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Report No. 1322

A BRIEF HISTORY OF THE HUNT CREEK FISHERIES EXPERIMENT STATION

By

David S. Shetter

Abstract

The Hunt Creek Fisheries Experiment Station, located in south-central Montmorency County, about 200 miles north of Ann Arbor, was established in 1939 on authorization of the Conservation Commission. The site was chosen after examination of several other streams because of the suitable size and character of Hunt Creek and its tributaries, state ownership of the water frontage, and because brook trout were the only species of trout present in the drainage. The buildings and physical properties of the station are described briefly. Dr. Justin W. Leonard directed the station's activities during the period September, 1939 to February, 1943. Since February, 1943, the author has been resident biologist-in-charge. The staff has varied from two to five individuals depending on the work at hand.

The experimental waters lie in the Northern Upland with the stream channels and lake basins occupying depressions in the Port Huron Moraine. The elevation of the region is approximately 1,000 feet. The average daily flow of Hunt Creek at the downstream boundary of the experimental waters is 23.7 cubic feet per second. The soil is mainly sand or sand and gravel; there are a few clay outcroppings. The hills and uplands support a cover of second-growth aspen and hardwoods broken by scattered stands of white, red, and jack-pine. Cedar-spruce-tamarack swamps are found along some of

the stream banks. Where swamp is absent the stream border is marshy meadow or aspen upland, and the dominant shrub is tag alder.

The land use history of the area surrounding the station has followed a lumber-agriculture-recreation cycle. Pine logs were driven down Hunt Creek some time prior to 1890. Hardwoods were logged off between 1890 and 1908 and removed by narrow-gauge railroads. Many hopeful agriculturists moved in during the period of hardwood cutting, but soon found the soil too poor and the growing seasons too short. Between 1920 and 1930 almost all of the land in the vicinity of the station passed into state ownership; most of it became a part of the public hunting grounds surrounding the former Lunden Game Refuge. Since 1920 the main use of the surrounding area has been of a recreational nature.

Fishing pressure on Hunt Creek in the period 1900 to 1915 was very light. Anglers reached the stream by horse-power or on foot. Most angling was by bait-fishing with muddlers or worms. Catches were good. Autos came into use about 1914, and the sportsmen began to build cabins along the banks. Angling quality has deteriorated since 1920, according to older anglers, because a severe winter about that time produced ice action which removed almost all of the aquatic vegetation. The extensive plant beds were the habitat for an abundance of trout foods. They also provided shelter for brook trout of all sizes.

The experimental sections of Hunt Creek and Fuller Creek embrace several types and combinations of types of brook trout stream habitat. Beaver dams of different sizes and ages are present, and also a 16-acre trout lake. These experimental waters were mapped in detail, and are the locale for studies relating to brook trout life history and the sport fishery for them. A total of 4.18 miles of stream (10.59 acres), 16 acres of trout lake, and a 14.58-acre beaver dam are under study at present.

Collection of angling records on the experimental waters during the past 13 seasons has been one of the major projects. These records provide

the best yardstick for measuring the effect of an experimental procedure. On the study sections of Hunt Creek yearly catches have ranged from 187 to 722 brook trout under angling pressures varying between 540 to 1,546 hours. East Fish Lake anglers' catches have fluctuated from 50 to 367 brook trout under yearly pressures ranging from 126 to 1,040 hours.

Various types of fish traps and blocking weirs have been developed and used in the tributaries and main stream. Marking of the fish as they move through these traps has given information on the time and extent of movement, as well as the growth and numbers later appearing in anglers' creels. The present structures now enclosing about two miles of the main stream help to provide indirect evidence that the great majority of the brook trout population spends the winter months where it is found in summer also.

Leonard's intensive studies on the bottom food fauna indicated that the experimental waters were relatively unproductive compared with a trout stream such as the North Branch of the Au Sable. Investigations of the feeding habits of angler-caught brook trout of Hunt Creek suggest that the fish ate insects and invertebrates almost exclusively despite the presence of numerous brook trout fry, muddlers and other minnows. Leonard also published observations on the winter food habits of brook trout fingerlings. His various studies brought to light a number of species of insects hitherto undescribed.

A study of the survival to the creel of fall-planted hatchery-reared brook trout fingerlings was one of the first projects initiated. Two plantings, marked with different fin-clip combinations, were released in 1939 and 1940. The numbers of marked fish later observed in anglers' creels in both intensive and random creel census operations suggested that a maximum of 3 percent of the plantings were later caught by the anglers. It was concluded that such stocking was not economically justified in a stream of this type.

Studies on the effect of deflectors on Section B, a 1,605-foot section of Hunt Creek, were carried on over an 8-year period. In the fall of 1941, after three years of creel census observations, the number of fishable pools was increased from 9 to 29. After improvement of this section the average total catch increased 120 percent, and the average pounds of fish per hour removed by anglers increased 46 percent despite an average increase in angling pressure of 64 percent during the five years following improvement of the section.

Fish population study techniques for both streams and lakes have received much attention. The electric shocker (AC) was first used in Michigan waters at Hunt Creek and the present Petersen-type stream population study technique was developed there. By combining the known angler's catch with the population estimate of legal brook trout in September on that portion of the experimental stream enclosed by fish-traps, it appears that the anglers remove from 55 to 60 percent of the available legal-sized population each year. By experimentation it was found that the brook trout of East Fish Lake and the various beaver dams could be captured quite readily just before and during the fall spawning season with hoop nets and small trap nets. Daily netting and marking of all fish taken, and the recording of the proportion of marked to unmarked fish each day permit application of various statistical formulae to estimate the population of the various bodies of water after a large enough series of fish have been netted.

