Original: ✓Fish Division
cc: Education-Game
H. L. Peterson - 2-23-43
David S. Shetter
Hunt Creek Laboratory
Inst. for Fisheries Res.

INSTITUTE FOR FISHERIES RESEARCH
DIVISION OF FISHERIES
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ALBERT S. HAZZARD, PH.D.
DIRECTOR

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A FISHERIES SURVEY OF EAST, MIDDLE, AND WEST FISH LAKES, AND SUTTON'S POND IN MONTMORENCY COUNTY.

by

David S. Shetter

When the Hunt Creek Experimental Laboratory was located in southern Montmorency County during the summer of 1939, the above-mentioned lakes were surveyed, inasmuch as they formed an integral part of the headwater drainage system of two of the tributaries to Hunt Creek. Through angling and through the survey it was established that two of these small bodies of water were brook trout lakes (East Fish, Sutton's Pond) in which more or less controlled studies on the life history of brook trout in lakes might be pursued.

The purpose of this report will be to place on record the physical and chemical conditions, and list the species of fish as we found them when the Institute for Fisheries Research first began intensive studies there in 1939.

Location and Drainage

The exact location of the lakes under discussion is given by town, range, and section in Table I.

Table I.

Location and acreage of lakes on the Hunt Creek Experimental Area, dates of mapping and lake survey.

Lake	Location in Montmorency County			Area	Date	Date
	Town	Range	Section	(acres)	Mapped	Surveyed
East Fish	29N	2E	34, 35	13.5	7/5/39	7/28/39
Middle Fish	29N	2E	34	2.5	7/27/39	7/25/39
West Fish	29N	2E	34	9.7	7/8/39	7/26/39
Sutton's Pond	29N	2E	27	1.8	7/31/39	8/1/39

1/ Personnel of mapping and survey party consisted of Dr. David S. Shetter, F. V. Ames, and E. L. Cooper. Mapping dates are given in Table I, also survey dates.

They lie in Albert Township of Montmorency County. East Fish Lake is the largest lake, followed in order by West Fish, Middle Fish, and Sutton's Pond.

These lakes lie approximately 7 miles east of the town of Lewiston, and about 2 miles south, and can be reached via county highway #612 and various secondary sand trails which are open to auto traffic for 9 months of the year. Sutton's Pond can be reached by car, but most anglers walk the east one-half mile. All the other lakes are within 100 yards or less of the connecting roads.

The Fish lakes constitute a natural group, since they were all at one time in the past connected by small streams. At present only West Fish and Middle Fish lake have a semi-permanent stream connection. The stream formerly connecting Middle Fish with East Fish Lake is blocked by an old beaver dam. However, about 100 yards below this old beaver dam it is possible that sub-surface drainage from Middle Fish Lake contributes to the volume of water found in the present East Fish Lake inlet. East Fish Lake is drained by the East Fish Lake outlet, a good-sized, permanent stream, which enters Fuller Creek in Section 34 of Town 29N, R2E about 1/3 of mile to the north (Fuller Creek is the main tributary of Hunt Creek, which flows into the Thunder Bay River).

Sutton's Pond, which lies to the north of the Fish Lakes, and north of Fuller Creek, is fed by one main inlet from the west and south and several small springs. Its outlet stream flows through an old beaver dam, through the Liljack pond (private) and then into Hunt Creek. Thisstream has been designated as tributary No. 3. of the Hunt Creek Experimental Area. Sutton's Pond is only a gun shot from the north end of the Fuller Creek Beaver Dam.

Past and Present Use.

The Fish Lakes have never been the site of any industrial or home, or cottage development, as far as could be learned or observed. Sutton's Pond was once the home site of the Sutton family (about 1900), and the pond has taken its name from the family, according to John Sutton, of the Forest Fire Experiment Station Staff.

Outside of angling and occasional duck hunting, the only use to which any of these lakes has been put has been as a source of marl for local farm fertilizer. East Fish Lake has six rather recent marl "cuts" on the north shore, where drag lines have dug trenches in the removal of marl.

There is no cottage or resort development at the present time.

The entire shore lines of all of the lakes are state-owned. County roads and parking spaces are available within sight of all the Fish Lakes. Sutton's Pond may be reached by a half-mile hike along a section-line trail.

