Original: Fish Division
cc: Education-Game
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Paris Hatchery 8-18-42

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DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
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ANN ARBOR, MICHIGAN

October 28, 1940

REPORT NO. 626

A FISHERIES SURVEY OF THIRTEEN SMALL LAKES IN THE PROPOSED MARTINY FLOODING PROJECT, MECOSTA COUNTY

by

C. J. D. Brown and John L. Funk

The thirteen small lakes described in this report are within the proposed Martiny flooding project. They are part of the headwaters of the Chippewa River and are located about eight miles southwest of Barryton in Mecosta County. The location of each lake by town, range and section is given in the following table.

Name of lake	T	R	Sections
Tubbs	15 N	7, 8 W	1, 6, 7, 12
Lost	15 N	8 W	1
Diamond	15 N	7, 8 W	1, 6
Dogfish	15 N	8 W	1, 12
Boom	15 N	8 W	11, 12
Bass	15 N	8 W	12
Saddleback	15 N	8 W	11
Grass	15 N	8 W	11
Bullhead	15 N	8 W	11
Lower Evans	15 N	8 W	2, 11
Manaka	15 N	8 W	2
Upper Evans	15, 16 N	8 W	2, 35
Little Evans	16 N	8 W	35, 36

The order given above is according to each lake's position in the drainage; Tubbs Lake being at the downstream end of the group and Little Evans at the upstream end.

These lakes were surveyed by an Institute party* during February, 1940. The maps resulting from this survey, showing the lake outlines, contours and bottom types, were used subsequently as bases for plotting vegetation beds and sampling stations during the biological inventory** made between July 19 and August 10, 1940.

For the use of boats and camping facilities and for help afforded the survey party, we wish to thank the following: Rex Franklin, William Coleman, W. C. Dill, Charles Rose, L. B. Thomas, Elmer Evans, Molby Lamb and the management at Steve's place. Practically all of the people in the vicinity were very cooperative and showed great interest in the work.

No very detailed history is available regarding the early use of these waters for navigation and other purposes. However, a sawmill once stood on the shores of Boom Lake and all of the waters directly connected with the Chippewa River are said to have been used for log transport. Lumbering operations around these lakes were on a fairly large scale, according to reports. Boom Lake received its name from the explosion which destroyed the sawmill there.

Except for Bass, Grass, Bullhead and Manaka Lakes, all the waters in this part of the Chippewa drainage are open to public fishing. As shown in the following chart, the accessibility of these waters by road is only fair.

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*The personnel of the mapping party was as follows: Richard Bohland, leader; William Mason and Frank Lydell, assistants.

**The personnel of the Fisheries inventory party was as follows: John L. Funk, leader; David Anderson, William Reavley and Michael Meyer, assistants.

The lakes through which the Chippewa River flows are accessible by rowboat. The connecting channels in some places are almost completely choked with vegetation, however, making it difficult to get an outboard motor through.