Beside these studies just described, there is on file considerable data on brook trout spawning habits, fecundity of female brook trout, and the results from the spawning of controlled numbers of males and females of known sizes in screened portions of the stream. All of the records concerning beaver dams will provide material for the evaluation of beaver-trout relationships. A detailed analysis of the catch records of three of the experimental

stream sections under a 6-inch size limit and under a 7-inch size limit has been completed. Numerous other short-term problems have been investigated and the results reported.

The personnel of the station have cooperated with various state and Federal agencies from its inception to the present. It has served as a base of operations for several doctoral students.

In addition to maintaining an active research program on the experimental waters of the Hunt Creek drainage, the resident biologist and/or his staff members have performed numerous researches away from the station. Some of the more important of these studies were the exploratory investigations on the sea lamprey problem, the fingerling lake trout marking for Lakes Huron and Michigan and the operation of the control experiments on the marks used, and operation and analysis of the random creel census on the Fletcher Floodwater in 1948.

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By

David S. Shetter

Introduction

Experience in trout stream research in Michigan and in other states (Lord, 1935; Surber, 1937) emphasized that year-round observations on a typical trout stream are highly desirable. There was also ample precedent for the establishment of a permanent fisheries field station from the records of agriculture and game management research, both in and outside of Michigan. At such a station further details of trout life history might be learned, and various experimental trout management procedures might be tested and developed under reasonable controlled conditions.

In July of 1937 the Michigan Conservation Commission authorized the establishment of a trout research station. During the balance of 1937 and in 1938 several possible sites, both in the Upper and Lower Peninsulas, were visited and considered. The headwaters of Hunt Creek, one of the major tributaries of the Thunder Bay River, was chosen as the location of the Institute for Fisheries Research's first field station for the following reasons (Hazzard, 1940):

1. Hunt Creek was a reasonably typical trout stream drainage with a variety of brook trout habitats, and the brook trout (Salvelinus f. fontinalis Mitchill) was the only species of trout present.

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[1] Contribution of the Michigan Department of Conservation.

2. State ownership of all but a fraction of the stream frontage in the experimental area permitted establishment of regulations and procedures not feasible elsewhere.

3. The size of the streams was such that experimental work could be performed with the techniques and the equipment then available.

Field operations were initiated in April, 1939, with the intensive creel census of the experimental waters. Ground was broken in September, 1939, for a laboratory-residence which was completed and occupied in January, 1940. A three-room cabin and a one-room cabin were built along the stream in 1940 to accommodate resident technicians. In 1941 an addition to the laboratory-residence for housing visiting investigators was completed. In 1948 the two cabins were enlarged by adding a room to each, and made more comfortable for winter occupancy. In the spring of 1949 a small portable building was remodeled to serve as a registration office and checking station for anglers.

Other physical properties include the three screened diversions of the main stream of Hunt Creek which were excavated during the fall of 1940, and the various weirs and blocking devices used on the main stream and the tributaries to trap fish.

From September, 1939, to February, 1943, the activities of the Hunt Creek Fisheries Experiment Station were under the direction of Dr. Justin W. Leonard. Since February, 1943, the author has been the resident biologist-in-charge. The staff has usually consisted of the resident biologist and an assistant on a full-time basis, supplemented by other Institute personnel assigned to the station for specific periods and projects, plus assistance hired locally as the need arises. During the past three years the staff has been made up of five individuals on full time between April 15 and December 15, and two full-time workers and one part-time helper for the remainder of the year.

The portion of the Hunt Creek drainage with which we have been chiefly concerned is located in south-central Montmorency County about nine miles east and slightly south of the village of Lewiston, Michigan, in Township 29 North, Range 2 East, in what Scott (1921) calls the Northern Upland. The experimental waters flow through sections 25, 34, 35 and 36. The lake and stream channels occupy depressions in the principal moraine of the Port Huron morainic system (Scott, 1921). The elevation of the region is approximately 1,000 feet above sea level. At the downstream border of the experimental waters, the main stream of Hunt Creek has an average daily flow of 23.7 cubic feet per second according to unpublished data furnished me by the U. S. Geological Survey.

At present the hills and uplands have a cover of second-growth aspens and hardwoods interspersed with scattered stands of white and red pine and jackpine. The grassy openings are broken up by clumps of Juneberry, pin cherry, chokecherry and sumac. A high percentage of the stream banks is bordered by cedar-spruce-tamarack swamp. Where swamp does not occur, the stream is bordered by marshy meadows and aspen upland. The dominant bank cover is tag alder which occurs in all the experimental sections.

The soil is chiefly sand or sand and gravel with a few clay outcroppings. Consequently, soil drainage is excellent and surface run-off is held to a minimum. As might be expected the soil fertility is relatively low.

Early history

The vicinity of the site of the present experimental area was the scene of considerable lumbering activity in days past. White and red pine were cut and floated down Hunt Creek mainly between 1880 and 1890, and the remains of four dams used in these operations are still to be

seen. I have not been able to establish the date of the last "drive" on Hunt Creek with any accuracy. Following the logging of the pine, the stands of hardwood remaining on the high ground were taken out between 1890 and 1908 on narrow-gauge railroads operating from the towns of Comins and Lewiston. Charred pine stumps indicate that the area was burned over at least once.

After the loggers were finished much of the land fell into the hands of land speculators who painted a glowing but untruthful picture of the capability of the soil to yield crops. A number of pieces of land were occupied by hopeful agriculturists. Today abandoned fields and orchards and rotted building provide fading monuments to the lost struggle with rapidly exhausted soil fertility and short growing season. The map (Figure 1) as given by a 1900 plat book (Myers and Myers, 1903, p. 31) shows the early occupancy of the land in the upper Hunt Creek drainage. For comparison, I have also traced the same approximate sections as mapped in 1930 by the Land Economic Survey (Figure 2). On the latter map are shown locations of all the abandoned homes which can be recalled by local residents and which were occupied sometime between 1900 and 1930. The map in Figure 3 depicts the occupation pattern in 1949 and as it is today.