Unverified reports from local anglers indicate that East Fish and West Fish Lakes, and Sutton's Pond may have been brook trout lakes ever since brook trout have been planted by the Fish Division. The conditions found in West Fish Lake were not favorable for brook trout at the time of the

survey, however. Brook trout were present in East Fish Lake and in Sutton's Pond at the time of the survey, although no very large brook trout were found in either lake.

II

Physical Characteristics.

Geologic Origin

All of these lakes are located in depressions of one of the connecting lobes of the Port Huron Moraine[1]. All of the lakes appear to have been originally of the "kettle hole" or "pit" type, and their basins formed when the glaciers left huge blocks of ice behind in their melting retreat. When the ice blocks melted, the resultant water could not escape because of the topography of the surrounding country as the sand and gravel morainal deposits almost completely blocked the drainage channels. All of these lakes originally had a much greater water volume and a greater depth, as is brought out in Institute Report No. 816 (Sedimentary deposits of East, Middle and West Fish Lakes in Montmorency County, Michigan) by Dr. Ira T. Wilson, of Heidelberg College.

The approximate elevation is close to 1,000 feet above sea level.

The drainage basins of all of these lakes are roughly circular. Middle and West Fish Lakes which are only about 150 yards apart drain approximately 160 acres of land, and East Fish Lake probably does not drain more than that. Sutton's Pond, which has a comparatively lengthy inlet probably drains about 350 acres of the surrounding territory.

Type of country

The morainal ridges in the general area are a mixture of sand with some gravel and boulders, while the low areas consist chiefly of peat and organic detritus. Hills of varying heights (up to 150 feet near the shores of West Fish Lake) almost surround all the lakes.

The immediate shores are wooded to a considerable degree. Where the hills come down to the lake shores, the timber stand consists of oaks, maples, aspens, red and white pine, alders, dogwood, and numerous pin cherry clumps. Blueberries have varied in abundance.

On the swamp borders of the lakes, tamarach and cedar are found with some Balm of Gilead, and also fairly extensive beds of Mare's tail and various other rushes.

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[1] Leverett, Frank and Frank B. Taylor, 1915.
The Pleistocene of Indiana and Michigan and the History of the Great Lakes. Mon. of the U. S. G. S., Vol. LIII, Dept. of the Interior, p. 303

Water Fluctuation

The fluctuation in West Fish and Middle Fish Lakes appears to depend on the amount of precipitation and snowfall which determine to some extent the level of the ground water table in the immediate vicinity. In the other two lakes, (Sutton's Pond and East Fish Lake) the water levels could be affected by the above-mentioned factors, and also the condition of the beaver dams located at their outlets. At the time of the survey, there appeared to have been little fluctuation in recent years. Although the level of West Fish Lake seemed to have been slowly receding as the summer progressed.

West Fish Lake has no inlets while Middle Fish Lake receives some drainage from West Fish Lake in spring of year and possibly after heavy summer rains.

East Fish Lake receives much of its water from the inlet entering at the southwest corner. At the lake this streams is approximately 6 feet wide and averages about 1 foot deep. It flows approximately 2 CFS of water. In addition to this inlet, eight major springs of varying sizes along the west shore, three on the south shore, and one on the east shore, contribute to the water supply. The entire south and west shores consist of a thick cedar-tamarach-spruce bog complex and undoubtedly there is much water reaching the lake from beneath the surface of the bog mat.

Sutton's Pond has one main inlet which enters the northwest corner. This originates in the hills almost $\frac{1}{2}$ mile to the west and slightly south of the Pond. A small amount of spring water seeps under the bog mat which almost completely surrounds the lake.

Outlets

West Fish Lake has a semi-permanent outlet about 3 feet wide which connects it to Middle Fish Lake. An old beaver dam about 2 feet high partially blocks the flow.

Middle Fish Lake has no apparent surface outlet, although subsurface drainage from this lake may reach the inlet of East Fish Lake. An old beaver dam about 2 feet high once blocked the stream flow.

East Fish Lake has a permanent outlet varying in size from 3 to 6 feet. This stream is about 500 yards long, and meets Fuller Creek just below the Fuller Creek Beaver Dam. The outlet was blocked at one time by an abandoned beaver dam about 2 feet high which was a barrier to fish migration.

Sutton's Pond has a permanent outlet 2 to 4 feet wide and from 4 to 6 inches deep. This was blocked by an abandoned beaver dam which even now is an effective barrier to fish migration.

