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EVALUATION OF BROOK TROUT PLANTINGS IN EAST FISH LAKE, MONTMORENCY COUNTY, MICHIGAN

By

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A THESIS

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I also extend my sincere appreciation to Dr. Karl F. Lagler for his firm guidance throughout all phases of this research, to Messrs. Gerald P. Cooper, Walter R. Crowe and Don W. Hayne for reading and criticizing the manuscript, and to Mr. W. L. Cristanelli who prepared the figure of East Fish Lake.

INTRODUCTION

Planting trout in suitable waters is a long established practice first begun in the United States by the State of Washington in 1866, and carried on primarily for two reasons: (1) to introduce the species into waters where they do not occur naturally, or where a catastrophe such as natural or artificial poisoning has destroyed the population; and (2) to maintain the population of trout either in a stream or lake at a high enough level to support a sport fishery. This report deals with the latter type of planting.

Trout plantings vary, and can be catalogued under two major headings, variations in the season in which the plantings occur and variations in the size of the trout when they are planted. Basic to any release of trout is the assumption the fish will survive to reproduce themselves in their new habitat, and/or will contribute directly to the anglers' catches, and that the planting procedure will enable the hatchery to operate with maximum efficiency to achieve the desired sport fishing.

The problem involved in this report is the determination of what planting procedures produce the best sport fishing on East Fish Lake. Should fingerling, sublegal or legal-length trout be planted? Should they be released in the fall, spring, or in the summer?

It is not easy to set up criteria for a satisfactory fishery because different opinions exist concerning the definition of the term. Some anglers are content with catching a fair number of trout, and are not overly concerned with big fish--this category envelopes the majority of fishermen. On the other hand, some fishermen want big fish and will fish for hours just

to land a trophy. The agency responsible for planting fish cannot provide trophy fish for each angler and must of necessity attempt to satisfy the majority of the people.

The measurement of a satisfactory harvest from the plantings discussed herein was made from comparisons of numbers of trout harvested by the anglers in relation to numbers planted, the pounds harvested compared with the pounds planted, and the distribution of the catch throughout the seasons that they were harvested.

The brook trout fishery on East Fish Lake was selected for this evaluation because the creel census records were complete from 1939 through 1955. Also, the lake has been examined periodically over the years for thermal and chemical changes which would tend to affect the fishery. Another important reason was the fact that the Michigan Department of Conservation has had complete control of the lake and its watershed. This fact tended to minimize any criticisms and pressures from the fishermen and gave the Department full control of experimental and management practices on the lake.

METHODS AND MATERIALS

From 1939 to 1948 a census clerk was stationed at East Fish Lake, or made periodic interceptive trips to the lake daily to interview all fishermen. The creel census records are thought to be complete, although an occasional fisherman may have been missed. After 1948, the fishermen were required to obtain a daily, free permit at a centrally located checking station and to present their catch for examination by the attending clerk.

Planting records were obtained from the Hunt Creek Station files and from the Michigan Department of Conservation Fish Planting Record.

Fish trap records, rough fish removal, and population study data were obtained from the Hunt Creek Station.

Spring population studies were attempted once on East Fish Lake but because of the immobility of the brook trout in the spring, and due to the paucity of netting sites along the steep dropoff and limited shoal area of the lake, the spring population studies were not successful.

In the fall, the brook trout actively seek out suitable spawning sites and are susceptible to capture in trap nets on the limited netting areas. The November-December population estimates of brook trout five inches and larger were calculated by the Schumacher and Eschmeyer modification of the mark and recovery method..

The 1948 to 1955 estimates were as follows:

Year	Number		Population Estimate
	Marked	Recovered	
1948	149	218	176
1949	114	35	244
1950	81	25	171
1951	145	87	217
1952	134	69	223
1953	512	253	833
1954	123	13	656
1955	566	156	1,298

When the analysis of the East Fish Lake fishery was first undertaken, the chief goal was the evaluation of the spring, fall, fingerling, sublegal-length, and legal-length plantings that would lead to generalized recommendations for stocking the lake. However, it was soon evident that no such comprehensive comparisons were possible because of statistical differences among the various types of plantings, e.g., spring planting harvests differed from each other, as did the harvests from the fall plantings. It was therefore necessary to treat each planting separately, then to choose representative members from the various groups for comparison.

EAST FISH LAKE

East Fish Lake is located in T. 29 N., R. 2 E., Sec's. 34 and 35 of Montmorency County in the northern lower peninsula of Michigan (Fig. 1). The lake is tributary to the Thunder Bay River--Lake Huron drainage via Fuller and Hunt creeks.

The lake is located at an elevation of 1,000 feet above sea level, and in a depression of one of the connecting lobes of the Port Huron moraine (Leverett, 1915), and appears to have been originally of the kettle or pit type.

In August of 1941 a dam was constructed across the lake outlet. Prior to the construction of the dam, the lake had a surface area of about 13.5 acres and a shore development of 1.56. The lake level was raised at this time to increase the shoal area for fish food production. Still, the shoal area remained small and the dropoff steep. In 1955 the lake had an average depth of 20 feet, a maximum depth of 41 feet, a surface area of 16 acres, and a shoreline development of 1.14 (from a I.F.R. 1943 survey map), indicating a roughly circular shoreline characteristic of an unproductive lake.

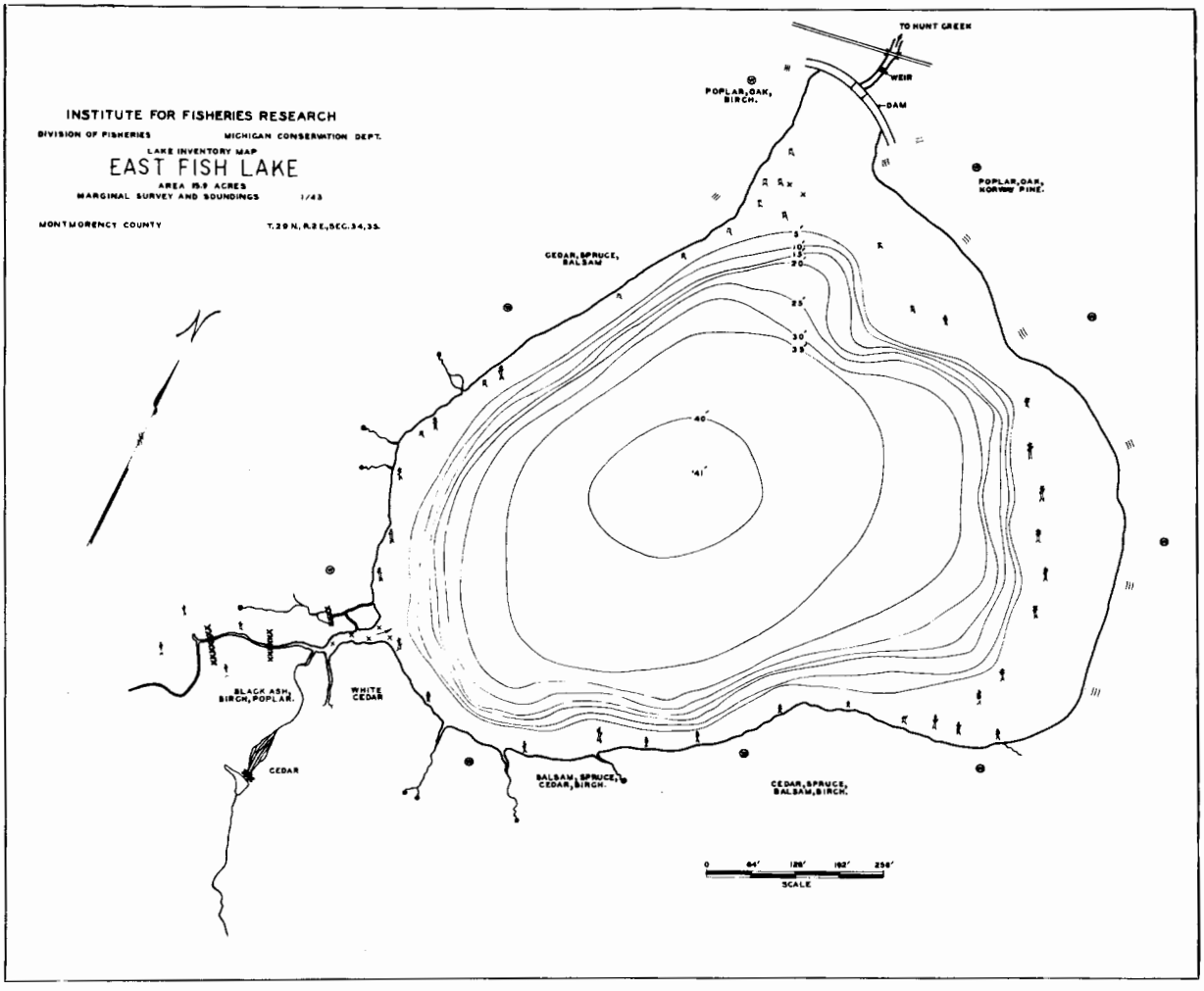
East Fish Lake has a permanent outlet that varies in width from 3 to 6 feet. The outlet is about 500 feet long and flows into Fuller Creek.