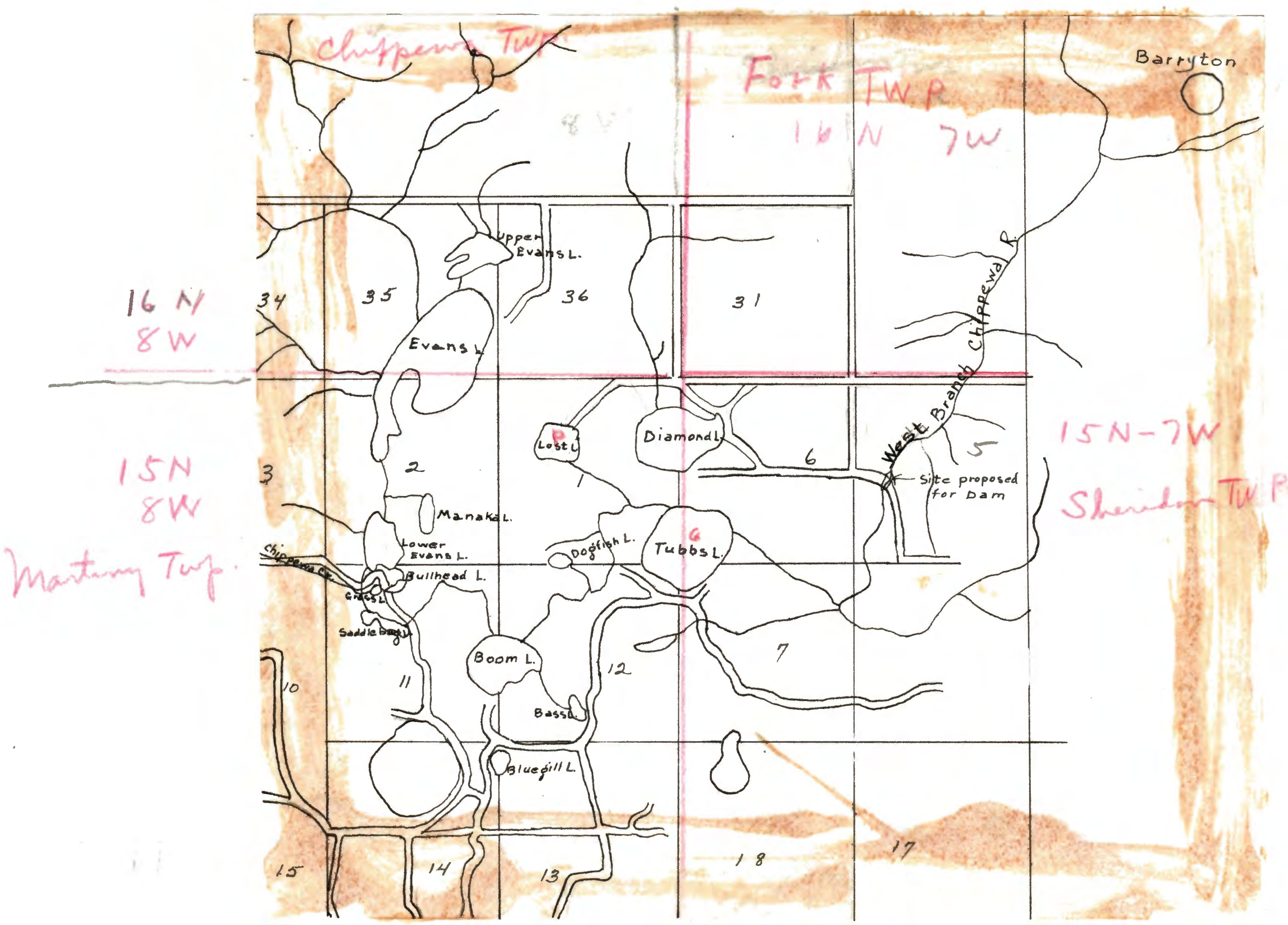
Lake	Public or private	Accessibility	Cottages	Resorts	Boat liveries
Tubbs	Public	1 good road	12	2	2
Lost	Public	1 mi. poor road	..	.	1
Diamond	Public	2 good roads	50	2	1
Dogfish	Public	inaccessible	..	.	.
Boom	Public	$\frac{1}{2}$ mi. poor road	..	.	2
Bass	Private	good road	..	.	1
Saddleback	Public	poor road	..	.	1 boat
> Grass	Private	fair private road	..	.	.
Bullhead	Private	fair private road	..	.	1 boat
> Lower Evans	Public	fair road	..	1	1
Manaka	Private	$\frac{1}{2}$ mi. very poor road	1	.	1
Upper Evans	Public	$\frac{1}{2}$ mi. poor road	6	1	1
Little Evans	Public	no roads - accessible from outlet	..	.	.

There is a total of 69 cottages, 6 resorts and 12 boat liveries on the shores of these lakes. Diamond Lake has by far the greatest number, with Tubbs Lake second.

These lakes receive medium to heavy fishing and the cottage development here would undoubtedly be far more extensive if the lake shores were not so low and marshy. As it is, high ground cottage sites are limited to a very few small areas. Pan fish are numerous and fishing is good. These lakes are potentially very productive and are passing through a stage not far from extinction.

There is little doubt but that all of these lakes originated as a result of glaciation. They are situated in a large morainic tract which extends across north central Mecosta County. The lake basins are irregular and beset with knobs and hollows not greatly different from the terrain of the surrounding country. Undoubtedly most of these were joined in their earlier stages to form a single lake. Subsequent filling as a result of organic deposition (primarily vegetation), along with lowering the outlets by cutting, has isolated the deeper basins and made them more or less distinct lakes, connected only by the west branch of the Chippewa River and its tributaries.

Tubbs, Boom, Saddleback, Lower Evans and Upper Evans lakes form part of the channel of the west branch of the Chippewa River; all of the others are connected with the river or one of these named lakes by short weed-filled tributaries (see map below). The West Branch joins the North Branch of the Chippewa near Barryton. The Chippewa flows into the Tittabawassee River near Midland, which in turn enters the Saginaw River at Saginaw. The Saginaw then continues to Lake Huron via Saginaw Bay. It is rather interesting that water originating in such a westerly part of the state should end



up in Lake Huron, since immediately north and south of these lakes the drainage is to the west. These thirteen lakes and their tributaries drain an area of about 35 square miles located almost entirely in the northeast part of Martiny and the southeast part of Chippewa townships. The most important tributary is Chippewa Creek, which empties into the West Branch below Lower Evans Lake.

The land immediately surrounding these lakes is agriculturally unproductive. The low land is marshy and most of the high land is abandoned to second growth aspen. Portions that have been cleared are now densely overgrown with sumac. Outside the area of about 10 square miles immediately surrounding the lakes, the land is fair, producing what appear to be moderate crops.

There are no man-made dams on the waters concerned in this report, although a project is under way to place a structure below Tubbs Lake (see above map) for the purpose of raising the water level about 4 feet. This would cause the flooding of the lowlands between these lakes, making the entire chain a more or less continuous body of water. Beaver dams are reported to be made from time to time at various locations along the river and its tributaries. These have in the past temporarily affected the lake levels above, but the practise has been to remove such barriers. The present lake levels are normally subject to only very slight annual fluctuation and this does not greatly affect their productivity.

