, almost entirely midge larvae, was found to be likewise very scarce, and since this type of food is more constant throughout the season, samples taken by the survey probably reflect a real scarcity of fish food in the Chaffee lakes. The volume in cc. per square foot of bottom sampled averaged as follows: Tie - 0.2; Temple - 0.13; Man - 0.2, and McComb - 0.1. We believe this scarcity is due to a paucity of basic salts and organic matter and that improvement in food supply depends upon addition of these substances to the lakes.

Fish present

Game Species. Table 2 shows the species of fish taken in the lakes by the survey party or reported as caught by anglers.

Large-mouthed bass and bluegills are common to all four lakes and are the only fish found in Man Lake. Evidently stocking small-mouthed bass and walleyes in McComb Lake has not resulted in establishing these species, and since the lake is small and already contains northern pike, large-mouthed bass and perch, it is probably well these attempts were failures, as there is a danger of overbalancing a lake when too many fish-eating species are present. Considering the size and limited food supply of all the lakes, the number of species now present is adequate.

Spawning grounds for all game species present appear to be quite satisfactory with the possible exception of the northern pike in McComb Lake. However, in this lake the marshy bay at the southwest end probably is adequate for the limited pike population which this lake can support. Many young of the year of all important game fish were taken by seining wherever the nature of the bottom permitted this activity. This supports the contention that spawning facilities seem to be adequate to maintain as large a population as the lakes can supply with food and shelter.

As indicated previously, this group of lakes is decidedly deficient in both food and shelter for fish and production will therefore remain

limited in spite of any stocking which may be done until these deficiencies are corrected.

Scale samples were secured for growth studies and the mounts have been examined in the scale reading machine at the laboratory. The results are given in Table 4. It will be noted that growth is best in the richest of the four lakes, that is in McComb. Growth of perch, bass and pike (at least during the first two years for this species) is probably at least average for this part of the state. In Tie Lake both perch and rock bass are undoubtedly stunted. Samples from other species were not adequate. Scale readings indicate that perch grow slowly in Temple Lake and that bass and especially bluegills do not make satisfactory growth in Man Lake.

Forage fish and coarse fish. Blunt-nosed minnows (considered an excellent forage minnow for perch and bass) were found to be present in both Tie and McComb Lake. A few horned dace taken in McComb Lake must have been released as bait, since this is a stream-spawning species. The Johnny darter is a small perch-like fish which rarely exceeds three inches in length and is usually unimportant as food for game fish because of its bottom dwelling habit. Common suckers were found in all but Man Lake, but did not appear to be exceptionally numerous. The young of this so-called "coarse fish" are probably taken as food by bass, perch and pike.

Management suggestions

Designation All four lakes are in the "all other lakes" class, that is, are open to fishing on June 25 and are closed on April 1. Since it is considered desirable to protect and encourage bass and bluegills, no change in the designation is suggested.

Stocking — No further stocking is recommended for the Chaffee lakes, as it is believed they already contain a sufficient variety and number of game fish considering their size and limited food and shelter. Since spawning facilities are adequate, many more young fish are now produced than the lakes can support. Planting more would be wasteful or might aggravate dwarfing.

Predator control — No control of predators is recommended, as investigations have shown that fish-eating animals are rarely important in limiting fish production in natural lakes and may actually be an aid in maintaining a balanced population.

Parasites — Due to unsuitable conditions for intermediate hosts (snails and fish-eating birds), the fish in these lakes are almost completely free of both internal and external parasites. Some Neascus (black spots) and Clinostomum (yellow grubs) were found in the perch from Tie Lake.

Shelter — As previously stated, weed beds are virtually lacking in all but McComb Lake. Weeds may be expected to increase somewhat with proper fertilization, but the beds will always be limited by the unsuitable bottom found on most of the limited shoal. No further introductions of aquatic plants are recommended. Aquatic plants are distributed by ducks and other water birds and are generally found in maximum abundance in all natural waters. Since their numbers are limited by the environmental conditions as previously discussed, no increase will result from any plantings until the environment is improved. As all four lakes already contain sparse growths of desirable plants, if the addition of brush shelters and fertilizers improve conditions for plants, the vegetation present will increase of itself.