All but 80 acres in sections 35 and 36 were owned in 1900 by one H. B. Fuller, who attempted to run a stock farm. His unsuccessful efforts to rear Angora goats are still recounted locally. Fuller was at various times owner and editor of the long-since defunct "Lewiston Journal," postmaster, and principal of the Lewiston School. He encountered financial difficulties after his shingle mill, located about 200 yards east of the present laboratory-residence, burned to the ground about 1907.

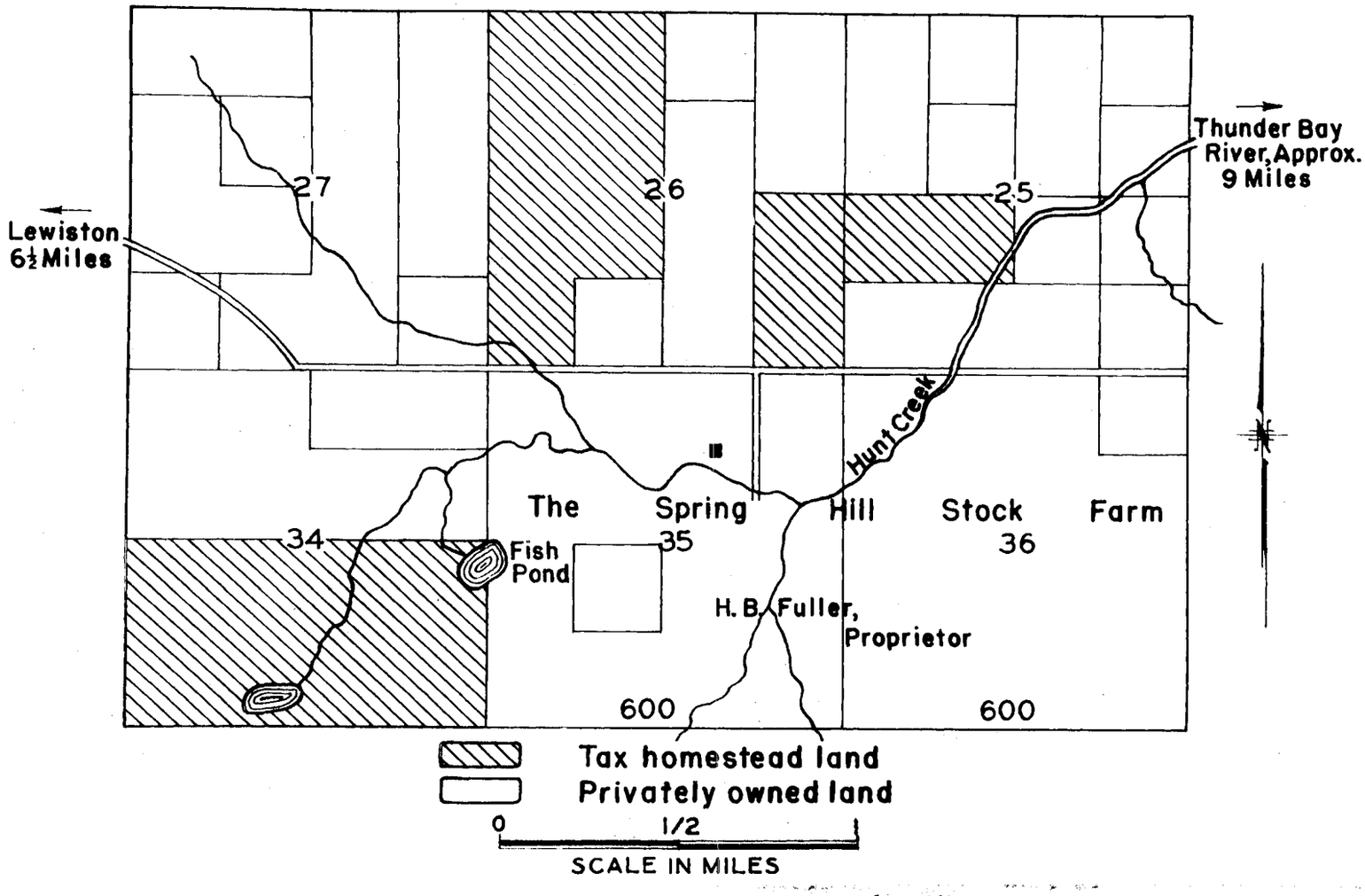

Figure 1.--The immediate vicinity of the Hunt Creek Fisheries Experiment Station circa 1900, as traced from Myers and Myers (1903, p. 31).