All of the Martiny lakes are small. Upper Evans is the largest with 194 acres and the size ranges down to 2.1 acres (Grass Lake). Lakes of this size are seldom greatly affected by wind action. The short expanse of water, the surrounding hilly contour and encroaching vegetation reduce wave action to a minimum. There is hardly any evidence of shore cutting or bottom movement. With molar activity reduced to a point of no significance, aquatic plants have taken over these lakes and by so doing have further reduced the amount of open water.

A summary of the physical factors is given in the following table.

Summary of the Physical Characteristics of the Martiny Lakes

Lake	Area in acres	Max. depth (ft.)	Shoreline develop-ment	Approx. % of shoal	Bottom types: Shoal	Bottom types: Depths	Color of water	Secchi disc (ft.)
Tubbs	116.0	33	1.21	30	Marl, sand, peat, fibrous peat	Pulpy peat	Brownish	12
Lost	30.6	24	1.26	25	Fibrous peat	Pulpy peat	Brown	9
Diamond	86.6	12	1.3	100	Sand, marl, pulpy peat		Colorless	10
Dogfish	4.7	4	1.18	100	Pulpy peat		Brownish	bottom
Boom	42.7	30	1.47	25	Fibrous peat	Pulpy peat, fibrous peat	Brownish	8
Bass	2.8	27	1.96	20	Marl	Marl and pulpy peat	Brownish	10
Saddleback	11.8	21	2.00	75	Pulpy peat	Pulpy peat	Brownish	8
Grass	2.1	9	1.11	25	Marl and pulpy peat	Pulpy peat and marl	Brownish	4
Bullhead	5.3	15	1.31	100	Fibrous peat		Brownish	9
Lower Evans	41.9	37	1.43	20	Marl, fibrous peat and pulpy peat	Pulpy peat	Colorless	8.5
Manaka	14.0	33	1.44	50	Fibrous peat	Fibrous and pulpy peat	Brownish	9
Upper(Big) Evans	194.0	42	2.02	50	Fibrous peat and marl	Pulpy peat	Colorless	7.5
Little Evans	41.9	36	1.76	35	Marl and pulpy peat	Pulpy peat	Colorless	9.5

Some of these lakes have a rather high shoreline development. As can be seen from the above table, Saddleback and Upper Evans lakes have a development of 2. This means that their circumference is twice as long as a perfectly round lake of the same acreage. Other things being equal, high shore development is indicative of high productivity. This does not hold so well in small shallow lakes, however, because they are usually productive regardless of shore development.

Estimates of the quantity of shoal are given above. Shoal is considered as that part of the lake bottom potentially capable of producing higher aquatic plants. The average shoal of all the lakes here considered is better than 50 per cent, and approximately this amount of the lake bottoms supports abundant vegetation.

The bottom types consist mainly of fibrous peat and pulpy peat with varying quantities of marl. Diamond and Tubbs lakes have small amounts of sand. The bottom of the deeper areas is composed almost entirely of pulpy peat with small quantities of fibrous peat and sand present in a few.

The water is colorless in the Evans Lakes and Diamond Lake and brownish in all the others. A possible explanation is that the first named are headwater lakes and therefore are not so apt to have waters stained by bottom deposits. The color most probably results from the large quantities of decaying vegetation found in the lakes and marshes lower down in the drainage. The transparency of the water varied greatly between lakes. Transparency of water is influenced by both the actual color of the water and the amount of suspended matter present. The water in Tubbs Lake was the most transparent. A Secchi disc could be seen to a depth of 12 feet. It is possible, however, that Dogfish Lake would show a reading as great if the water had been deep enough to make such a test. Color of water and turbidity are important factors in lake productivity because they may limit the growth of vegetation. On the other hand, water may be turbid because it is highly productive. In such a case plankton may be the important cause of turbidity.

On the whole, the physical factors operating in the Martiny lakes favor a high degree of productivity. The stability of shoals, rich bottom deposits, and warm temperatures are responsible, at least in part, for the extraordinary plant, invertebrate (insects, etc.) and fish populations.

The temperature and chemical factors operating in these lakes are summarized in the following table.