The lake receives its water from the main inlet at the southwest corner. This stream discharges about 2 c.f.s. of cold, clear water into the lake. In addition, eight major springs of varying sizes empty into the lake.

Thermally, East Fish Lake is a cold water lake. It stratifies in the summer and overturns twice a year. A survey in 1939 (Shetter, 1943a) revealed a thermocline between the 12- and 30-foot levels. Surveys in 1955

Figure 1.

East Fish Lake Inventory Chart


INSTITUTE FOR FISHERIES RESEARCH
DIVISION OF FISHERIES
MICHIGAN CONSERVATION DEPT.
LAKE INVENTORY MAP
EAST FISH LAKE
AREA 15.9 ACRES
MARGINAL SURVEY AND SOUNDINGS 1/43
MONTMORENCY COUNTY
T.29 N, R.2 E, SEC. 34, 35.
TO HUNT CREEK
WEIR
DAM
POPLAR, OAK, BIRCH.
POPLAR, OAK, NORWAY PINE.
CEDAR, SPRUCE, BALSAM
5'
10'
15'
20'
25'
30'
35'
40'
41'
BLACK ASH, BIRCH, POPLAR.
WHITE CEDAR
CEDAR
BALSAM, SPRUCE, CEDAR, BIRCH.
CEDAR, SPRUCE, BALSAM, BIRCH.
0
64'
128'
192'
256'
SCALE

and 1956 indicated stratification characteristics had not changed radically.

The dissolved oxygen content during the July, 1939 survey was adequate to support fish life at all depths. A survey in September, 1956, indicated that the deep water was uninhabitable at that time of the year because of oxygen depletion (1.4 p.p.m. at 30 feet).

The lake water is "hard." The 1939 survey results ranged between 190 p.p.m. methyl orange alkalinity at the surface to 202 p.p.m. at the bottom. The pH varied only 0.2 [illegible]. among 5 samples from surface to bottom.

The dominant emergent form of vegetation is big bulrush which grows chiefly on the shoals along the north and south shores. The dominant floating plants are yellow water lily and floating pondweed. They are found chiefly along the west shore near the inlet, and sparsely on the east side of the outlet bay. The dominant submerged aquatic plants are bass weed, musk grass, and bladderwort.

The high sandy lake shore is timbered with oaks, maples, aspens, red and white pines, alders, dogwood, wild cherries, birch, and stunted beech. The swamps to the south and east on the lake contain mostly tamarac, cedar, spruce, and some Balm-of-gilead.

The East Fish Lake area has never been the site of any industrial, home, or resort development. During this study, the lake was used only for angling for brook trout (Salvelinus fontinalis) and occasionally for duck hunting.

There was no erosion problem on the lake watershed, which is less than one-half square mile in area, and is composed of fourth-class soil on an area of the state which Veatch (1941) classified as north farming-resort-forestry soil. The above data are indicative of a typical Northern Michigan trout lake.

EAST FISH LAKE POISON TREATMENT

Leonard (1941), writing on the food habits of the East Fish Lake brook trout, stated that only 12 stomachs examined from a sample of 172 legal trout contained food. He suggested that unproductive, marly, East Fish Lake might produce more fish food (and probably more fish) if the lake level were raised a foot or two; and, if minnows and perch were eliminated, more invertebrate food organisms should be available to the trout. Leonard further stated that the production of trout in the lake might be increased by poisoning all rough fish and by adding gravel to the inlet stream to render it suitable for spawning. Further, to poison the lake without destroying the trout in the outlet streams, a dam would have to be constructed across the outlet channel to retain the toxic water in the basin until it was no longer lethal.

Consequently, the dam was built across the outlet in August of 1941 and the lake and inlet treated with rotenone by the Hunt Creek staff and other department employees. During the 16 days following the poison treatment, 406 pounds of fish were picked up from the lake. A minority of these fish were brook trout; the rest:

Common name	Scientific name
White sucker	Catostomus commersoni
Yellow perch	Perca flavescens
Iowa darter	Etheostoma exile
Grayling	Thymallus signifer
Mudminnow	Umbra limi
Stickleback	Eucalia inconstans
Pumpkinseed	Lepomis gibbosus

Smelt	Osmerus mordax
Creek chub	Semotilus atromaculatus
River chub	Hybopsis micropogon
Common shiner	Notropis cornutus
Golden shiner	Notemigonus crysoleucas
Blacknose shiner	Notropis heterolepis
Brassy minnow	Hybognathus hankinsoni
Northern redbelly dace	Chrosomus eos

The lake level was raised by two feet in November of 1941, and a two-way trap installed in the outlet.

The poisoning effected a complete kill of all yellow perch and probably all other fish except brook trout and creek chubs (Shetter 1943b). Native brook trout were taken by anglers the following year, so must have survived the poisoning. They could not have entered the lake through the outlet because of the fish trap barrier.

Creek chubs were taken by anglers during the 1943 season and were present thereafter. The white suckers regained entrance into the lake by 1948, when a 12-inch specimen was taken by an angler. Common shiners, brook sticklebacks, and northern redbelly dace were again present in 1950, but the dates of their re-entry are unknown.

FISH WEIRS

Shortly after the East Fish Lake outlet was dammed and the lake treated with poison, a two-way V-shaped fish trap was installed in the outlet to prevent the re-entry of rough fish. Migrating brook trout were manually transferred over the structure. The V-shaped trap was replaced with a one-way Wolf-trap in the spring of 1949, and thereafter no upstream immigration into the lake was possible. Downstream emigrants were tallied and returned to the lake.