The general physical data for the four lake are presented in Table II.

Table II.

General physical data on East, Middle, and West Fish Lakes, and Sutton's Pond, Montmorency County.

Lake	Area (acres)	Maximum depth (feet)	Shore development	Dominant bottom types		Color of water	Water Transparency (Secchi-disk)
				Shallows (0'-15')	Depths over 15'		
East Fish Lake	13.5	42	1.56	Marl	Marl	white	20 feet
Middle Fish Lake	2.5	6	1.19	pulpy peat		white	bottom
West Fish Lake	9.7	12	1.73	Fibrous peat		white	5 feet
Sutton's Pond	1.8	8	2.10	Fibrous peat		white	6 feet

The lakes vary in size from 13.5 (East Fish) to 1.8 (Sutton's Pond) acres. Maximum depths range from 42 feet in East Fish Lake to 6 feet in Middle Fish Lake.

Shore development, (the number of times longer the present shoreline is than if the outline of the lake were a perfect circle with the same area) varies from 1.19 (Middle Fish Lake) to 2.10 (Sutton's Pond). A high shoreline development is usually indicative of greater productivity in lakes since the irregular shorelines of such lakes afford protection for plant and animal life in the resultant bays and coves.

Only one of these lakes, East Fish Lake, could be called "deep". In the shallow water - less than 15 feet deep - in East Fish Lake, the dominant bottom type is marl. A delta of sand and organic debris is by the inlet at the southwestern part of the lake. In the waters over 15 feet deep, the dominant bottom type has been classified by Dr. Ira Wilson as marl, although the writer first classified it as pulpy peat. A combination of marl and clay was found in the small bayou on the east shore.

In Middle Fish Lake, fibrous peat was found around the edges of the lake, but a slightly greater area of the bottom was composed of pulpy peat.

In West Fish Lake, except for a small strip of sand and gravel on the northeast shoreline, all of the bottom above the five-foot contour line was composed of fibrous peat,while the central portion of the lake bottom was covered by pulpy peat.

In Sutton's Pond, the "shoals" (less than 5 feet deep) were almost entirely composed of fibrous peat, while the central deeper portions consisted of muck and organic debris.

Wave and ice action

Because these lakes are all situated in intermorainal depressions they are all rather well protected on at least two sides. Winds cause little wave action as a result of their location, with the exception of West Fish Lake, where there is a wave-swept beach composed of sand and gravel on the north

east shore. The bog mats on all of these lakes also help to cut down the effects of wave action.

West Fish Lake is also the only lake where there was any evidence of ice action, and here it appeared that it had pushed a small amount of the larger gravel particles shoreward, and occasionally broken off some of the portions of the encroaching shoreline.

Discussion of physical factors in relation to fisheries.

In general it may be said that the greater volume of water the more fish a lake is capable of supporting and hence the better possibilities for producing good angling. If such a condition exists particularly with a high shoreline development, that lake is more likely to be a good producer of fish life and fish foods, since there will be a greater variety of habitats for all stages in the life cycles of the fish and their foods. The color and transparency of the water determines the depth to which the light can penetrate. This in turn affects the abundance of submerged aquatic plant growth. Im the lakes under discussion, all the lakes except Middle Fish had some plants growing down to the limit of visibility of the Secchi disk.

Temperature and Chemical Characteristics.

Table III gives a tabular summary of the temperatures and chemical analyses on these lakes.

Table III.

Summary of temperature and chemical analyses on East, Middle and West Fish Lakes, and Sutton 's Pond in Montmorency County.