Installation of brush shelters over barren areas in water from 6 to 10 feet in depth is recommended for all four lakes. Any of the types shown in Institute for Fisheries Research Bulletin No. 2 should be suitable. These shelters will augment the deadheads and submerged trees and the limited weed beds. They may help in the spread of aquatic plant beds especially if the "hollow square" type is used.

Regulation of water level

Since no inlets or outlets are present, regulation is impossible. It is questionable whether the ditch connecting Tie and Temple lakes serves any useful purpose so far as fish production is concerned; in fact may be endangering the fishing in Temple Lake, as has been suggested by Mr. Kilpela. Since rock bass in Tie Lake are stunted, the ditch should be filled in immediately to prevent them from reaching Temple Lake--if it is not already too late.

Spawning facilities

These are considered satisfactory in all lakes unless further attempts are made to establish small-mouthed bass in McComb Lake. The lack of gravel may have been responsible for the apparent failure of earlier plantings. Bulletin No. 2 gives directions for installing gravel spawning beds for small-mouthed bass.

Fertilization

The scarcity of lime and the evident lack of organic material especially in Temple and Man lakes suggest that marked improvement in fish production might be expected following the addition of crushed limestone and soybean meal. This should be especially true since the lakes are landlocked and any fertilizer added should remain until used up. The following program is suggested starting with this year (1940) and continuing for a three-year period, after which, upon request by the interested parties to the Institute, a check-up will be made gratis to determine whether further fertilization is needed:

Tie Lake	-	4,500 lbs. soybean meal
Temple Lake	-	1,400 lbs. crushed limestone (from size of pea to powder)
		1,200 lbs. soybean meal
Man Lake	-	1,800 lbs. crushed limestone
		1,600 lbs. soybean meal
McComb Lake	-	4,600 lbs. soybean meal

The above figures--rounded off to the nearest hundred weight--were determined from data secured by Dr. Juday in his lake fertilizing experiments in Wisconsin and described in the article entitled "Effect of fertilizers on plankton production and on fish growth in a Wisconsin lake" by C. Juday and C. L. Schloemer, University of Wisconsin, and Clarence Livingston, Works Progress Administration. This article was published in the Progressive Fish Culturist for Aug.-Sept., 1938, pp. 24-27.

The fertilizers should be distributed in shallow water near shore where the depth is about two feet following the Wisconsin method. Fertilizers can be applied at any time during the season, but we consider early spring to be most desirable, as they will be available for plankton, plants and other life from the start of the season.

The cost of crushed limestone is quoted as $2.50 per ton delivered near Ann Arbor, but would doubtless be somewhat higher delivered to the lakes in question. No price could be secured on soybean meal, but Dr. Juday informed us that the cost to them was about .01 per pound. Based on these figures, the total annual cost of fertilizer for the lakes would be $123.00 or approximately $.80 per acre.

If this program is regarded by Mr. Chaffee as too expensive, McComb Lake could be left unfertilized as this lake is the richest of the group and does not need treatment as badly as the others. Since McComb and Temple lakes are open to public fishing, it might be possible for the

U. S. Forest Service and the Conservation Department to share in the cost of fertilizing these lakes.

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TABLE 1

Some Physical and Chemical Characteristics of the Lakes

	Tie	Temple	Man	McComb
Area (acres)	58.2	16	20.6	59
Shore development	1.55	1.13	1.2	1.59
Max. depth (feet)	25	20	40	20
Approx. % shoal	5-8	4	5	10
Bottom type				
Shoal	Sand	Fibr. peat, sand	Sand, fibr. peat	Sand, fibr. peat
Deep	Sand to pulpy peat	Pulpy peat	Pulpy peat	Pulpy peat
Inlets and outlets	None*	None*	None	None
Water color	Light brown	Colorless	Light brown	Light brown
Secchi disc (ft.)	10	13	10.5	5
Thermocline** (depth range)	12-20 ft.	12-15 ft.	9-24 ft.	9-12 ft.
Date	7/28/39	7/31/39	7/31/39	7/27/39
Time	3:30 p.m.	10:00 a.m.	2:00 p.m.	7:30 a.m.
Air Temp. °F.	80	82	81.5	81
Sample analysis				