V-shaped traps were installed in the inlet stream in October, 1944, to gain information on the extent of use of the stream by spawning brook trout. The traps were removed in November, 1948. Hunt Creek records indicate that the brook trout used the inlet for spawning until about 1948, then ceased to use it. The author's observations and electrofishing trips to the inlet from 1952 to 1956 suggest that a few fingerling trout remain in the inlet stream, but that it is little used by large native or planted brook trout even during the spawning season.

This, then, means that the brook trout under consideration in this study had free access to the inlet stream, that emigration was permitted through the outlet weir until the spring of 1949, and thereafter, the fish were returned to the lake. Table 1 indicates that no hatchery brook trout were observed leaving the lake, and migration does not enter into consideration in the evaluation of the hatchery brook trout fishery.

Table 1.--Migration of native brook trout through the East Fish Lake inlet and outlet, as recorded by fish trap captures[1]

Movement through the outlet stream

Year and direction	Jan.-March	April-June	July-Sept.	Oct.-Dec.	Total
1942-1948					
Exited	8	30(6)	7	72(3)	117(9)
Entered	42	166	56	102	366

Movement through the inlet stream[2]

1944-1947					
Exited	0	11	18	86	115
Entered	18	155	35	7	215

[1] Parentheses enclose the number of fish put back into the lake. No planted fish migrated.

[2] The trap was often not fish-tight.

FISHING REGULATIONS

Several changes in fishing regulations were made during the 16-year census period. All regulation changes were of a minor nature and were initiated to improve the sport fishery.

From 1939 to 1944 the daily legal limit was 15 trout. From 1945 to 1948 the creel limit was reduced to 10 trout, thereafter it was 5 trout. These changes were made in hopes of creating a better distribution of the catch among the anglers.

The minimum legal length was increased from 7 to 10 inches just before the 1951 season opened to permit the brook trout to mature before being harvested.

Between 1939 and 1947, the average trout season began the last Saturday of April and ended the day after Labor Day, an average season of 131 days. Thereafter, it began on the last Saturday in April, but ended on the second Sunday of September, an average season of 138 days. This ruling provided the fishermen with more time afield, yet did not interfere with the brook trout spawning, which begins in late September or early October.

Because of the numerous species present that probably were not native to the lake, and thought to have been introduced by the dumping of bait pails and unofficial plantings, the State Conservation Commission ordered that no live "minnows," Cyprinidae, Catostomidae, Cottidae, and Umbridae were to be used as bait. The Commission order was later changed to read no minnows, then to unlawful to use live fish for bait.

PLANTING RESULTS

1940 spring planting.--The second year of Department control over East Fish Lake was 1940. The lake at that time was heavily populated with perch, suckers, and other rough fish. In the season preceding 1940, anglers caught 51 brook trout in 126 hours on 63 fishing trips. To improve the 1940 catch, 250 legal-length brook trout (43.32 pounds) were planted in the lake on April 22, five days before the season began (Table 2). The average size of these fish was 7.7 inches and 0.173 pound, and the planting was at a rate of 20 per acre.

The 118 fish harvested from the planting were all taken the first summer after release. Table 3 lists the distribution of the combined catches by two-week periods. April contained three angling days during which 13 of the 31 fish caught were hatchery fish. In the following month, 105 of the 135 trout caught were hatchery trout. No 1940 spring-planted fish entered the catch in the following months of the 1940 season or thereafter. This planting made up 69 percent of the total catch that year, a valuable contribution to the fishermen's success. The fishermen removed 47 percent of the number and 41.8 percent of the pounds planted.

1940 fall planting.--The 1940 spring planting was followed by a planting of 243 legal-length brook trout (39.76 pounds) on October 26, at a rate of 19 fish per acre. The average size of these fish was 7.6 inches and 0.164 pound .

The 1941 season opened on April 26. By April 30, 94 percent of the trout from this planting that would be eventually caught had been harvested. This high rate of return early in the season was characteristic of all the legal-length plantings discussed in this report.

Table 2.--Stocking, harvest, and seasonal catch distribution data of the East Fish Lake, planted brook trout fishery

	Year planted												
	1940		1941		1942	1950	1951	1952		1953			1954
Date planted	Apr.22	Oct.26	Apr.11	Nov.15	Apr.6	Nov.6	Oct.-Dec.	Sept.	Nov.	Aug. Control	Aug. Trained		April
Days before season opened	4	...	16	...	22	...	...	...	...	...	...	...	...
Number planted	250	243	248	250	249	500	1,001	1,032	1,007	200	...	450	600
Number per acre	20	19	20	20	20	31	63	65	63	...	41	...	38
Pounds planted	43.3	39.8	54	46.4	61.3	5.7	9.3	10.9	80	...	99.3	...	83.1
Average length	7.7	7.6	8.5	7.9	8.7	3.6	3.1	3.1	5.8	...	8.1	...	7.1
Average weight	0.17	0.16	0.22	0.19	0.25	0.01	0.01	0.01	0.08	...	0.15	...	0.13
Catch													
1940	118												
1941	...	33	142										
1942	...	...	...	133	196								
1943-51	...	...	...	...	...								
1952	...	...	...	...	...	13							
1953	...	...	...	...	...	5	23		5				
1954	...	...	...	...	...	4	22	8	23	10		22	7
1955	...	...	...	...	...	2	1	7	1	2		4	20
Total caught	118	33	142	133	196	24	46	15	29	12		26	27
Percentage caught	47	14	57	53	79	5	5	1	3	6		5.8	5
Pounds recovered	18.1	5.6	29.4	32.1	54.1	15.2	23.1	7.4	11.0	5.3		12	14.8
Percentage of pounds planted	41.8	14.1	54.4	69.2	88.3	167.7	147.0	67.9	13.8		17.4		17.8

The drop in the catch from the October planting was drastic after April, and after June, no fish from this planting were caught. The total return was 33, or 14 percent of the 243 planted; and 5.63 pounds, or 14.2 percent return on the weight planted. Compared with the wild trout taken in 1941, the planted brook trout composed 32 percent of the catch. However, additional hatchery fish were planted in the spring of 1941, thus, of the total of 244 trout creeled that year, 14 percent were from the 1940 fall planting.

Shetter (1947) stated that records of planted fish in Michigan and elsewhere demonstrated that 13 to 88 percent of fall-planted brook and rainbow trout would be taken by fishermen. Further, the worst feature of the management program was the extremely high percentage of return, about 90 percent of the season catch, on the first two weeks of the season and by a small percentage of the total number of anglers who use the lake. Cooper (1948) in summarizing Michigan's stocking policies stated that legal trout liberated in small lakes give generally unsatisfactory results because of the fast removal for the first few days, followed by the remainder of the season when very few are caught.

1941 spring planting.--Another 248 legal-length hatchery brook trout (53.96 pounds) were liberated in the lake on April 11, 1941, at the rate of 20 fish per acre. The average size of these fish was 8.5 inches and 0.218 pound. Most of the fish (120) from this planting were also creeled early, during the first four days of April, 1941, when 85 percent of the 142 that would eventually enter the catch were caught. The May catch included only 18 fish, 3 in June, and only 1 during the remainder of the season. The planting produced 55 percent of the total catch of 244 fish that year, and 67 percent of the catch when combined with wild fish only. Fifty percent of the 248 brook trout planted and 54.4 percent of the 46.38 pounds planted were harvested.