Item Depth ft.	Temperature (Fahr.)	O_2 (ppm)	CO_2 (ppm)	Methyl Orange Alkalinity (ppm)	pH	Remarks
East Fish Lake						
0	73.0	7.4	0.0	190.0	8.0	7/28/39 - 8:30 AM, air
6	72.5					
12	69.8					temperature 66° F, sky cloudy, light
15	67.2	8.5	0.0	192.0	7.8	
18	63.8					rain, wind light SW, preceding
21	55.4	9.2	0.0	200.0	7.8	
24	52.8					weather clear and hot
30	48.2	9.6	0.0	186.0	7.8	
33	47.8					
36	47.8					
40	46.6	9.5	0.0	201.5	7.8	
42 (bottom)	47.6					
Middle Fish Lake						
0	77.0	7.9	3.0	153.0	7.9	7/25/39 - 9:30 AM - Air temperature 90° F.
6 (bottom)	72.2	No sample-suspended sediments				sky clear, light east wind, preceding weather, clear and hot
West Fish Lake						
0	77.2	6.6	0.0	105.0	8.4	7/26/39 - 10 AM - Air temp. 74° F.
3	77.2					
6	76.0					sky partly cloudy, moderate SW wind, preceding
9	74.8	7.4	0.0	128.0	8.1	weather clear, hot
11 (bottom)	71.0					
Sutton's Pond						
0	72.2	6.7	4.0	99	7.7	8/1/39 - 10:30 AM - Air temp. 80° F.
1	71.4					
2	69.0					sky clear, moderate to heavy SE wind.
4	64.8					
6	63.2					preceding weather clear and hot
8	62.7	6.4	7.0	120	7.6	
8½ (bottom)	62.7					

[1] - Methyl orange alkalinity determinations by J. W. Leonard and Paul Barrett on East Fish Lake taken on Aug. 13, 1942.

Temperature

Thermal stratification was found in two of the four lakes, East Fish Lake, and Sutton's Pond. In East Fish Lake the thermocline (the region of rapid temperature change - i.e., where the drop in temperature exceeds 1.8 degrees F. for each 3 1/4 feet of depth) was found to exist between the 12 and 30-foot levels. In Sutton's Pond, a thermocline was in existence between the surface and the 6-foot contour at the time of the survey. Neither West Fish Lake nor Middle Fish Lake were thermally stratified.

Chemical conditions

The dissolved oxygen content, as determined at the time of the survey, was adequate to support fish life in all lakes at all depths. No determinations lower than 6.4 parts per million of dissolved oxygen (near the bottom of Sutton's Pond) were noted. Because of their comparative shallowness and also because of the composition of their bottom soils, and the absence of any water supply except surface drainage, it is possible that Middle and West Fish Lake might suffer winter-kill in winters with heavy snowfall as a result of oxygen depletion. However, East Fish Lake and Sutton's Pond probably never suffer "winter kills" because of the presence of inlets carrying oxygen-bearing water into these lakes.

Alkalinity and pH

In general the waters of these lakes would be classed as "moderately hard" to "hard", since their Methyl Orange alkalinity content varied from 99 ppm. to 201.5 ppm. The determinations for pH varied from a low of 7.6 (bottom of Sutton's Pond) to 8.4 (surface of West Fish Lake), indicating that all of the lakes are definitely of an alkaline nature.

Pollution

No pollution of any kind was noted in the survey of these lakes.

Discussion of temperature and chemical factores in relation to fisheries.

The presence of comparatively low temperatures at most of the depths in East Fish Lake and Sutton's Pond, together with the presence of adequate amounts of dissolved oxygen indicate that these two bodies of water are trout lakes. The presence of brook trout of all sizes at the time of the survey gives indesputable evidence of this.

West Fish Lake, on the other hand, has temperature ranges which are probably too high to safely support trout throughout the entire summer, as the bottom temperature was 71° F. with the surface at 77° F. at the time of the survey. Adequate amounts of dissolved oxygen were noted, however, so that it is very likely that bass and bluegills could survive there. A similar situation prevails as to Middle Fish Lake.

Biological Characteristics

Vegetation

A tabular summary of the species of plants collected and identified is presented in Table IV.

Table IV.

Summary of the species list of vegetation found in and along the immediate shores of East, Middle, West Fish Lakes, and Sutton's Pond.
(Identifications by Miss Betty Robertson).

(S=sparse, M=medium stand, D=dense stand; figures indicate water depth)