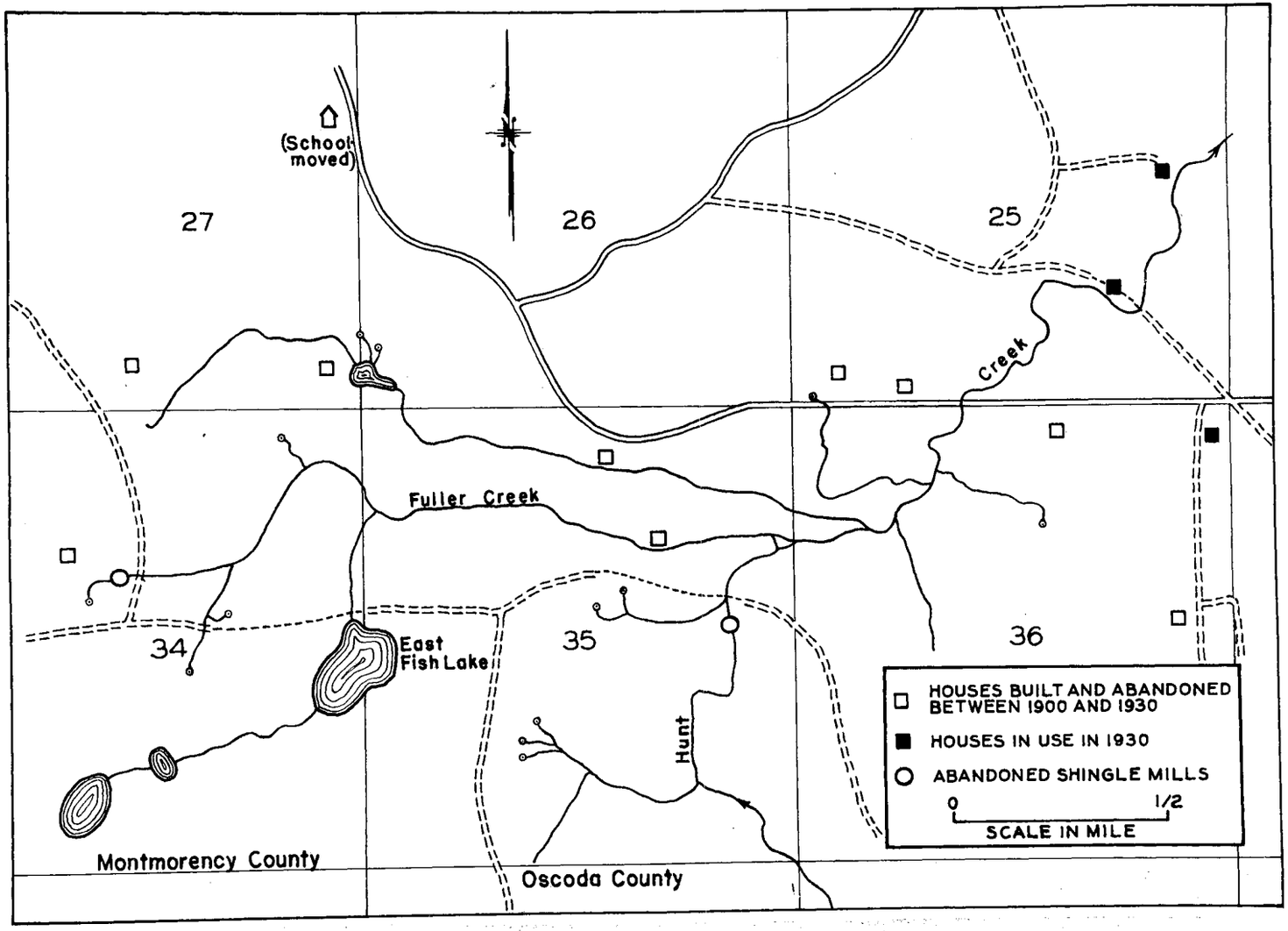

Figure 2.--The immediate vicinity of the Hunt Creek Fisheries Experiment Station, 1930. Traced from Farm-Forest Map, South Half of Montmorency County, Land Economic Survey, Michigan Department of Conservation, 1930. Data on approximate locations of buildings have been given me by two long-time residents of the immediate area: Mrs. Lilian M. Marshall and Mr. James H. Vondett.

Following this reversal Fuller sold or lost title to his holdings, and all but the shaded portions shown on the map in Figure 3 are now in state ownership. The present state holdings were acquired through tax title and purchase, mainly in the period 1920 to 1930 to provide public hunting grounds around what was then the Lunden Game Refuge located about one and one-half miles to the north. The upper part of the drainage since 1880 has passed through a lumbering-private enterprise-recreational use cycle. Since about 1920 it has served chiefly as recreational land, although a limited amount of general farming, stock raising and some lumbering is conducted today.

Erosion problems at present are limited chiefly to the immediate banks, except where unnatural channels have been created by trail and road bridge approaches.

Some facts concerning the early fishing on Hunt Creek have been supplied by Mr. George A. Sachs, Mr. James H. Vondett, and Mr. O. L. Brailey. Mr. Sachs came to Lewiston as a young man in 1898 and fished Hunt Creek in the period 1900 to 1920. In the early 1900's he had to make the 19-mile round trip on foot or with a horse and buggy. Except for a few local residents he seldom saw another fisherman on the stream. Bait fishing with worms or muddlers was the accepted method of fishing. He recollects that he was often able to bring hem 50 brook trout ranging in size from 7 to 12 inches. Mr. Vondett fished the stream about the same time and had similar fishing experiences. Both are more or less in agreement that automobiles were not used to reach the stream until about 1914.

Mr. O. L. Brailey of Toledo, Ohio, has fished the stream annually since 1915. In that year he and five other anglers formed an angling club, and built the cottage that is listed on most maps as the "Ohio Club,"