Summary of the Temperature and Chemical Conditions in the Martiny Lakes

Lake	Date	Surface temp. (F.)	Bottom		Thermocline								Range, M.O. alkalinity, p.p.m.	Range, pH Top to bottom
					Top				Bottom					
			Depth (ft.)	Temp. (F.)	Depth (ft.)	Temp. (F.)	O_2, p.p.m.	CO_2, p.p.m.	Depth (ft.)	Temp. (F.)	O_2, p.p.m.	CO_2, p.p.m.		
Tubbs	7/19/40	75°	30	51°	9	74°	8.5	0.0	21	54°	0.6	8.0	124-158	7.4-8.5
Lost	7/17/40	72°	23	49°	6	71°	7.1	0.0	21	49°	0.0	22.0	150-167	7.2-8.3
Diamond	7/16/40	71°	10	70°	No thermocline. Surface oxygen, 8.0; CO_2, 0.0								108-112	8.3-8.4
Dogfish	7/22/40	87°	..	...	No thermocline. Surface oxygen, 5.7; CO_2, 0.0								135	9.1
Boom	7/24/40	80°	29	47°	6	78°	7.5	0.0	21	50°	0.0	20.0	126-167	7.3-8.3
Bass	7/25/40	80°	25	46°	6	70°	10.2	0.0	21	49°	2.0	18.0	125-204	7.2-8.1
Saddleback	7/30/40	80°	20	47°	6	77°	7.4	0.0	18	49°	0.0	25.0	132-164	7.1-8.1
Grass	7/31/40	78°	7	77°	No thermocline. Range, O_2 6.8-6.9; CO_2 4.0-8.0								166-172	7.7-7.9
Bullhead	7/31/40	81°	7	77°	No thermocline. Range, O_2 8.2-8.8; CO_2 0.0								94-97	8.8
Lower Evans	8/6/40	76°	35	48°	6	76°	7.9	0.0	24	51°	0.0	15.0	111-169	7.2-8.3
Manaka	8/1/40	77°	29	44°	9	78°	6.8	0.0	21	48°	0.0	37.0	102-140	6.8-8.4
Upper (Big) Evans	8/7/40	76°	43	50°	12	75°	7.8	0.0	27	53°	0.0	10.0	118-166	7.3-8.5
Little Evans	8/9/40	78°	32	45°	6	78°	8.4	0.0	27	46°	1.1	11.0	125-202	7.1-8.4

Surface temperatures taken between July 19 and August 10 ranged from 71° F. at Diamond Lake to 87° on Dogfish Lake. All of these lakes had well developed thermoclines (zone in which water temperature drops very rapidly) with the exception of Diamond, Dogfish, Grass and Bullhead. These latter are very shallow and would not be expected to show any great difference in temperature from top to bottom.

The temperatures of the deeper waters ranged from 46° F. at 27 feet in Little Evans to 54° F. at 21 feet in Tubbs Lake. The temperature drop from top to bottom in those lakes with thermoclines was very abrupt; ranging from 23° F. in Lost Lake to 34° F. in Bass Lake. This 34° F. drop in temperature from top to bottom in Bass Lake represents 1.36° F. for each foot of depth.

When there is a thermal stratification in a body of water there is also likely to be chemical stratification because the bottom waters are isolated, in that there is very little mixing, except for a brief period each spring and fall. The oxygen supply in all of the Martiny lakes was greatly reduced below the thermocline. Bass Lake had the largest amount (2 p.p.m.). The other lakes had either no dissolved oxygen at all or such small quantities that the water was entirely unsuitable for fish. The surface water had abundant oxygen in all the lakes studied.

The water above the thermoclines of these lakes was free from carbon dioxide. Below the thermocline it varied between 8 and 37 p.p.m., the greatest quantity being recorded for Manaka Lake. Even this maximum quantity of carbon dioxide is not of any direct importance to fish.

The water of these lakes is moderately hard with a methyl orange alkalinity ranging from 94 p.p.m. in Bullhead Lake to 202 p.p.m. in Little Evans. Moderately hard water is known to be more productive than either very soft or very hard waters. The pH tests made show that the water is almost entirely alkaline. Manaka showed very slightly acid water on the surface of the bottom, but was very alkaline (8.4) at the top. Dogfish Lake had a pH of 9.1 which is extremely alkaline.

On the whole, the chemical conditions found in the Martiny Lakes are very satisfactory for fish growth. The lack of oxygen in the deep waters of some of these lakes limits the area available for fish during the latter part of each summer and possibly late each winter. This, however, does not have any very serious effect on fish populations and growth.

Fifty species of aquatic plants were collected from the Martiny lakes. These included a number of near shore plants such as the sedges, wild celery, wild rice, etc. A summary of the vegetation analyses is given in the following table.