Common name	Scientific name	East Fish Lake	Middle Fish Lake	West Fish Lake	Sutton's Pond
Sedge	(Carex sp)	....	M-(shore)	....	S-(shore)
Sedge	(Carex rostrata)	....	.....	....	S-(0'-1')
Sedge	(Carex comosa)	....	.....	....	S-(0'-2')
Cladium	(Cladium mariscoides)	....	.....	M-(shore)	....
Mare's Tail	(Hippuris vulgaris)	S-(shore)	.....	....	M-(2'-6')
Buckbean	(Menyanthes trifoliata)	....	S-(shore)	....	S-(0'-2')
Yellow Water Lily	(Nuphar variegatum)	M-(2'-4')	M-(2'-4')	D-(0-3')	S-(3'-6')
Smartweed	(Polygonum natans)	....	.....	....	S-(0'-2')
Smartweed	(Polygonum pennsylvanicum)	....	.....	....	S-(0'-1')
Leafy pondweed	(Potamogeton foliosus)	....	.....	....	M-(1'-6')
Bass weed	(Potamogeton amplifolius)	D-(4'-10')	.....	....	....
Floating pondweed	(Potamogeton natans)	S-(4'-8')	.....	....	D-(4'-6')
Flat-stemmed Pondweed	(Potamogeton zosteriformis)	....	.....	....	M-(2'-8')
Marsh Cinquefoil	(Potentilla palustris)	....	S-(shore)	....	....
Crowfoot	(Ranunculus Gmelini)	....	.....	....	S-(0'-2')
Wapato	(Sagittaria latifolia)	S-(0-1')	.....	....	S-(2'-6')
Big Bulrush	(Scirpus acutus)	M-(0-2')	.....	....	S-(shore)
Willow	(Salix discolor)	....	.....	....	S-(shore)
Bur Reed	(Sparganium)	....	.....	....	S-(0'-2')
Cattail	(Typha latifolia)	....	.....	....	S-(shore)
Bladderwort	(Utricularia vulgaris)	S-(0-4')	.....	....	M-(2'-8')
Water Speedwell	(Veronica connata)	....	.....	.....	M-(2'-6')
Musk grass	(Chara sp.)	D-(3'-6')	.....	....	D-(1'-8')
Coontail	(Ceratophyllum demersum)	....	.....	....	M-(2'-6')

The greatest number of species was found in Sutton's Pond, and the next largest number of species was listed from East Fish Lake. Middle and West Fish Lakes supported a comparatively limited number of species, although those that were present were medium to dense in concentration.

In East Fish Lake, the dominant emergent form of vegetation was the Big Bulrush (Scirpus acutus), which was growing chiefly on the shoals along the north and east shores. The dominant floating plants were the Yellow Water Lily (Nuphar variegatum) and the Floating Pondweed (Potamogeton natans) which were to be found chiefly along the west shore near the inlet and to some extent near the eastern embayment. The dominant submerged aquatic plants, in their order of abundance were: Bass Weed (Potamogeton amplifolius), Musk grass (Chara sp), and Bladderwort (Utricularia vulgaris americana).

In Middle Fish Lake, the dominant emergent form was an unidentified species of sedge (Carex sp), and the only true aquatic plant was the Yellow Water Lily.

In West Fish Lake, the dominant emergent shore form was Cladium (Cladium mariscoides), a sedge-like plant, and the only truly aquatic plant noted was the Yellow Water Lily which occurred in moderate to dense beds around the entire shore line.

Some 21 different species of plants were listed from Sutton's Pond. The dominant emergent form was Mare's Tail (Hippuris vulgaris). The dominant floating plant was Floating pondweed, (Potamogeton natans). More submergent aquatic forms were noted here than in any of the other lakes, Musk grass (Chara sp) and Coontail (Ceratophyllum demersum), Bladderwort, and Leafy and Flat-stemmed pondweeds (Potamogeton amplifolius, zosteriformis), were found, and their abundance appeared to be in that order.

The beds of aquatic plants, particularly the submergent and floating types, are valuable to the general fisheries economy of a lake in that they furnish sanctuary to the younger, smaller fish, and also harbor insect and invertebrate food for fish of all sizes. Considering all related factors (such as shape of basin, bottom types, chemistry, etc.) it appears that all of the lakes except Middle Fish Lake, are supporting an optimum of aquatic plant life.

Fish Foods

Plankton samples were taken at the time of the survey, but no centrifuge tubes were available for volumetric determinations, nor were species determined as no microscope was available. Planktonic forms, visible to the naked eye, varied greatly in numbers in all four lakes.

The investigations on the bottom food organisms present are summarized in Table V.

Table V.

Summary of the number of bottom organisms found in the several habitats examined in East, Middle, and West Fish Lakes and Sutton's Pond. (Numbers in table indicate number of specimens found in 36 sq. inches of bottom taken by an Eckman dredge).