Depth	Tie			Temple			Man				McComb		
	Surf.	15'	20'	Surf.	9'	18'	Surf.	15'	24'	40'	Surf.	12'	18'
Temp. °F.	75.5	72.1	64.0	75	73.9	66.4	77	56.1	45	43.9	78	69.8	63
Dissolved oxygen	7.5	7.4	3.1	7.4	7.2	7.1	6.9	1.9	0.0	0.0	8.5	7.1	1.6
Carbon dioxide	1.0	...	10	1.0	2.0	2.0	1.0	11.0	...	14.0	0.0	0.0	7.0
ph.th. alk.	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	3.0	4.0	0.0
M.O. alk.	30	...	22	5.0	4.0	4.0	5.0	11.0	...	6.0	21.0	20.0	22.0
pH	6.8	...	6.8	6.4	6.8	6.3	6.4	5.4	...	5.4	6.8	6.6	6.4

* Connected by ditch during high water levels.

** Thermocline defined as drop of 1° C. in 1 m. = drop of 1.8°F. in 3.09 feet.

TABLE 2

Species of Fish Collected or Reliably Reported to be Present in Tie, Temple, Man and McComb Lakes, Alger County

	Tie	Temple	Man	McComb
Game Fish				
Largemouth bass	*	(Reported)	*	*
Northern pike				*
Pumpkinseed sunfish	*			
Bluegill	*	(Reported)	*	(Reported caught by anglers)
Rock bass	*			
Yellow perch	*	*		*
Coarse and Forage Fish				
Common sucker	*	*		*
Bluntnosed minnow	*			*
Horned dace				*
Johnny darter				*

TABLE 3

Stocking Record from 1934 to 1938 and Including Walleye Plantings in 1939

Species	Tie	Temple	Man	McComb
Bluegills	No stocking of any species 1934-1938	1935 - 2,000; 1938 - 8,400	No stocking of any species 1934-1938	1935 - 2,000; 1938 - 8,400
Largemouth bass				1935 - 100
Smallmouth bass				1935 - 50; 1936 - 100; 1938 - 800
Walleyes				1935 - 90 M.; 1936 - 90 M.; 1939 - 150 M.

TABLE 4

Growth Rate of Fish -- Average Total Length in Inches for Each Age Group*. Number of specimens in each group in parentheses. Actual lengths.

Lake	Species	I annulus	II	III	IV	V	VI	VII
Tie	Yellow perch	...	6.1 (7)	6.4 (24)	6.7 (3)	6.8 (1)	...	8.4 (1)
	Pumpkinseed sunfish	...	...	6.1 (1)	...	...	...	...
	Bluegill	...	...	7.1 (3)	...	...	...	...
	Rock bass	...	...	5.1 (5)	5.7 (7)	6.7 (2)		
Temple	Yellow perch	...	5.9 (22)	...	9.8 (1)	...	...	...
Man	Largemouth bass	...	...	...	...	14.8 (2)	14.4 (3)	...
	Bluegill	...	...	...	...	6.4 (4)	6.6 (4)	
McComb	Yellow perch	...	...	6.5 (1)	7.9 (5)	7.9 (3)	6.5 (1)	...
	Largemouth bass	...	...	...	13.7 (1)	16.5 (1)	15.4 (2)	17.1 (1)
	Northern pike	19.7 (11)	...	...	...	...	...	...

* Age group is based on the number of annuli or year marks completed. For example: those in the I group are in the second year of life; those in age group II in the ~~second~~ third year of life, etc.