Table 3.--Distribution of the catch of planted brook trout by 14-day periods, beginning with the season the fish first entered the catch

14-day periods	Fingerling plantings in the fall[1]			Legal-length planting in the spring[2]			Legal-length plantings in the fall[3]		
	Number recovered	Percentage of recovered fish	Percentage of fishing effort	Number recovered	Percentage of recovered fish	Percentage of fishing effort	Number recovered	Percentage of recovered fish	Percentage of fishing effort
1	17	20.0	41.7	377	82.6	55.7	156	94.0	62.8
2	5	5.8	6.1	55	12.1	12.3	1	0.6	5.2
3	5	5.8	4.5	8	1.8	7.7	1	0.6	4.3
4	2	2.4	5.9	4	0.9	3.5	4	2.4	4.6
5	4	4.7	9.2	6	1.3	2.9	1	0.6	4.1
6	2	2.4	6.7	3	0.7	7.1	0	0	8.5
7	0	0	4.6	1	0.2	5.3	1	0.6	4.7
8	2	2.4	2.5	0	0	3.6	2	1.2	3.7
9	2	2.4	10.0	2	0.4	1.9	0	0	2.1
10	5	5.8	8.8	...	...	...	...	...	...
Closed season									
11	27	31.7	39.0	...	...	...	...	...	...
12	1	1.2	7.0	...	...	...	...	...	...
13	1	1.2	5.1	...	...	...	...	...	...
15	1	1.2	9.6	...	...	...	...	...	...
17	1	1.2	5.8	...	...	...	...	...	...
19	2	2.4	9.1	...	...	...	...	...	...
20	1	1.2	9.1	...	...	...	...	...	...
Closed season									
21	5	5.8	42.3	...	...	...	...	...	...
31	2	2.4	54.9	...	...	...	...	...	...
Total	85	100	...	456	100	...	166	100	...

[1] 1950, 1951, and 1952 plantings
[2] 1940, 1941, and 1942 plantings
[3] 1940 and 1941 plantings

1941 fall planting.--By November the lake had lost its toxicity from the August poison treatment and 250 hatchery legal-length brook trout (46.38 pounds) were released at a rate of 20 per acre into the lake, a habitat supposedly devoid of competing species. The average size of the fish was comparable to past plantings, 7.9 inches and 0.186 pound. As in prior years, the majority of these fish were harvested during the first five days of the season when 93 percent were taken. The catch dropped to 2 fish in May, 4 in June, 1 in July, and 2 in the August-September period, for a total of 133 recoveries. Fifty-three percent of the fish planted were recovered and 69.2 percent of the 46.38 pounds planted were recovered--a very high rate of return for fall-planted legal-length fish. None of these fish entered the catch in following years.

Not all brook trout had been destroyed by the poison treatment as 34 wild fish entered the 1941 catch. The 1941 fall planting comprised 80 percent of the catch when combined with wild trout and 37 percent of the total catch. The remainder was composed of trout planted in the spring of 1942.

1942 spring planting.--On April 6, 1942, 249 legal-length hatchery brook trout (61.33 pounds) were placed in the lake at a rate of 20 per acre. The average size was 8.7 inches and 0.246 pound.

By April 30, five days after the season opened, 92 percent of the recovered trout had been taken. Again, after April 1, the catch was sharply reduced. By the end of the season 196 (79 percent) had been recovered, and 88.3 percent of the 61.31 pounds planted recovered. This was a high return. None entered the catch in following years.

1943 to 1950. No planting period.--Shetter (1943b) recommended that plantings of hatchery brook trout in East Fish Lake be stopped in order to determine whether the remaining brook trout could re-stock the lake sufficiently by natural reproduction in the limited areas provided in the inlet and outlet, and to determine the natural productive capacity of the lake.

No fish were planted in East Fish Lake between May, 1942, and November of 1950. The November planted fish did not enter the catch until 1952.

Angling on the lake fluctuated somewhat from 1942 to 1952 (Whalls and Shetter, 1954). From 1942 to 1945, the number of wild brook trout harvested increased from 34 to 169, and the average weight of the harvested fish increased from 0.20 to 0.88 pound. Catch per hour was satisfactory. The increase in the size and number was attributed to the probable beneficial effects of eradicating the perch and rough fish in 1941, plus the additional food available through raising the lake level. The free immigration of wild fish from the outlet stream possibly contributed to the catch in the early years following the poisoning (Table 1).

From 1946 to 1948, the catch of brook trout was relatively constant, but the average weight of the brook trout dropped from 0.75 to 0.49 pound. Angling was considered satisfactory. The creek chubs increased rapidly during this period, and white suckers entered the catch in 1948, and thereafter increased steadily. The rough fish had become a problem in the lake management.

The Hunt Creek staff began a rough fish removal program in 1954, netting the rough fish during their spring spawning migration into shallow water, and during the fall brook trout population studies. The rough fish removed from the lake were as follows:

Species	Year	Total removed	
		Number	Pounds
Suckers	1952	1,292	501
	1953	2,336	367
	1954	1,910	195 ↓
	1955	492	174
Chubs	1952	596	44
	1953	457	32
	1954	1,040	34 ↓
	1955	719	70

↓ 1,592 sampled. ↓ 678 sampled.

From 1952 through 1954, netting was at the same intensity, and effort was comparable. But in 1955, netting effort was reduced from lake-wide netting to the installation of one net on the only known spawning redd in the outlet bay (Whalls and Shetter, 1956).

From 1949 to 1952, the catch of wild brook trout decreased from 93 to 37 fish, and the average weight fluctuated from 0.82 to 0.61 pound.

A change from the legal minimum size of 7 inches in 1950 to 10 inches in 1951 reduced the number of brook trout theoretically available to the anglers, but the average length of the fish in the catch was always over 10 inches after 1944 (Table 4).

The regulation change in 1945 from a creel limit of 15 to 10 trout per day probably had little effect on the harvest except in 1942 as few anglers took more than five trout (Table 5). This regulation probably would have been most beneficial when the 1940, 1941, and 1942 hatchery fish were being harvested rapidly during the first two-week periods of the seasons following their release. It might have helped to distribute the catch among a greater number of anglers. In 1944, the year preceding the regulation change, no catches of five or more fish were made. From 1945 to 1947, five or more fish were caught on only 10 trips out of 1,210 trips.

The regulation change from 10 to 5 trout in 1948 probably had no affect on the total catch or the distribution of the catch in the following years. Only 14 out of 1,783 trips provided five brook trout in the years from 1948 to 1955.

1950 fall planting.--In November, 1950, 500 wild fingerling brook trout (5.69 pounds) were transferred from Hunt Creek to East Fish Lake to supplement natural reproduction and for experimental purposes (Whalls and Shetter, 1956). The average size of these fish was 3.6 inches and 0.01 pound.