The Higher Aquatic Plants* Found in the Martiny Lakes

Common Name	Scientific Name	Tubbs	Lost	Diamond	Dogfish	Boom	Bass	Saddleback	Grass	Bullhead	Lower Evans	Manaka	Upper Evans	Little Evans
Muskgrass	Chara	A	A	C	A	F	A	.	R	.	A	C	A	A
Cattail	Typha latifolia	F	C	.	.	.	.	.	.	.	C	.	C	.
Bur-reed	Sparganium sp.?	.	.	R	.	R	.	.	.	.	R	.	R	.
Pondweed	Potamogeton natans	.	A	C	.	.	.	R	.	.	R	R	.	F
"	" pectinatus	F	F	.	F	F	.	.	.	.	C	.	F	C
"	" panormitanus	.	.	.	.	.	.	R	.	.	C	.	R	.
"	" amplifolius	.	A	.	.	R	.	.	.	C	R	R	R	.
"	" praelongus	.	.	C	.	F	.	.	.	.	.	.	.	.
"	" tenuifolius	R	A	.	.	.	.	.	.	.	.	.	.	.
"	" Richardsonii	.	.	.	.	.	.	.	.	.	R	.	R	.
"	" angustifolius	.	.	F	.	.	F	.	.	.	.	.	.	.
"	" zosteriformis	A	A	.	.	A	.	A	.	C	C	C	.	C
"	" foliosus	.	.	.	.	.	.	.	.	.	.	.	R	.
"	" Friesii	F	A	.	A	F	.	A	.	.	C	A	F	C
"	" gramineus	.	.	.	.	.	.	.	.	.	.	.	F	C
"	" lucens	.	.	.	.	.	..	.	.	.	.	.	F	C
Bushy Pondweed	Najas flexilis	A	.	C	F	F	C	.	A	A	C	A	C	C
Waterweed	Anacharis canadensis	.	.	.	.	.	.	.	.	.	.	.	F	.
Wild Celery	Vallisneria americana	.	.	F	.	.	.	.	.	.	F	.	R	.
Wild Rice	Zizania aquatica	R	(R)	.	.	.	F	.	A	.	.	.	R	C
Bluejoint	Calamogrostis canadensis	.	F	.	.	.	.	.	.	..	.	.	.	.
Spike Rush	Eleocharis sp.?	R	.	.	.	.	.	.	.	.	.	.	.	.
Big Bulrush	Seirpus acutus	C	R	.	.	R	R	.	.	.	C	.	.	.
"	" validus	.	.	C	.	.	.	.	.	.	.	.	C	C
Twig Rush	Cladium mariscoides	.	.	.	.	.	R	.	.	.	.	.	.	.
Sedge	Carex lasiocarpa	.	.	C	.	.	.	A	C	C	.	.	.	.
"	" hystericina	.	.	.	.	.	.	F	.	.	.	.	.	.
"	" comosa	.	.	.	.	.	.	.	R	..	.	.	.	.
"	" stricta	..	.	.	A	.	.	.	.	.	.	.	.	.
"	" substricta	.	A	.	.	.	A	.	.	.	.	.	.	.
Arrow Arum	Peltandra virginica	C	C	.	.	C	.	C	.	C	A	.	R	F
Big Duckweed	Spirodela polyrhiza	C	.	.	.	F	.	F	.	.	.	.	.	.
Star Duckweed	Lemna trisulca	C	.	.	.	F	.	C	.	.	C	.	.	.
Lesser Duckweed	" minor	.	.	.	C	.	.	.	.	.	.	.	.	.
Pickerelweed	Pontederia cordata	F	C	C	.	C	F	C	R	F	C	C	F	F
Smartweed	Polygonum natans	.	R	.	.	.	.	.	.	.	R	.	.	R
Coontail	Ceratophyllum demersum	C	A	.	A	A	F	A	A	A	F	C	C	C
Water Lily	Nymphaea odorata	C	C	C	.	C	F	C	.	C	F	.	F	F
Yellow Water Lily	Nuphar advena	C	C	F	.	.	.	.	.	.	.	C	.	.
Yellow Water Lily	" " variegatum	.	.	.	.	C	F	C	F	C	C	.	.	F
Water Shield	Brasenia Schreberi	.	.	.	.	.	.	.	.	R	.	.	C	R
Water Crowfoot	Ranunculus longirostris	R	.	.	.	F	.	.	.	.	F	.	F	.
Marsh Cinquefoil	Potentilla palustris	R	.	.	.	.	.	.	.	.	.	.	.	.
Swamp Loosestrife	Decodon verticillatus	.	A	.	A	A	.	A	A	A	A	C	F	C
Water Milfoil	Myriophyllum exalbescens	R	C	.	.	F	F	.	.	.	C	C	C	F
Leatherleaf	Chamaedaphnae calyculata	.	.	.	.	.	.	.	.	.	R	A	.	.
Swamp Milkweed	Asclepias incarnata	R	.	.	.	.	.	.	.	.	.	.	.	.
Bladderwort	Utricularia vulgaris	R	.	.	F	.	R	.	.	.	.	.	.	.
"	" sp.?	.	.	.	.	.	.	.	R	.	.	.	.	.
Bur Marigold	Bidens Beckii	.	.	.	.	.	.	R	.	.	.	.	C	.

Symbols: A = abundant; C = common; F = few; R = rare.

*Identification by John Funk and Betty Robertson.

There are not only a large number of different plant species (about 1/3 those reported for Michigan) present in the Martiny lakes, but many of these are extremely abundant. The low, boggy, encroaching shores and rich bottom deposits are evidence of past plant invasion. All of the major types of aquatic plants are well represented. Water lilies, both white and yellow, are common. Thirteen species of pondweeds alone were reported, and along with these, coontail and muskgrass are extremely abundant in certain areas. All in all, these lakes (Diamond Lake excluded) are rapidly being filled with plant deposits which will eventually result in their complete extinction, possibly within the next 25 to 50 years. We believe that these extensive plant beds are responsible for the present high productivity and the large populations of pan fish present.

Fish food samples were taken from all the lakes in this group. Plankton (minute free-floating organisms) was abundant in all the larger lakes. Dogfish, Bullhead and Grass lakes had comparatively little plankton. Most of the plankters were small plants. The animal forms, however, while not predominant, were numerous in most of the lakes. Plankton is important in fish production because it is a fundamental link in the food chain of which the fish are a part. The small animals and plants are food for fish food organisms, and as well are directly used by the small fry of both game and forage fishes.