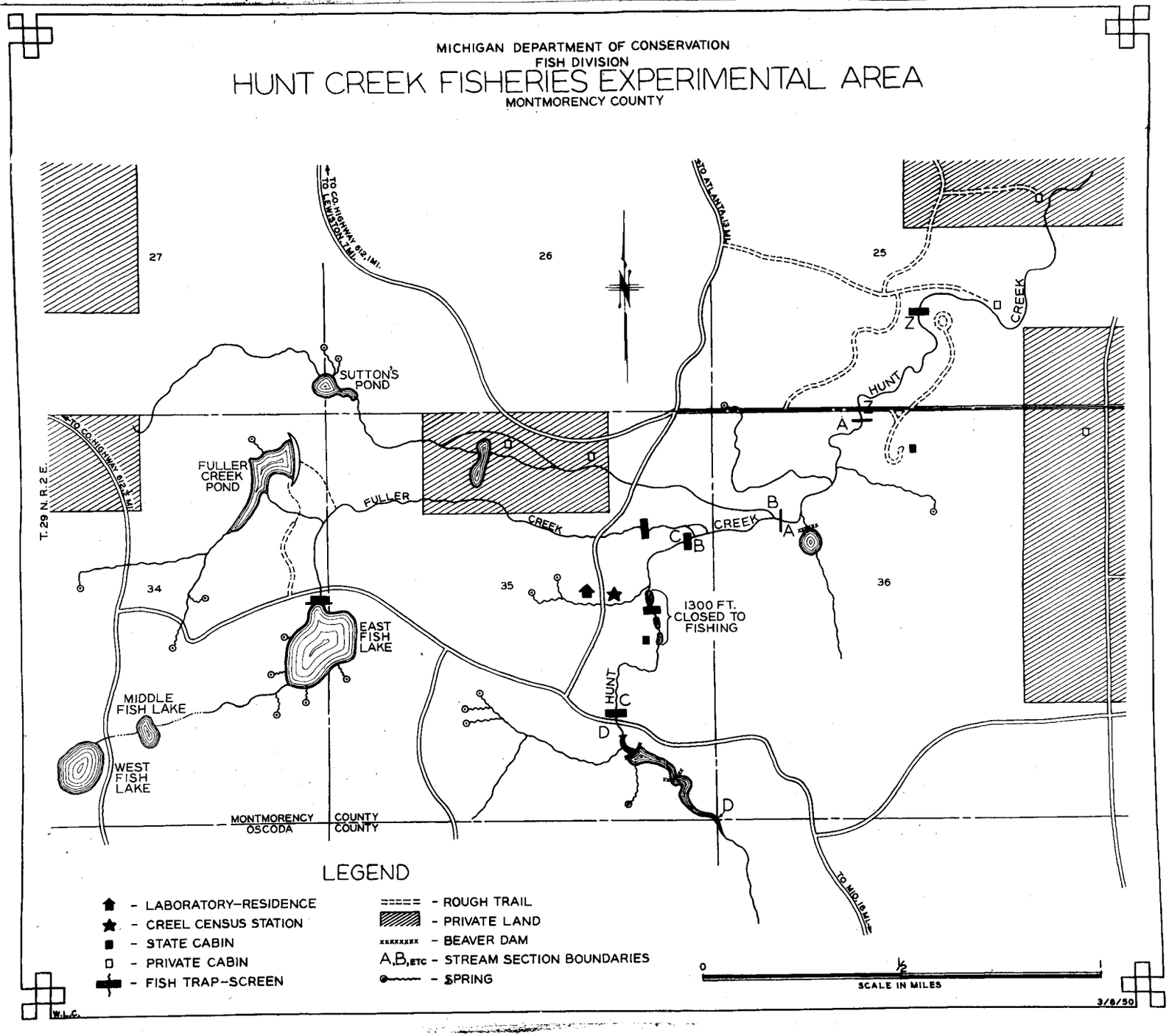

Figure 3.--The immediate vicinity of the Hunt Creek Fisheries Experiment Station, 1950. Scale 3.2 inches equals one mile.

slightly downstream from the border of the experimental waters. I am indebted to him also for the pictures reproduced here of Hunt Creek as it appeared between 1915 and 1920.

To reach the stream, Brailey and his associates traveled by rail to Lewiston (on a spur line of the Michigan Central Railroad, since abandoned) where a Model T "station wagon" was stored for travel between Hunt Creek and Lewiston. Not until about 1925 did Brailey attempt auto travel for the entire trip from Toledo.

Even in 1915 when Brailey first visited Hunt Creek the various lumber dams had fallen into a state of decay and held back no water. According to testimony from Brailey and others, the main difference between the stream as we knew it now and as it has been described then, is the present lack of large beds of the aquatic plant chara (see Figure 4). Comparison of the stream widths at known points with widths shown in Brailey's photographs suggest that a somewhat greater volume of water was carried by Hunt Creek during the first two decades of the present century.

According to both Brailey and Sachs an unusually severe winter about 1920, which caused the formation of considerably more surface and anchor ice than usual, was responsible for the removal of almost all of the chara beds in the stream. Both men infer that this loss of the plant beds has been the cause of what they consider to be a lower yield to the present-day angler in comparison with the halcyon days of 1910 to 1920. Figure 5 shows one day's legal limit of brook trout for two anglers, taken by Brailey and a companion in May, 1915, evidence that Hunt Creek angling of yesteryear was not to be shrugged off lightly.

With the development of the automobile and the extension of roads and trails, the upper reaches of Hunt Creek became more accessible to the angling public. Probably many who came to hunt deer and grouse after the

Figure 4.--Hunt Creek in the vicinity of Brailey's cabin. The photo (taken by O. M. Brailey) shows the stream about 1918. Note dense beds of chara.

Figure 5.--One day's legal limit of brook trout taken in May, 1915, by O. M. Brailey and companion from Hunt Creek.

land was acquired by the state returned to fish in following years. Where a mere handful of anglers fished the stream in 1915, probably 100 fishermen try their luck today.

Development and Research

When experimental operations were commenced in 1939 the main stream of Hunt Creek was marked off in sections for the purpose of keeping angling records on four rather different trout habitats. Section A, the lowermost section at that time, is bordered by an open marsh with little or no shade except that provided by scattered clumps of tag alder and overhanging grasses, the current is slow or sluggish, banks are low and ill-defined, and the bottom is composed chiefly of sand and silt. Cover is present mainly in the form of deeper holes at the bends or undercut banks. It receives water from three spring tributaries. The average depth is about 18 inches, but some of the holes range up to 5 feet in depth. This section is fished readily by any method.