Table 4.--Fishing statistics of legal-length brook trout from East Fish Lake

Year	Total trips	Fishing hours	Native brook trout						Planted trout caught	Total trout caught
			Number caught	Pounds caught	Catch per hour: Number	Catch per hour: Pounds	Average: Length	Average: Pounds		
1939	63	126	51	...	0.40	...	...	...	...	51
1940	111	308	54	...	0.14	...	...	...	118	172
1941[1]	156	386	69	11	0.18	0.03	7.4	0.15	175	244
1942[2]	159	289	34	10	0.12	0.03	9.1	0.29	329	363
1943[3]	121	200	68	26	0.34	0.13	9.3	0.37	...	68
1944[4]	311	651	105	79	0.16	0.12	11.2	0.75	...	105
1945[4]	436	928	158	131	0.17	0.14	11.9	0.83	...	158
1946[5]	430	935	92	69	0.10	0.07	11.5	0.76	...	92
1947[5]	344	711	89	54	0.13	0.08	11.1	0.61	...	89
1948[6]	287	853	113	56	0.13	0.07	10.4	0.49	...	113
1949[7]	287	1,040	93	71	0.09	0.07	11.5	0.76	...	93
1950	218	613	47	39	0.08	0.06	12.3	0.82	...	47
1951[8]	200	732	56	36	0.08	0.05	11.9	0.64	...	56
1952	174	596	25	16	0.04	0.03	12.3	0.65	13	38
1953	123	446	16	11	0.04	0.02	12.6	0.70	33	44
1954	264	940	7	4	0.01	...[9]	12.0	0.54	97	104
1955	230	902	2	1	...[9]	...[9]	11.0	0.48	37	38
Averages	230	627	63	41	0.10	0.06	...	...	...	110

1. Lake treated with poison in August. Two-way traps installed in outlet. Lake level raised about two feet.
2. Minnows as bait forbidden.
3. Inlet weir installed in October.
4. Creel limit changed from 15 to 10 trout per day.
5. Inlet weir removed.
6. Creel limit changed from 10 to 5 trout per day.
7. Wolf-trap replaced two-way traps in outlet. Permit system started.
8. Size limit changed from 7 to 10 inches.
9. Less than 0.005.

The return from this planting, unlike that of previous plantings, was distributed over a period of several years. They first entered the catch in 1952 and continued to enter the catch through 1955. Whereas the previous plantings were removed at a rate of 83 to 94 percent the first two-week period, this planting yielded only 38 percent; followed by a similar unevenly distributed return throughout the four years they entered the catch. Only five percent of these fish were removed by the fishermen, but from the 5.69 pounds planted, 15.23 pounds were harvested, or 168 percent increase over the planted weight.

The 1950 planting composed 34 percent of the total catch in 1952, 10 percent in 1953, 4 percent in 1954, and 5 percent in 1955, thus increased the four year catch from 205 to 229 fish.

1951 fall planting.--During October, November, and December of 1951, 1,001 wild fingerling brook trout (9.34 pounds) were collected from Hunt Creek by electrofishing and transferred into East Fish Lake. These fish had an average size of 3.1 inches and 0.01 pound. Some of the fish reached the minimum legal-length of 10 inches in 1953 and began to enter the catch. They entered the catch from 1953 to 1955, and were similar to the 1950 planting in distribution of returns as only six percent entered the catch on the opening two-week period following their release. The greatest number was caught in the two-week period following the opening of the 1954 season when 17 (37 percent of the total recovery) fish were creeled.

Twenty-three fish from the 1951 planting entered the 1953 catch, and comprised 47 percent of the total catch. In 1954, almost as many (22) were caught, but made up only 21 percent of the total catch because brook trout from plantings made after 1951 had begun to come into the catch. Only one fish from this planting was caught in 1955, or three percent of the total catch.

The total weight of the 1951 planting was 9.34 pounds. By the end of the 1955 season, 23.08 pounds had been harvested, an increase of 148 percent over the amount planted.

1952 fall wild fingerling planting.--A planting of 1,032 Hunt Creek brook trout (10.89 pounds) transfers were planted in the lake together with 1,007 hatchery-reared brook trout to compare the survival and return to the creel of the two groups. However, these two groups were not of comparable size at the time of planting; the Hunt Creek transfers averaged 3.1 inches in length and the hatchery fish averaged 5.8 inches in length. Because of the difference in average length, a differential mortality existed between the two groups from the time of planting until the time they began to enter the catch. The average hatchery fish had only to grow 4.2 inches to reach the legal catchable size, while the transfers had to grow 6.9 inches. The period of natural and hooking mortalities was therefore greater for the Hunt Creek transfers.

According to the work on hooking mortalities by Shetter and Allison (1955) trout under a 10-inch size limit are vulnerable to hooking mortality, possibly, into the fourth summer of life. "The longer a fish is subject to hooking mortality the less chance there is that he will survive to reach the angler's creel." Shetter and Allison found that 42.37 percent of the brook trout caught by worm-baited hooks die, and that 3.31 percent of all brook trout hooked on flies in natural streams die.

There was no evidence to support a hypothesis that the mortality rates were different in East Fish Lake. The fly-caused mortality possibly was the same. On the other hand, a brook trout hooked on live bait in the lake was usually at a greater depth than would be found in a stream, and this probably resulted in a lethally swallowed hook more often than in a stream.

Table 5.--Frequency distribution of the number of angling trips on which 0 to 15 brook trout were caught

Year	Number of brook trout caught per trip and percentage of total trips							Total number of trips
	0	1	2	3	4	5-10	11-15	
1940	51	17	9	5	4	13	1	111
1941	58	15	7	2	5	9	4	156
1942	54	17	9	3	2	4	11	156
1943	63	20	12	3	0	2	0	121
1944	78	15	5	2	0	0	0	311
1945[1]	77	13	6	2	1	1	...	436
1946	85	9	4	0	1	1	...	430
1947	86	8	4	1	0	1	...	344
1948[2]	80	11	4	2	1	2	...	287
1949	81	11	5	2	1	0	...	287
1950	86	9	2	1	1	1	...	218
1951[3]	84	10	3	1	0	2	...	200
1952	87	5	7	1	0	0	...	174
1953	80	9	6	2	2	1	...	123
1954	74	19	5	2	0	0	...	264
1955	89	7	3	0	1	0	...	230
Averages	76	12	6	2	1	2	1	240

[1] Creel limit reduced from 15 to 10 trout per day.

[2] Creel limit reduced from 10 to 5 trout per day.

[3] Size limit increased from 7 to 10 inches.

Whatever the cause; differential mortality either by hooking or natural factors, such as predators or space and food competitors, or the wild and hatchery backgrounds of the two groups; they differed in planting and harvest statistics so will be treated separately.

The average size of the 1,032 fingerling brook trout transferred from Hunt Creek in September of 1952 was 3.1 inches and 0.01 pound. They did not enter the catch in 1953, but eight were caught in 1954 and seven in 1955. The entire catch for the two years amounted to only one percent of the number planted, indicating an unusually high mortality. Only 7.42 pounds of these fish were caught, or 68.1 percent of the poundage planted. They entered the catch in low numbers in 1954; one each in April, May, July, and August, and four in June, and accounted for eight percent of the catch that year. In 1955, six were caught the first day of the season, one in August, but no others. Because of the low number of fish harvested (39) that year, they made up 18 percent of the total catch.

1952 fall sublegal-length planting.--The 1,007 sublegal-length hatchery brook trout (80 pounds) planted in November of 1952 were 5.8 inches and 0.08 pound average size. Five of these fish entered the catch from July through September of the 1953 season; they made up 10 percent of the total catch. The greatest number were taken during the opening two-week period of the 1954 season, to make up 22 percent of the total catch. Only one was caught in 1955, to make up three percent of the total catch. Six percent of the number and only 13.8 percent of the poundage have been recovered.