Organisms	East Fish Lake		Middle Fish Lake			West Fish Lake		Sutton's Pond
	42 feet pulpy peat	10 feet marl, (chara)	1 foot marl (chara)	6 feet pulpy peat	2 feet fibrous peat	2 feet fibrous peat (with pond lilies	11 feet pulpy peat	8 feet muck (chara)
Round worms (Nematoda)			2					
Earthworms (Oligochaeta)	1				3			
Water mites (Hydracarinadae)						2		
Midges (Corethra)				39			1	1
Midges (Chironomidae)	13	1	3			2		10
Crane flies (Tipulidae)	1							
May flies (Ephemeridae)			19		2			
Dragonflies (Anisoptera)			1		1			
Amphipods (Amphipoda)					10			
Caddisflies (Trichoptera)								1
Water worms (Tubificidae)								34
Total organisms	15	1	25	39	16	4	1	46

Only in West Fish Lake did there appear to be a scant bottom fauna, where only three species of insect life were found. In East Fish Lake, midges (Chironomidae) were numberous, while in shallow water, mayfly (Ephemeridae) nymphs were present.

In Middle Fish Lake, phantom midge larvae (Corethra) and scuds (Amphipoda) were the most numberous food organisms present. Water mites (Hydracarina) and midges (Corethra and Chironomidae) were the only species found in West Fish Lake. The sample from Sutton's Pond yielded fairly large numbers of water worms (Tubificidae) midges (Chironomidae).

Forage fish were found in numbers ranging from moderate to abundant in all of the lakes (see Table VI for species lists).

Fish Present

The species of fish present in the several lakes are shown in Table VI.

Table VI.
Summary table of numbers and species of fish taken by gill-netting and seining East, Middle and West Fish Lakes and Sutton's Pond Montmorency County, summer of 1939 (Size ranges of game fish are given in parentheses).

Item	Fish Lakes			Sutton's
	East	Middle	West	Pond
Game fish				
Brook trout (Salvelinus fontinalis)	13 (7½"-12")	...	...	11 (5"-10")
Yellow Perch (Perca flavescens)	5 (1"-7")	...	...	...
Northern Pike (Esox lucius)	...	...	4 (17"-22")	...
Coarse fish				
Common sucker (C. commersonnii)	3 (4")	2 (6"-13")	...	8 (5"-9")
Forage fish				
Northern dace (Margariscus margarita)	...	1	2	...
Red-bellied dace (Chrosomus eos)	...	177	46	117
Black-nosed shiner (Notropis heterolepis)	98	14	7	...
Common shiner (Notropis cornutus frontalis)	20	...	...	...
Fat-head minnow (Pimephales promelas)	...	4	11	...
Iowa darter (Poecilichthes exilis)	13	...	40	...
Brook stickleback (Eucalis inconstans)	...	5	...	6
Horny-headed chub (Nocomis biguttatus)	9	...	...	...
Creek chub (Semotilus atromaculatus)	10	...	...	1
Gill net hrs. expended	47	54	85	14
Area of lake seined	300 sq. ft.	100 sq. ft.	300 sq. ft.	500 sq. ft.

The only stocking record for these lakes between 1933-1939 was as follows: 1934 - "Fish Lakes" - Albert Twp. T-29N, R2E, sec 34, 210 yrlg. Brook trout which probably means they were planted in East Fish Lake.

Brook trout (Salvelinus fontinalis) were captured both by angling and by gill nets in East Fish Lake and in Sutton's Pond. Yellow perch (Perca flavescens) were found only in East Fish Lake. Northern pike (Esox lucius) were the only game fish taken in West Fish Lake. No species of game fish were netted or observed in Middle Fish Lake.

The only coarse fish observed or captured was the common sucker (Catostomus c. commersonnii), and this species was found in all except West Fish Lake. A comparatively abundant supply of minnows was found in all of the lakes. The red-bellied dace (Chrosomus eos) and the black-nosed shiner (Notropis heterolepis) were the species found in the greatest numbers.

No obnoxious species were found or were reported to have been in these lakes in recent times.

The only stocking recorded for any of the lakes between 1933-1939 was in 1934. According to the planting records 210 yearling brook trout were planted in "Fish Lake" T29N, R2E, sec. 34 in 1934. If the section number as given is correct, these fish were planted in East Fish Lake.