Section B, immediately upstream, is a short piece of stream flowing through the heart of a dense cedar swamp. Its current is moderately rapid, the banks are fairly well defined, and the bottom consists of fine gravel and rubble mixed with some sand. The average depth in 1939 was about 14 inches with a few pools ranging up to 2 feet deep. Cover for trout was fair to good, and was present in the form of sunken logs, overhanging branches and undercut banks. Some cover also was provided by the remains of several log deflectors which were remnants of the CCC's attempts to improve the stream. Two large tributaries empty into Section B within the limits of the section. Section B can be fished either with fly or bait.

From the upper end of Section B, as one moves upstream in Section C, the swamp border continues for about 300 yards. Then the stream begins to be confined by a narrow valley with steep slopes, some of which rise 50 feet above the valley floor. Here the stream narrows down considerably

and is bordered by aspen and tag alder, the latter often forming a canopy over the stream which makes fly fishing difficult. It is more readily fished by use of a short rod and bait. Through Section C there is a considerable drop in elevation and the current is rapid. The pools are narrow, small and deep—up to 3 feet. Cover varies in quality, but is present mainly in the form of undercut banks and overhanging brush. Much of Section C has gravel and rubble bottom on the riffles and in the scoured pools, interspersed with deposits of sand and silt on the benches between the small falls. One spring tributary enters Section C, and there are two large springs in the main channel.

Section D, the uppermost section, except for a small portion of its downstream end which is more or less contiguous with Section C, lies in an old beaver meadow. It is relatively open. The current here is slow to moderate, and the bottom is composed mainly of sand, silt and detritus except for a short stretch in its mid-course where a stratum of clay is exposed. Good cover is present in the form of down timber, undercut banks, scattered clumps of overhanging tag alder and old beaver food piles. The depth and area of Section D has fluctuated through the years with the intensity of beaver occupancy. Under the present system of four dams there are certain pools up to 8 feet in depth and much of the section is 2 to 5 feet deep.

Section Z, the lowermost section at present, was added in 1949. It is immediately downstream from Section A. Here the main stream of Hunt Creek flows through a more or less open meadow where the banks are well developed. It is shaded to some degree in its upper end by a small section of tamarack swamp on its east and south banks, but elsewhere shade is given mainly by small clumps of tag alder and aspen. The current

is rapid, and there are several white-water riffles. In such sites the bottom is gravel and rubble, and many of the intervening "runs" are a mixture of closely compacted gravel and sand. Section Z has excellent underwater cover in the form of numerous undercut banks where logs have lodged, down timber, and several pools over 5 feet in depth, plus two large log jams.

The relatively open character of the banks and bank cover make this section ideal for fishing by any method.

The main tributary of Hunt Creek is Fuller Creek. For all but about 400 yards the stream flows through a dense cedar swamp, which lies in a narrow steep-sloped valley. It has a rapid current and numerous small falls as it flows from pool to pool. Fuller Creek receives considerable spring seepage between its source and where it joins Hunt Creek in addition to the outflow of East Fish Lake. The tangled mass of "down" cedar provides ample trout cover. The bottom consists mainly of sand and detritus mixed with some scattered patches of gravel. It can be fished only with a short rod.

Temperature records taken during the last decade for both Hunt Creek and Fuller Creek provide evidence that even during extreme air temperatures (80° to 90°+ F.) neither stream reaches 70° F. except on rare occasions. During the warmer months of the year, water temperatures range mainly between 55° F. and 65° F. in the lower experimental sections. The chemistry of the stream waters, described by Shetter and Leonard (1943), appears to be favorable for trout in all respects.

Other species of fish in addition to brook trout which have been observed or collected, generally in small numbers, in the experimental stream sections are: creek chubs (Semotilus atromaculatus), common suckers (Catostomus commersonnii), northern redbelly dace (Chrosomus eos), fathead minnows (Pimephales promelas), common shiners (Notropis cornutus),

bluntnose minnows (Hyborhynchus notatus), blacknose shiners (Notropis heterolepis), central mudminnow (Umbra limi), hornyhead chubs (Nocomis biguttatus), brook stickleback (Eucalia inconstans), Johnny darter (Boleosoma nigrum), rainbow darter (Poecilichthys coeruleus), Iowa darter (Poecilichthys exilis), and most numerous, slimy muddlers (Cottus cognatus).

East Fish Lake is a typical trout lake, originally about 12.2 acres in area before being dammed by beaver, and now some 16.0 acres since construction of a permanent dam at the outlet in 1941, which increased the maximum depth to about 45 feet. The lake has a well-developed thermocline, usually located somewhere between 10 and 35 feet and adequate oxygen (7.5 to 9.5 ppm.) at all depths. Carbon dioxide content is low (0 to 4 ppm.), and the water is alkaline (pH, 7.8 to 8.0). The water is relatively hard (Methyl orange alkalinity, expressed as ppm. of $CaCo_3$, ranges from 190 to 201). Although midsummer surface water temperatures exceed 80 degrees, the lower well-oxygenated waters remain below 70 degrees and provide a satisfactory habitat for brook trout. The lake is bordered to the present water line by a cedar-spruce-tamarack swamp on the south and west shores, and by hardwood second growth on the gentle slopes of the north and east banks. The bottom in the deeper water is a mixture of marl and pulpy peat, while at the shoreward edges it is composed of marl mixed with fibrous peat and some sand. Cover for trout is excellent. A rather well-developed band of water shield, yellow pond lily, submerged pondweeds, and chara borders the "dropoff" which is quite sharp. There are numerous deadheads and stumps on the shoal area. Many springs empty into the lake in addition to the small tributary which many years in the past connected Middle Fish and East Fish lakes.

Originally the species of fish resident in East Fish Lake probably consisted of brook trout, common suckers, yellow perch (Perca

flavescens), creek chubs, redbelly dace, brook sticklebacks, mudminnows, and common shiners (Notropis cornutus). The species composition was altered greatly by additions of species not normally found in trout lakes from bait buckets prior to 1941, when the lake was poisoned.