1953 summer planting.--In August of 1953, 650 control and conditioned sublegal-length hatchery brook trout (99.25 pounds) were planted in East Fish Lake by Psychological Research Services, Inc. (PRS). The primary purposes of the PRS planting in East Fish Lake and other waters of Michigan

were to determine the kind and amount of conditioning needed to make hatchery trout more successful in adapting to natural feeding, to the use of natural shelter, and in avoiding natural predators and anglers after planting. Shetter and Cooper (1957) analyzed the creel returns of the 1953 PRS control and conditioned trout from East Fish Lake. They found that the numerical differences in gain or loss to the creel of control and conditioned fish had a probability of 83 percent that the differences were significant, as determined by the Chi square test. The authors stated, "Probabilities of less than 95 percent are generally not regarded as conclusive."

Table 42 of Shetter and Cooper's report indicated that there was no difference between the proportion of returns from control and conditioned brook trout. The same report gave evidence that the spread or distribution of the catch was not different. For these reasons the control and conditioned trout are discussed as a unit for the purposes of this report.

The average size of the 1953 PRS planting was 8.1 inches and 0.15 pound. The average fish was 1.9 inches under the 10-inch minimum size limit when planted. This planting was made on August 26, after 124 days of the 142-day season and the majority of the fishing effort were past. None were taken by the fishermen in 1953. Three were taken the opening week of 1954, and they continued to enter a catch throughout the season. Thirty-two were taken in 1954. Thirty-one percent of the total catch (102) that year were from the 1953 planting. In 1955, six were caught on the opening day of the season, and no more were taken later. The total catch was low in 1955 (39 fish) so the few returns from the 1953 planting made up 18 percent of the total catch.

Thirty-eight of the 650 fish planted were recovered, or six percent. Likewise, the harvest of poundage was low; only 17.5 percent of the 99.25 pounds released.

1954 spring planting.--In April 1954, PRS planted 600 sublegal-length control and conditioned hatchery brook trout (83.10 pounds) in the lake. Shetter and Cooper's paper on the creel returns from this planting indicated that the gain or loss in numerical returns to the creel was not significantly different for conditioned and control fish, nor was the distribution of the catch different but the proportion of returns to the creel for the control and conditioned fish was significantly different for the most highly trained groups -- less trained fish than control fish were caught. There also were significant differences in the harvest between the conditioned groups.

The differences in return to the creel were partly the result of differences in the lengths of the control and conditioned fish at the time of planting. The average control fish weighed 0.139 pound, while the conditioned fish weighed from 0.122 pound to 0.141 pound. No data on individual lengths of the two groups of fish were collected, thus the average length figure of 7.1 inches (Table 2) is a composite for the entire group.

Because complete length data was lacking for the separate groups of this planting, because of differences in their lengths when planted (inferred from weight data), and because of the significant difference in the return to the creel of the two groups, combining the groups was not statistically valid. The data for the conditioned fish could be excluded and only the control fish data used, but, because the lengths or average length of the control fish was unknown, it was thought best to exclude an evaluation or comparison altogether. Shetter and Cooper give more detailed coverage of all PRS trout returns.

COMPARISON OF LEGAL-LENGTH PLANTINGS

1940 spring vs. 1941 spring plantings -- The harvest from the 1940 spring legal-length planting was inferior to that of the 1941 spring legal-length planting. The comparison of numbers harvested from the two plantings gave a Chi square of 4.64 (d.f.,1), indicating that the returns were statistically greater from the 1941 planting (Table 6). A greater weight recovery was also obtained from the later planting.

The distribution of the catch through the 1940 and 1941 seasons was essentially the same, 60 percent of the harvest from the 1940 spring planting and 88 percent of the harvest from the 1941 spring planting were taken the first two-week period of the season. The second two-week period of 1940 accounted for another 39 percent of the harvest of the 1940 spring planting, while during this second two-week period the percentage of the harvest of the 1941 spring planting dropped to six percent. Returns thereafter were low for both groups.

The evidence available indicated that one possible cause for the greater harvest of the 1941 spring planting was the advantage had by the 1941 spring planted brook trout due to their larger average size. The average 1941 spring planted brook trout was 0.8 inch longer and 0.045 pound heavier than the 1940 spring planting.

Burdick and Cooper (~~1946~~ 1956) found that rainbow trout 3.1 and 3.6 inches survived 5.8 to 18.3 percent better than rainbow trout from 1.2 to 2.3 inches (0.3 to 1.7 percent) in Weber Lake, Wisconsin. Grecy Lake, New Brunswick (Smith 1956), yielded higher numerical returns from yearling brook trout than from fingerling brook trout. From 8,893 yearling trout planted 41 percent were harvested, and from 87,675 fingerlings planted, 16 percent were harvested. Smith's work

included plantings on the lake from 1944 to 1954. Although the East Fish Lake plantings compared in this instance did not differ in size as much as the Weber and Crecy lakes trout, it seemed reasonable to conclude that the difference in harvest was in part due to the size differences.

There was one more factor involved which may have affected the harvest. The brook trout planted in 1940 were planted four days before the season opened and those planted in 1941 were released 16 days before the season opened. (Table 2) There appeared to be a relationship between the number of fish harvested and the number of days that had elapsed between the time of release and the opening of the fishing season. The data suggest that a planting released in the spring well ahead of the season was harvested in greater numbers than one released just before the season opened. This relationship, if any, probably does not affect fall releases.

1940 spring planting vs. 1942 spring plantings -- The data indicated an obvious numerical difference in the harvest from the 1940 spring legal-length and 1942 spring legal-length planting. The harvest from the 1942 spring planting was vastly superior to that from the 1940 spring planting. Likewise, a greater poundage harvest was harvested from the 1942 plantings. In both years, the majority of the brook trout recovered were harvested in the first two-week period of the season, 60 percent from the 1940 planting and 88 percent from the 1942 plantings. The returns from the 1942 planting dropped sharply to six percent in the second two-week period, and to 39 percent for the 1940 planting. Recoveries from either planting were practically nil after 28 days.

The cause of the difference in harvest from these two plantings appeared to be the result of the effects of the lake treatment in 1941, when the lake water was treated with poison and the lake level raised. Whereas the brook trout released in 1940 had to compete with other fish in a limited area, the brook trout released in 1942 had no interspecific competitors. The brook trout from the latter release supposedly had more shelter and food provided by the raised lake level.

The brook trout planted in 1940 were released four days before the season opened, again suggesting that spring plantings released several days before the season opens enter the harvest in greater numbers. The size differential between the two plantings may also have contributed to the unequal harvest.

1940 fall vs. 1941 fall plantings -- The harvests from the legal-length brook trout planted in the fall of 1940 and 1941 were significantly different (Chi square, 84.80; d.f., 1).

A series of Chi square comparisons between the harvested fish planted in 1940 and 1941 revealed that the method of marking the 1941 planting had no relationship to the numbers harvested, that the method of marking accompanied a differential return from the 1940 planting--more fin-clipped fish were recovered, that the harvest of the jaw-tagged fish was greater from the 1941 planting than from the 1940 planting, and that the harvest of fin-clipped fish was greater from the 1941 planting than from the 1940 planting.