The larger food organisms which are used directly by many fishes were very abundant in these lakes. Samples taken from the shoals and its accompanying vegetation show the fresh-water "shrimp" to be the most abundant form. Muskgrass and Ceratophyllum beds were simply teeming with these shrimp in many places. Midges, mayflies, caddisflies, snails, dragonflies and damselflies were also very numerous on the weed beds and over the shoals. Snails were particularly abundant in Boom Lake. Other less frequent forms noted were watermites, beetles, crayfish, leaches and fly larvae. Possibly more than 90 per cent of the food organisms observed were from the weed beds. The lake bottom of the shoal did not support many organisms. The bottom of the deeper areas was much less productive than the shoal areas, and this might be expected since it was composed of loose pulpy peat. Midge larvae and aquatic earthworms were the only important food organisms observed from the bottoms of deeper regions.

In the survey, considerable effort was put forth to secure a representative sample of the fish population. Some of the fish listed in the following table were not seen by the party, but were reported by reliable people. Our estimate of the abundance of each fish is shown by a symbol as follows: A = abundant; C = common; R = rare.

Lake	Game fish											Forage fishes										Coarse				Obnoxious
	Perch	Northern pike	SM bass	LM bass	Rock bass	Black crappie	Bluegill	Pumpkinseed	Green sunfish	Long-eared sunfish	Warmouth bass	Black-nose minnow	Black-chin shiner	Menona killi-fish	Blunt-nose minnow	Iowa darter	Common shiner	Horny-head chub	Pug-nosed shiner	Golden shiner	Skipjack	Yellow bullhead	Brown bullhead	Common sucker	Lake chub sucker	Dogfish
Tubbs	C	*R	*	A	A	C	A	A	.	A	A	.	A	C	C	C	C	R	R	.	.	C	C	R	.	C
Lost	C-R	C-R	.	.	.	C-R	A	A	.	C	C	.	.	.	.	.	.	.	.	.	.	.	C-R	.	.	.
Diamond	A	*R	*R	A-C	.	*C	A	*A-C	.	.	.	R	.	.	A	.	.	.	.	.	.	.	*C-R	.	.	.
Dogfish	.	.	.	C-A	.	.	A	C-A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*C
Boom	R	C	.	*C	*C	C	A-C	C	R	.	.	C	.	C-R	.	.	.	.	.	.	.	C	.	.	.	C-R
Bass	*R	R	.	*C	.	C	A-C	*C	.	.	.	.	.	.	.	.	.	.	.	.	.	‡		.	.	.
Saddle-back	.	*R	.	.	.	*C	A-C	*C	.	.	*C-R	.	C-R	.	C	.	.	.	.	.	.	C	C-R	.	.	C-R
Grass	C-R	.	.	C	.	*C	*C	C	.	.	.	.	.	.	.	.	.	.	.	*C	.	.	C	.	.	*R
Bullhead	C-R	.	.	*C	.	*C	A	C	.	.	C-R	.	.	.	.	.	.	.	.	*C	.	‡		.	.	*C-R
Lower Evans	R	*C-R	.	C	*C-R	C	A	C	.	C	C-R	.	.	.	.	.	.	.	C-R	.	.	C	R	.	.	*C-R
Manaka	C-R	*R	.	*C	.	C	A	*C-R	.	.	C	.	.	.	.	.	.	.	.	*C	.	C	.	.	.	C-R
Big Evans	C	A-C	.	*C	C	A-C	A	C	.	.	C	.	C-R	R	C-R	R	.	.	R	.	A-C	C	.	.	.	C-R
Little Evans	*C-R	C-R	.	C	*C-R	C	*C	C	.	.	C	.	.	.	.	.	.	.	.	.	.	C	C-R	.	R	*C-R

*Reported, not taken by survey party.

‡Bullhead, unknown species, reported as common.

The bluegill and pumpkinseed sunfish are the most numerous game fish present. These fish are there in very large numbers throughout most of these lakes. Fishermen's catches were unusually large and limit catches were not uncommon. Crappie and largemouth bass were common and perch and northern pike were occasionally taken.

Eight species of forage fishes were collected by the survey party and one other, the golden shiner, was reported. The black-nose minnow and black-chin shiner were probably the most numerous. Careful seining for minnows was not always possible, however, because of the encroaching shore and soft bottom. There is little doubt but that a number of other species are present in addition to those listed.

The brown bullhead was the most numerous of the coarse fish collected. Yellow bullheads were common in most of the lakes. The common sucker and lake chub were rare, as can be seen from the above table. The dogfish was the only obnoxious fish present. It was fairly common in nearly all of these lakes.

Only about a dozen creel census records over the past 7 years were reported for these lakes and the data, therefore, have little significance.

Growth rate studies were made on the scales of all of the game fish collected during the survey. A summary of this is given in the following table.