An important type of brook trout habitat, the beaver pond, is to be found on several of the experimental waters in various forms and sizes. The most significant of these has been the Fuller Creek Pond, originally present in the period 1936 to 1942. It was re-established in 1949 by construction of an earth fill dam on the site of the old beaver dam. The water area is approximately 16 acres. The original impoundment flooded and killed much cedar and tamarack which has since fallen into the water and provides excellent fish cover. Chara grows densely in the deeper waters (2 feet or deeper). Other aquatic plants are scattered and of little importance. In the shallow edges marsh grasses are dominant and offer good cover. The silt-and detritus-covered bottom is underlain by marl and gravel. Depths in the old stream channel range up to 6 feet. Thermal stratification has been noted in summer and there is sufficient oxygen at all depths.

The beaver dams of Section D on the main stream of Hunt Creek have been of more than passing interest since the station's establishment in 1939. At that time there was one non-inhabited dam impounding about one half of the water acreage of the section. This dam was broken by high water in the late spring of 1943, and between that time and May, 1947, no dams were present. The beaver returned to Section D in May, 1947, and by September had built three dams, and there have been at least three dams occupied and kept up since that time. The effect of these structures on the stream ecology and on the trout fishing are being studied in detail by Arthur K. Adams in his doctoral investigations of beaver-trout relationships.

In Table 1 a summary of the physical measurements of the various experimental waters is given. These data have been determined chiefly from measurements on plane table maps drafted at the scale of 20 feet to the inch. Prints are used in planning and in recording the results of experiments and observations. The water areas briefly described on the preceding pages have been the locale for numerous studies of various types relating to brook trout life history and the sport fishery for the brook trout.

Creel census

One of the major projects each year is the intensive creel census of all trout waters within the Area. During each trout season all angling effort and all trout catches are recorded in detail; angling and catch records for 13 consecutive seasons for the various stream sections, beaver ponds, and East Fish Lake have been accumulated. Under terms of a Conservation Commission order all desiring to fish the posted waters are required to obtain daily permits and report their angling success at the conclusion of each fishing day. This system has been in operation since 1949 and has proved quite successful. Prior to that time it was the responsibility of the staff to keep constant check on the angling by driving to all the access points at frequent intervals each day. We have felt that the creel census provides one of the best yardsticks for measuring the effect of an experimental procedure. Angling pressure and other pertinent statistics for each year are summarized for the experimental sections of Hunt Creek (Table 2) and for East Fish Lake (Table 3).

TABLE I

Dimensions of the various experimental waters, Hunt Creek drainage, Montmorency County, 1951.

Experimental water	Dimensions			
	Length (feet)	Length (miles)	Average width (feet)	Area (acres)
Section Z	2,397	0.45	20.3	1.12
Section A	2,577	0.49	24.3	1.44
Section B	1,605	0.30	17.5	0.64
Section C[1]	2,700	0.51	11.8	0.71
Section D[2]	2,896	0.55	50.0	3.11
Totals, experimental sections, Hunt Creek	12,175	2.31	25.1	7.02
Fuller Creek and East Fish Lake outlet exclusive of Fuller Creek Pond	9,875	1.87	15.7	3.57
Fuller Creek Pond	...	...	...	14.58
East Fish Lake	...	...	...	16.00

[1] Figures given exclude 1,270 feet of stream (0.36 acres) in the vicinity of the screened experimental diversions which are closed to fishing.

[2] The area given was determined from a plane-table map made in 1949. Increased beaver activity has increased this acreage slightly.

TABLE II

Summary of angling statistics, experimental sections, Hunt Creek, 1939 to 1951 inclusive.

Daily creel limit, 15 trout. Minimum size limit, 7 inches total length.

(Total water acreages each year are given in parentheses.)

Item	Year												
	1939 (4.33)	1940 (4.69)	1941 (4.33)	1942 (4.33)	1943 (4.33)	1944 (4.33)	1945 (4.33)	1946 (4.33)	1947 (4.33)	1948 (6.13)	1949 (7.02)	1950 (7.02)	1951 (7.02)
Total angler days	438	505	1,015	800	311	340	375	753	607	504	597	533	681
Total hours fished	780	901	1,546	1,267	540	640	637	1,206	872	869	1,437	1,388	1,388
Legal brook trout taken	492	406	722	543	378	364	315	439	187	492	713	578	555
Pounds of fish creeled	67	60	116	83	59	53	52	68	26	78	115	97	93
Yield per acre	15.4	12.8	26.8	19.2	13.7	12.3	12.0	15.6	6.1	12.8	16.3	13.8	13.3
Average total length	7.5	7.6	7.7	7.6	7.5	7.7	7.9	7.7	7.6	7.7	7.8	7.8	7.8
Catch per hour	0.63	0.45	0.47	0.43	0.70	0.57	0.49	0.36	0.21	0.57	0.50	0.42	0.40

TABLE III

Summary of angling statistics, East Fish Lake, 1939 to 1951 inclusive.

Size limit, 7 inches total length, 1939 to 1950; 10 inches total length, 1951.

Daily creel limit, 15 fish, 1939 to 1946; 10 fish, 1947; 5 fish, 1948 to 1951.

(Acreage each year given in parentheses.)