Creel census

No creel census data is available for West Fish or Middle Fish Lake. Intensive creel census records from East Fish Lake for the 1939 trout season show that 63 anglers fished 125.50 hours and caught 51 legal brook trout and 204 legal perch. A total of 68 undersized brook trout were returned to the water. The catch per hour of brook trout was 0.41 fish, of perch, 1.63 fish. The average size of the legal brook trout was 7.8 inches.

Sutton's Pond records for 24 anglers during the 1939 trout season indicate that 54.5 hours were spent in fishing, during which time 42 legal brook trout and 3 undersized brook trout were caught. The catch per hour of legal brook trout was 0.77 fish. The average size of the brook trout was 8.6 inches.

Growth rate of game species

The growth rate of the species of game fish found in the various lakes is summarized in Table VII.

Table VII.
Summary of the average total lengths (in inches) of the various age-groups of game fish in East Fish and West Fish Lakes, and in Sutton's Pond, summer of 1939[1]
(Number of specimens are given in parentheses).

Lake and species	Average total length at year of life. I	II	III	IV	V
East Fish Lake					
Brook trout	...	7.2 (19)	8.9 (3)	...	...
Yellow Perch	...	4.9 (4)	6.2 (5)	7.5 (9)	8.6 (1)
West Fish Lake					
Northern Pike	...	...	17.5 (1)	22.3 (2)	...
Sutton's Pond					
Brook trout	...	7.5 (10)	8.9 (7)	12.4 (2)	...

[1] Ages of yellow perch and northern pike were determined by W. C. Beckman, ages of brook trout were determined by W. C. Beckman and D. S. Shetter.

In addition to the samples obtained by gill-net, specimens taken by angling have been included in the growth rate study also.

In East Fish Lake, the average total lengths of the brook trout in the II and III age-groups are 0.2 and 0.6 inches less than the average size of fish of the same age from average Michigan brook trout water (Shetter, Institute Report 780). The yellow perch also appear to have grown at a slower rate than the average Michigan perch, as the average total lengths of the various age-groups were from 0.3 inches to 1.3 inches shorter than fish of the same age in the determinations of the state averages (Beckman, Institute Report 741).

The three northern pike found in West Fish Lake appeared to be growing at an average rate. There is some question as to whether or not West Fish Lake was always their home. Unverified reports were received to the effect that some time during the winter of 1938-39 a number of northern pike had been placed in West Fish Lake by unauthorized parties.

Brook trout, the only game fish living in Sutton's Pond, was growing at a rate close to, but slightly under, the state average (Shetter, 1942).

Natural propogation

Young game fish were present in East Fish Lake and in Sutton's Pond, as could be observed by angling, when one would take several undersized fish on almost any fishing trip. No young game fish were noted in either Middle or West Fish Lake, even though adult northern pike were taken in West Fish Lake.

Spawning facilities for the reproduction of yellow perch were adequate in East Fish Lake. The brook trout of this lake, however, appeared to have comparatively limited spawning facilities. They had to move either through the old beaver dam at the outlet into the outlet proper, or else migrate up the inlet as far as possible, and even then there was not a very large area of suitable gravel bottom available. Despite these apparent reproductive handicaps, the brook trout had maintained a fairly large population with almost no assistance from hatchery plantings.

The brook trout of Sutton's Pond are able to spawn on a fairly good sand and gravel bottom in the inlet about 200 yards above the lake.

Management Proposals

Designation of lake

East Fish Lake is at present designated as a "trout" lake, and should continue to be so designated.

Middle and West Fish Lakes are in the "all other lakes" classification and should remain there.

Sutton's Pond has not been classified heretofore, but on the basis of the survey findings, this body of water should be listed among the "trout" lakes

(open only between the last Saturday in April and Labor Day), inasmuch as the brook trout is the dominant species of game fish found there.

Stocking

East Fish Lake - Brook trout only are to be planted as requested by the Institute. (Five plantings of tagged or fin-clipped legal trout have been made in the spring and fall of 1940 and 1941, and in the spring of 1942. The results have already been reported on or are in preparation. See list of reports at the end).

Middle Fish Lake - Do not stock this lake. It is too shallow and too small to carry any number of game fish. It is suggested that this lake be opened for the taking of bait minnows by anglers or commercial minnow dealers. The bait fish could be secured in fair numbers by means of traps. No damage could be done inasmuch as no game fish are now present in this lake.