Only 14 percent of the 243 brook trout planted in the fall of 1940 were recovered, whereas 53 percent of the 250 brook trout planted in the fall of 1941 were recoverd. The poundage harvested varied greatly between these plantings (Table 2). The opening two week period of the

season following the planting of both groups accounted for 94 percent of the recovered fish from both plantings.

The probable cause for the differential harvest was the greater overwinter survival of the 1941 fall planted fish, which was related to the absence of interspecific competitors in the lake following treatment with poison in August of 1941. The average size of the brook trout in the two plantings was similar

1940 spring vs. 1940 fall planting -- The harvest from the 1940 spring legal-length planting was vastly superior to the 1940 fall legal-length planting. A comparison of relative numbers harvested yielded a Chi square of 63.94 (d.f.,1). and indicated a real difference in returns of the two groups. Weightwise, the spring-planted fish provided the largest harvest.

The harvest distribution by the anglers was quite similar to that listed in Table 3. Sixty percent of the spring and 94 percent of the fall harvests were completed in the first two-week periods. During the second two-week period 39 percent of the spring and 3 percent of the fall harvests were taken. Thereafter each planting yielded only one more fish, and during the same season following planting.

The average lengths of the two plantings were probably not different, and the average weights of 2.8 and 2.6 ounces were quite similar. Each group of fish was handled in the same manner prior to planting, so the only major difference existing between the two groups was the season of planting, spring and fall. Whereas the spring planted fish were subjected to possible mortalities and environmental pressures for only five days before they became available to the anglers, the fall planted fish had to overwinter in the lake in competition with the other brook trout, perch, and abundant rough fish.

Shetter and Hazzard (1941), Wales (1946), Smith (1947), Shetter (1947), Thorpe, Rayner, and Webster (1947), Greene (1952), Miller (1952 and 1954) and Nielson, Reimers and Kennedy (1957) were all in agreement that mortalities were high in trout overwintering in lakes and streams.

Smith found that brook trout planted in the fall produce a lower harvest than spring planted trout. Miller, who worked with both wild and hatchery-reared cutthroat trout in Gorge Creek, Alberta, found low overwinter survival. Greene studied overwinter survival of both wild and hatchery-reared fingerling brook trout in Stillwater Pond, New York and found that difference in overwinter survival could be attributed to differences in hereditary background.

Overwinter survival in lakes is superior to overwinter survival in streams (David 1939), but in both habitats, spring planting produced more trout for the angler. The causes of the differential survival have not been intensively investigated, especially in lakes.

1941 spring vs. 1941 fall planting -- The harvests from the 1941 spring and fall legal-length plantings were not significantly different; which was in contrast to the 1940 spring and fall legal-length plantings. The returns from these two plantings, fortified with the data from the 1940 and 1941 fall plantings, demonstrate that a fall planting in a lake recently treated with poison was comparable to a spring planting in survival to the creel, and that the high survival rate probably was due to the effects of competitor removal.

COMPARISON OF FINGERLING PLANTINGS

1950 fall vs. 1951 fall plantings -- The harvests from the 1950 fall fingerling and 1951 fall fingerling plantings were not different.

Five hundred wild brook trout in 1950 and 1,001 wild brook trout in 1951 were transferred from Hunt Creek to East Fish Lake. In each case, 5 percent of the number planted were later harvested. An outstanding feature of these plantings was the relationship of the poundage of fish planted to that harvested. Of the 5.69 pounds planted in the fall of 1950, 268 percent were harvested by the anglers in subsequent years, and 248 percent of the 9.34 pounds planted in 1951. Although numerical survival was low for both groups, growth compensated somewhat for the numerical loss.

Another point at which the fingerling harvests differed from the legal-length plantings was the distribution of the harvest. Whereas the legal-length brook trout were captured in large numbers during the first two-week period of the season and completely harvested after the first season, the fingerlings were taken in lesser numbers during the first two-week period (Table 3) and entered the catch for more than one season.

The harvest of the 1950 planting was 38 percent complete after the opening two-week period of the 1952 season, when they first entered the catch. Thirteen were caught in 1952, five in 1953, four in 1954, and two in 1955. The 1951 planting was smaller in length when planted so did not enter the catch in great numbers in the first two-week period of 1953, when 13 percent were taken. The following year 37 percent of the total harvest was taken in the first two-week period. The 1951 brook trout entered the catch for three seasons: 23 in 1953, 22 in 1954, and one in 1955. J. H. Wale's (1946) work on Castle Lake

demonstrated that brook trout fingerling plants contributed to the catch the first year but were removed after two years.

The data for the 1950 and 1951 fingerling harvests were not different and are combined in the following comparisons. The similarity between the two plantings indicated that to obtain the greater numerical harvest from fingerling plantings in East Fish Lake, 1,000 rather than 500 should be planted.

As was mentioned earlier, rough fish again flourished in the lake as early as 1943, so then, the brook trout from the 1950 and following plantings were engaged in inter- and intraspecific competition.

1950-1951 fall vs. 1954 fall fingerling plantings -- The wild fingerling brook trout transferred to East Fish Lake in the fall of 1954 were planted during the period from 1950 to 1955 when the estimated fall population of wild and planted brook trout in the lake was increased from 171 to 1,498 fish. At the same time, the rough fish population was probably increasing or near its maximum density.

The comparison of the 1954 wild transferred and the 1950-1951 wild transferred brook trout harvests indicated a significant difference (Chi square 18.45; d.f.,1). Only one percent of the 1,034 fish planted were recovered by the end of the 1955 season. The recovered fish had increased in size and with only 15 of the 1,034 fish recovered 68.1 percent of the 10.89 pounds planted were recovered. These recovery data are much lower than for the 1950-1951 plantings. The low return from this planting was attributed to increased inter- and intraspecific competition.

The distribution pattern of the catch during the 1954 and 1955 seasons was similar to the 1951 fingerling harvest distribution.

COMPARISON OF SUBLEGAL-LENGTH PLANTINGS

The only sublegal-length plantings in East Fish Lake occurred in the fall of 1952 and in the late summer of 1953. The two plantings were not comparable in that the fish in the 1953 planting were of a larger average length (8.1 inches) than that of the 1952 planting (5.8 inches). Also the 1952 planted fish overwintered in the lake before becoming available to the anglers the following season, while the 1953 release were subjected to the anglers' fish hooks immediately after release. That some hooking mortalities occurred was noted by the author and the Hunt Creek staff.

The numerical returns from the 1952 and 1953 hatchery sublegal-length brook trout release were low and similar to the numerical return from the fingerling planting (Table 2). Poundage-wise, the harvests were inferior to all other plantings except the 1940 fall legal-length planting. The two plantings in the sublegal-length category most likely suffered subnormal survival because of the crowded condition of the lake from 1953 through 1955. There were enough unmeasured variables influencing the harvests from the 1952 and 1953 sublegal-length plantings that no generalization on the relative merits of a sublegal-length planting compared to a legal length, or fingerling plantings could be made. The data indicate that the planting of sublegal-length brook trout in August provided a better harvest than the planting in November of 1952.

COMPARISON OF LEGAL-LENGTH AND FINGERLING PLANTINGS

1940 fall vs. 1950-1951 plantings -- The 1950-1951 plantings of fingerling brook trout was thought to be typical for fall-planted brook trout because the conditions under which they were planted were more or less normal, e.g., inter- and intraspecific competitors were present, the lake was good trout habitat, and was easily accessible to fishermen.