Growth Rate of Fish Taken from the Martiny Lakes*

Lake	Species	Age Group**	No. of Specimens	Av. total Length in inches	Av. weight in oz.
Tubbs	Yellow perch	III	4	5.8	1.3
	Largemouth bass	II	1	7.7	3.2
	Rock bass	V	3	6.1	2.6
		VI	4	6.3	2.7
	Black crappie	II	4	6.1	1.8
	Bluegill	III	24	5.6	1.9
		IV	4	6.4	3.0
		V	1	7.5	4.6
		VI	1	7.6	4.9
		VII	1	7.8	3.8
		VIII	2	7.3	5.1
	Pumpkinseed	IV	6	5.2	1.7
		V	1	5.1	1.5
	Long-eared Sunfish	IV	4	4.2	1.2
	Warmouth bass	IV	2	5.9	2.5
		V	2	6.2	3.0
		VI	1	6.8	3.8
		VII	2	7.1	4.6
Lost, and adjacent river	Yellow perch	VI	1	9.1	5.2
	Great n. pike	III	1	20.7	20.0
	Smallmouth bass	II	2	6.8	2.1
	Black crappie	II	1	6.9	2.6
	Bluegill	II	1	3.9	0.6
		III	5	4.1	0.7
		IV	13	6.0	2.0
		VI	1	8.1	2.8
	Pumpkinseed	III	2	4.2	0.9
		IV	2	5.3	2.1
		V	1	5.7	2.3
	Warmouth bass	III	2	6.1	2.7
		V	1	5.4	2.0
Diamond	Yellow perch	III	5	8.5	4.4
		IV	5	9.5	6.2
		VII	1	11.5	10.2
	Largemouth bass	II	1	8.3	3.6
	Bluegill	II	3	5.1	1.6
Dogfish	Largemouth bass	III	2	9.6	7.2
	Bluegill	IV	5	6.3	3.1
		VI	2	7.6	5.1
	Pumpkinseed	II	1	3.8	0.8
		V	2	6.8	3.7
Boom	Yellow perch	V	1	5.5	1.1
	Great n. pike	III	2	19.3	21.5
	Black crappie	IV	1	7.6	3.7
	Bluegill	III	1	3.7	0.5
		IV	3	5.2	1.5
		VI	1	5.8	2.1
	Pumpkinseed	IV	1	5.4	1.6
	Green sunfish	IV	1	5.3	1.6
Bass	Great n. pike	II	1	18.7	18.8
	Black crappie	II	1	6.7	2.3
	Bluegill	VI	1	7.3	3.8
Saddleback	Great n. pike	IV	1	30.6	96.0
	Largemouth bass	II	1	7.1	2.4
	Bluegill	IV	1	5.3	1.5
Grass	Yellow perch	III	1	7.1	1.8
	Pumpkinseed	II	2	4.7	1.2
		V	1	6.3	3.2
Bullhead	Yellow perch	II	2	4.8	0.8
	Bluegill	III	2	5.0	1.4

Boom	Yellow perch	V	1	5.5	1.1
	Great n. pike	III	2	19.3	21.5
	Black crappie	IV	1	7.6	3.7
	Bluegill	III	1	3.7	0.5
		IV	3	5.2	1.5
		VI	1	5.8	2.1
	Pumpkinseed	IV	1	5.4	1.6
	Green sunfish	IV	1	5.3	1.6
Pass	Great n. pike	II	1	18.7	18.8
	Black crappie	II	1	6.7	2.3
	Bluegill	VI	1	7.3	3.8
Saddleback	Great n. pike	IV	1	30.6	96.0
	Largemouth bass	II	1	7.1	2.4
	Bluegill	IV	1	5.3	1.5
Grass	Yellow perch	III	1	7.1	1.8
	Pumpkinseed	II	2	4.7	1.2
		V	1	6.3	3.2
Bullhead	Yellow perch	II	2	4.8	0.8
	Bluegill	III	2	5.0	1.4
	Pumpkinseed	IV	2	5.7	2.4
		V	1	5.9	2.6
Lower Evans	Yellow perch	III	1	5.0	0.7
		VI	1	7.8	3.2
	Largemouth bass	I	1	4.7	0.8
		III	1	11.5	12.1
	Rock bass	III	1	4.6	0.9
		VI	1	6.7	3.2
		VII	1	6.5	2.3
	Black crappie	II	5	6.1	1.6
	Pumpkinseed	II	1	3.3	0.4
		IV	2	5.1	1.8
	Bluegill	IV	8	6.1	2.7
		V	1	7.2	4.4
		VI	3	6.8	3.8
		VII	3	6.8	3.6
	Warmouth bass	VI	1	6.4	3.2
Manaka	Yellow perch	VI	1	10.0	7.5
	Black crappie	IV	1	7.5	3.4
	Bluegill	VI	3	5.9	2.1
		VII	1	5.8	2.0
		VIII	1	7.6	4.2
		IX	1	6.9	2.0
	Warmouth bass	VII	1	6.0	2.4
Upper (Big) Evans	Yellow perch	VI	3	8.5	4.4
		VII	2	9.6	6.8
	Great n. pike	I	11	15.1	11.9
	Rock bass	VI	1	6.4	2.9
		VII	1	7.3	3.8
	Black crappie	II	9	6.0	1.6
	Bluegill	II	1	4.0	0.8
		III	29	6.7	2.1
		IV	9	6.4	3.0
		VI	1	7.5	4.7
	Pumpkinseed	IV	1	5.2	1.9
	Warmouth bass	V	2	5.9	2.7
		VI	1	6.3	2.6
		VII	2	7.0	4.3
Little Evans	Great n. pike	II	1	15.7	14.1
	Largemouth bass	II	1	6.9	2.6
	Black crappie	II	5	6.1	2.0
	Pumpkinseed	III	1	5.0	1.5
		IV	2	5.1	1.6
		V	4	5.6	2.1
	Warmouth bass	VII	1	5.7	2.2
		VIII	1	5.9	2.3