West Fish Lake - Physical, chemical conditions, and general habitat conditions would appear to be suitable for bluegills in West Fish Lake. A stocking of 3,000 fin-clipped four-five months old bluegills was suggested. (On November 1, 1940, 1900 bluegill fingerlings were planted in West Fish Lake after clipping the right pectoral fin. See report 635).

Sutton's Pond - No stocking of brook trout is recommended for this pond. Fishing pressure is comparatively light, and natural reproduction seems to meet the present angling demands of this small body of water. (In 1941, 200 adult Montana Grayling were placed in Sutton's Pond as an experiment chiefly to determine whether or not the grayling would reproduce in the inlet).

Predators and parasites

Casual observation of the fish collected revealed no great amount of parasitization. No detailed examinations of the viscera or muscles were made. An occasional kingfisher, bittern or blue heron was seen on all of the lakes, but no concentration of fish-eating birds was observed in the vicinity of any lake. No control measures appear to be needed.

Shelter

Weed beds appear to be adequate in all lakes at present. In addition there are a number of brush shelters in East Fish and West Fish Lake (installed about 1937 by C.C.C. camp Lundeen), plus a generous supply of beaver cuttings and "down" timber lying in and along the shores. The weed beds present in Middle Fish Lake and Sutton's Pond supply adequate shelter for the species of fish.

Regulation of water level

The water level of Middle and West Fish Lakes is determined by the amount of precipitation and the general ground water table level, and cannot be controlled.

In November 1941, an earthen dam with a wooden spillway was completed at

the site of the old beaver dam at the outlet of East Fish Lake. The water level has been kept between 12 and 18 inches higher than the 1939 autumn level in order to utilize the marl shoals as a bottom-food-producing area.

No attempts have been made to regulate the water level of Sutton's Pond, although the water level could be raised and controlled by the installation of a dam at the site of the present beaver dam. Whether the expense to increase the water level would be justified is debatable because of the comparatively light sport fishery prosecuted here. An increase of a foot in the water level would probably make several acres of fine duck marsh. However, the inlet might be ruined as a brook trout spawning stream if this were done.

Improvement of spawning facilities

The spawning grounds for brook trout in both East Fish Lake and Sutton's Pond could be improved by the installation of several cubic yards of washed gravel which should be a mixture of material varying in size from that of a pea to that of an egg. In the event that solid stream bottom cannot be reached, spawning boxes might be constructed from rough lumber 4 feet square and 18 inches deep with a bottom of 4-mesh-to-the-inch hardware cloth, and the gravel placed in these boxes. If a firm bottom is available the gravel can be spread between the banks over 15 to 20 feet of stream where there is a moderate current. However, since wild trout of various sizes have been caught in both lakes it is suggested that improvement of spawning grounds be deferred until the need for greater reproduction has been proven.

Note

Since the completion of the field work recorded in this report, certain management practices have been initiated on East Fish Lake and West Fish Lake. In addition to the suggested plantings which have already been carried out, East Fish Lake was poisoned during the period August 25-29, 1941 and a very large population of common suckers, yellow perch, and a large number of minnows was eliminated. A report on the population found at the time of the poisoning is in preparation. As far as the staff of the Hunt Creek Experimental Laboratory could determine during the 1942 trout season, the only fish now present in East Fish Lake are brook trout. A two-way fish trap has been installed at the outlet, and prevents any minnows from attempting to cross the present dam. Any future plantings of brook trout or other species in these lakes should be made only on special request to the District Supervisor of Fisheries Operation by the Institute for Fisheries Research.

Other Institute Reports concerning these Lakes.

Report 555 - Creel census on the Hunt Creek Fisheries Experimental area, 1939 trout season.

Report 635 - Report on the planting of bluegills in West Fish Lake, Montmorency County.

Report 644 - Creel census on the Hunt Creek Fisheries Experimental area, 1940 trout season.

Report 662 - Notes on the feeding habits of brook trout on East Fish Lake, Montmorency County, Michigan, Hunt Creek Experimental area, during the summer of 1940.

Report 816 - Sedimentary deposits of East, Middle and West Fish Lakes in Montmorency County, Michigan.

INSTITUTE FOR FISHERIES RESEARCH

by David S. Shetter

Report approved by: A. S. Hazzard

Report typed by: T. Maki