The 1940 fall planting was chosen to represent the legal-length fall planting because it was the only one that approached normalcy. The only other planting, 1941, was released in a competition-free habitat.

The numerical return from the 1940 fall planting was superior to the 1950-1951 harvest (14 percent vs. 5 percent), but the poundage returned and the distribution of harvest was superior for the 1950-1951 plantings. The major difference occurred in the poundage returned, being greater for the 1950-1951 plantings. Whereas the harvest from the 1940 planting was complete after one season, the harvest from the latter planting was spread over a four-year period.

The only conclusion was that the fall plantings of fingerlings produced a superior harvest to the fishermen.

1941 spring vs. 1950-1951 fall plantings -- Either the 1940 or 1941 spring planting of legal-length trout could have been chosen for comparison with the 1950-1951 fall fingerling plantings; and, although the two spring plantings differed in numerical returns (Chi square 4.64; d.f.,1), the variation in return may be considered an example of the variation in harvest returns that occurs even when factors such as average size and time of planting are rigorously controlled. The causes of such variations in harvest are generally unknown.

Table 6.--Numbers of Planted Brook Trout Caught and Not Caught, Chi square values

	Year Planted								
	1940		1941		1942	1950	1951	1952	
Season	Spring	Fall	Spring	Fall	Spring	Fall	Fall	Fall	
Source	Hatch-ery	Hatch-ery	Hatch-ery	Hatch-ery	Hatch-ery	Hunt Creek	Hunt Creek	Hunt Creek	Hatch-ery
Number Caught	118	33	142	133	196	24	46	15	29
Not Caught	132	210	106	117	53	476	955	1,017	978
Total	250	243	248	250	249	500	1,001	1,032	1,007

Chi square comparison for certain of the above plantings for significant differences in harvest. A Chi square value greater than 3.84 indicates a significant difference at the 5% level of confidence.

Plantings	1940 Spring	1940 Fall	1941 Spring	1941 Fall	1950 Fall	1950-51 Fall	1952 Fall
1940 Fall	63.94					28.35	
1941 Spring	4.64						
1941 Fall		84.80	0.67			487.91	
1942 Spring			25.30	35.01			
1951 Fall					0.002		
1952 Fall Hunt Creek						18.45	
1952 Fall Hatchery						4.60	87.89

Either planting compared to the 1950-1951 planting would give very similar results.

It was evident that the numerical returns from the 1941 spring planting was far superior to the 1950-1951 returns. But here again, the poundage returned and distribution were superior for the fingerling plantings (Table 2).

Which of these two groups provided the best catch was a difficult question to answer. If the fishermen were primarily interested in catching large numbers of trout, then probably the spring planting provided the best harvest. If naturally produced poundage was the chief criterion of a successfully harvested planting, then the fall fingerling plantings must be judged the best. Under suitable conditions both of these planting practices may be necessary and justifiable.

RECOMMENDATIONS FOR FUTURE PLANTINGS

The fish plantings in East Fish Lake should continue to center on experimental plantings of brook trout. Management-type plantings, per se, should play a minor part in the lake.

The data enumerated in this report indicate that a more concrete, long-range plan for the experimental plantings in East Fish Lake should be formulated and executed. A single type of planting, such as 1,000 fall-planted, hatchery-reared, legal-length brook trout, should be liberated annually for a period of five years, or until the data indicated that the harvest was not being significantly affected by some unknown natural phenomena, then the planting schedule changed to another planting such as 1,000 fall planted, hatchery-reared, sublegal-length brook trout, which in turn should run for a period of another five years. Needless to say, when plantings such as the 1952 fall planted, wild and hatchery, fingerlings are to be tested for comparable survival, all factors, other than the one to be tested, such as size and method of marking should be essentially the same. Comparable sizes could be obtained by obtaining the hatchery fish first, calculating their length range and mean, then going to the stream and electrofishing for comparable wild brook trout.

Fall population estimates begun in 1948 will make possible a more accurate evaluation of survival from the planting. Also of undoubted assistance in evaluating the fate of the planted fish, would be more accurate detailed population estimates of the number of fish not harvested from each planting surviving from season to season and the determination of their eventual fate. If adequate money and netting techniques were available, a spring population estimate would be helpful.

SUMMARY

1. Plantings of legal-length brook trout in the spring resulted in a fair numerical harvest, poundage returns were low, most of the fish were harvested during the first two weeks of the fishing season, and no overwinter survival occurred.

2. Plantings of legal-length brook trout in the fall resulted in high overwinter mortalities and a low numerical and poundage harvest, except after the lake was treated with poison, when overwinter survival and harvest were comparable to a spring planting. Here, too, the majority of the fish were harvested during the first two weeks of the season following planting.

3. Removal of inter-specific competitors from the lake caused increased overwinter survival of planted brook trout.

4. During the period from 1943 to 1950 no brook trout were planted. The fishing for native trout was considered satisfactory until 1948 when the presence of rough fish in increasing numbers caused a decline in the fishing.

5. The fall fingerling plantings of 500 wild brook trout in 1950 and 1,001 wild brook trout in 1951 produced comparable returns. The poundage recovered was much greater than the pounds planted, but the numerical harvest was low. The harvests were distributed over three and four year periods.

6. The wild fingerling planting in the fall of 1952 yielded a poor harvest, possibly because of increasing competition from rough fish and other brook trout.

7. The harvests from the sublegal brook trout planted in the fall of 1952 and summer of 1953 were numerically similar to the numerical returns from the fingerling plantings, but the poundage recovered was inferior.

8. Spring plantings of legal-length brook trout provided a greater harvest than fall planted brook trout.

9. Legal-length plantings provided a larger numerical harvest and fingerling plantings provided the largest poundage gain in harvest. Both types of plantings are acceptable management practices.

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ABSTRACT

Hatchery-reared brook trout of legal-length when planted in the spring provided a fair numerical harvest. Fewer pounds of fish were harvested than were planted. The majority of the brook trout that entered the catch were creeled by the fishermen the first 14 days of the season following planting. There was no survival to the second fishing season.

Hatchery-reared brook trout of legal-length when planted in the fall suffered high overwinter mortalities, entered the catch in small numbers, the poundage return was low, and none survived to the following season.

Removal of competitors from the lake by treatment with poison resulted in increased overwinter survival of fall planted trout and, in general, increased the survival and harvest of fall and spring planted brook trout.

Following the treatment of the lake with poison, the re-entering rough fish increased in numbers from 1943 to 1953 and contributed to the decline of the brook trout fishery.

Planting 500 and 1,001 fingerling brook trout produced a similar harvest. In each case the numerical returns were low, but poundage harvested was greater than the poundage planted. These fish entered the harvest for more than one season.

Plantings of sublegal-length brook trout in the fall of 1952 and the summer of 1953 yielded a numerical harvest similar to the fingerling plantings. The poundage recovered was relatively less than the fingerling or the legal-length plantings.

Spring plantings of legal-length brook trout resulted in a greater harvest than fall plantings.

Plantings of legal-length brook trout provided a larger numerical harvest than the fingerling plantings, but resulted in loss in pounds harvested as compared to pounds planted. The poundage harvested from the fingerling plantings exceeded the pounds planted. Both legal-length plantings in the spring and fingerling plantings in the fall are acceptable management practices.