*Age determinations were made by W. C. Beckman.

**Add one year to the ages given to get actual number of growing seasons.

The number of fish studied is far too small, in most instances, to give an accurate picture of growth rate. However, even a few cases give evidence of the general size and condition of the fish for the different age groups. Indications are that perch have their most rapid growth in Diamond Lake (legal length in third summer) and their poorest growth in Boom Lake (legal length in fifth or sixth summer). The average time for the perch of all of these lakes to reach legal length is very probably during their fourth summer. Northern pike seemed to grow very rapidly. Fish in their second and third summers ranged between 15 and 18 inches in total length; those in their fourth summer averaged about 20 inches; and specimen in its fifth summer was 30.5 inches.

Bluegills were rather slow growing -- very probably because of the large number present. In most of the lakes this species does not reach legal length until its fifth summer. In Big Evans Lake, however, 29 four-year-old fish averaged 6.7 inches in total length. The crappie shows very good growth, reaching legal length during its third summer.

On the whole, the growth rate of the fish from these lakes is fair. Northern pike and crappie show about average growth or a little better, while bluegills, perch and sunfish have a growth rate a little below average.

Management Suggestions

The present designation of this group of lakes in the "All other lakes" classification seems to be satisfactory and in agreement with the findings of this study. No stocking is recommended. Small individuals of most of the game fish present were found in abundance. Previous stocking has been light and has probably had little effect on the fish population. A summary of the plantings made during the past six years (1934-1939, inclusive) is given in the following table.

Fish Planted in Martiny Lakes

1934-1939 inclusive

Lake	Bluegills	Smallmouth bass	Largemouth bass
Tubbs	17,000	...	...
Lost	No fish planted		
Diamond	14,000	...	...
Dogfish	No fish planted		
Boom	" " "		
Bass	" " "		
Saddleback	" " "		
Grass	" " "		
Bullhead	" " "		
Lower Evans	" " "		
Manaka	" " "		
Upper (Big) Evans	...	3,000	1,200
Little Evans	No fish planted		

Perch, sunfish and crappies are very numerous in these lakes even though none have been planted during the past 6 years. Smallmouth bass are not well suited to these lakes because of the lack of spawning grounds for this species. Largemouth bass, bluegills, northern pike, perch, crappies and sunfish are the species which should be encouraged, and natural propagation will very probably be sufficient to stock these waters to their carrying capacity.

No serious parasite infestations were noted in the fish from these lakes. Predatory animals such as herons, watersnakes, turtles, etc., were fairly numerous, but seemed to have no harmful effect on the fish populations. On the other hand, these predators may have a very beneficial effect in removing diseased or over-abundant fish. No control is recommended.

The cover in these lakes is entirely adequate. The extensive plant beds, overhanging banks, logs, etc., provide ideal shelter for those fish requiring it.

The proposal of the Game Division to construct a dam and maintain a higher water level to improve conditions for waterfowl was the chief reason for the fisheries survey. The question is: what effect will an increase in water level have on the fish and fishing in these lakes? This we can only answer with a limited degree of certainty. It is true that the panfish population is near its maximum for these waters, and that the present water level is responsible, at least in part, for this. Any change of water level, higher or lower, will very probably be away from these optimum conditions.

However, there are other things to be considered. As already stated, these lakes are near extinction if the present rate of filling by vegetation is left unchecked. An increase in the water level would tend to delay the filling process -- how long, we do not know. A higher water level would make all of the present private waters of this area accessible to the public and furnish much more suitable shore for real estate development. The fishing pressure would very probably be increased.

The proposed higher water would inundate a great deal of the low, flat shores and furnish greatly increased spawning facilities for northern pike. This species would almost certainly increase, with an accompanying reduction in largemouth bass and bluegills. This pike increase, if it follows the trend observed for other impounded waters, will reach its peak within five or six years, after which there will be a marked decline in which neither pike nor bass (and panfish) are very numerous.

The choice then, as far as fisheries are concerned, seems to be between the present good pan fishing extending possibly over the next 20 years, and the increased pike fishing for 5 or 6 years with a possible greatly reduced fish population after that time.

This project holds some very fine opportunities for a study of the aquatic vegetation and fish productivity. If it is approved, observations should be made on the effect of the higher water levels on existing aquatic plants and fish populations.

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