Item	Year												
	1939 (13.5)	1940 (13.5)	1941 (13.5)	1942 (15.9)	1943 (16.0)	1944 (16.0)	1945 (16.0)	1946 (16.0)	1947 (16.0)	1948 (16.0)	1949 (16.0)	1950 (16.0)	1951 (16.0)
Total angler-days	63	111	155	159	121	311	436	430	344	287	287	218	200
Total hours fished	126	308	286	289	200	651	928	935	711	853	1,040	613	732
Legal brook trout taken	51	172	242	367	69	108	169	93	89	117	93	50	56
Pounds of fish creeled	...	28	47	97	26	79	131	69	54	55	71	39	36
Yield per acre	...	2.1	3.5	6.1	1.6	4.9	8.0	4.3	3.4	3.5	4.4	2.4	2.3
Average total length	...	8.0	8.5	9.0	9.3	11.2	11.9	11.5	11.1	10.4	11.6	12.3	11.9
Catch per hour	0.41	0.56	0.63	1.26	0.29	0.17	0.18	0.10	0.13	0.14	0.09	0.08	0.08

Weir studies

Shortly after initiation of creel census activities in 1939, erection of two-way fish traps on several tributaries was begun. Except for the Fuller Creek installation these were made from stationary fine-meshed hardware cloth frames erected over driven sheet piling. On Fuller Creek, after a short period of operation with a stationary screen trap, a self-cleaning rotary screen powered by a paddle wheel was operated during the period 1942 to 1948. Carbine and Shetter (1944) have described these installations in some detail. Over the years nine different weirs have been used. Two blocking weirs on the main stream of Hunt Creek and one at the outlet of East Fish Lake are still maintained.

Since 1948 two additional devices have been utilized to block fish movement and to trap fish. These are the self-cleaning rotary screen and our own adaptation of the inclined screen trap (Figure 6) as described by Wolf (1951).

By fin clipping and jaw tagging fish as they move into the traps and transferring them in the direction of movement, considerable data have been accumulated on the time and extent of movement of the brook trout as well as information on growth and the number subsequently appearing in anglers' catches. The two traps presently in operation on the main stream of Hunt Creek, in addition to providing data on the points just mentioned, also enclose the trout population of approximately two miles of stream. Indirectly these devices are providing some evidence concerning the winter habits of brook trout. The blocking structures have been maintained in a fish-tight condition except for very short periods which occur chiefly on subzero nights during midwinter. The movement of fish into and out of the area is negligible in comparison with the population estimates available and the catch observed in the anglers' creels. Each year since 1949 there has been present a brook trout population of

Figure 6.--Rotary self-cleaning screen used in blocking fish movement (right photo) and horizontal screen trap (left photo) currently in use at the Hunt Creek Fisheries Experiment Station. (This is the same as Slide No. 23 and Slide No. 20.)

approximately the same dimensions between the two blocking structures which obviously spends the winter in the same general stream areas where it is found in the summer.

Along with a tabulation of the fish and other forms trapped, daily records of the air and water temperatures have been maintained, either with a pocket thermometer or by installing maximum-minimum thermometers. A continuous record of air and water temperature has been kept for Fuller Creek by the use of a Fries recording thermometer. Table 4 is a sample of the fish movements over one year at the Fuller Creek weir.

Food studies

During the tenure of Dr. Justin W. Leonard as biologist-in-charge, intensive studies of the bottom food fauna and the feeding habits of the brook trout were pursued by him and his assistants. These studies indicated that the bottom food present in the experimental waters was relatively sparse in comparison with a stream such as the North Branch of the Au Sable. It was found also that the brook trout in the anglers' catches fed almost entirely on insects and invertebrates despite the presence of numerous brook trout fry, small muddlers and a few minnows.

The winter food habits of brook trout fingerlings were studied, and the observations were published by Leonard (1942). Leonard's researches also brought to light several new species of insects hitherto not described.

Survival of fall-planted fingerling brook trout

One of the earlier studies on the experimental waters of Hunt Creek was concerned with the survival to the creel of hatchery-reared brook trout released in the fall of the year. In 1939 and 1940 known numbers of artificially-reared brook trout fingerlings were planted in Section C of the experimental waters after receiving a distinctive fin-clip combination.

TABLE IV

Summary of brook trout trapped in Fuller Creek fish-trap, October 1, 1945 to September 30, 1946.

Time period	Average air temperature (° F.)	Average water temperature (° F.)	Average water level	Upstream migrants			Downstream migrants		
				0-3.9 inches	4.0-6.9 inches	7.0 inches and over	0-3.9 inches	4.0-6.9 inches	7.0 inches and over
October 1 - 15, 1945	43.6	42.5	4.29	2	2	...	8	3	...
October 16 - 31, 1945	43.6	42.3	4.30	9	2	...	5	9	...
November 1 - 15, 1945	38.1	39.3	4.35	2	8	...	4	13	2
November 16 - 30, 1945	28.9	33.7	4.34	...	3	...	...	7	...
December 1 - 15, 1945	20.3	37.0	4.36	...	...	...	1	...	...
December 16 - 31, 1945	15.9	33.6	4.36	...	...	...	...	...	...
January 1 - 15, 1946	23.7	33.9	4.40	...	...	1	...	1	...
January 16 - 31, 1946	18.8	32.0	4.45	...	...	...	...	...	...
February 1 - 15, 1946	13.1	34.1	4.38	...	...	...	...	...	...
February 16 - 28, 1946	11.8	33.7	4.44	...	...	...	...	...	...
March 1 - 15, 1946	30.3	35.5	4.35	...	...	...	...	...	...
March 16 - 31, 1946	35.1	39.3	4.30	1	...	...	...	...	...
April 1 - 15, 1946	34.3	38.3	4.29	1	...	...	...	1	...
April 16 - 30, 1946	38.1	39.7	4.23	...	...	...	7	6	...
May 1 - 15, 1946	42.1	39.8	4.27	...	...	...	3	5	...
May 16 - 31, 1946	53.7	44.6	4.24	...	1	...	...	7	...
June 1 - 15, 1946	60.9	47.9	4.23	3	8	...	1	2	...
June 16 - 30, 1946	68.9	48.9	4.22	...	...	...	1	2	...
July 1 - 15, 1946	72.1	51.3	4.26	6	2	...	1	2	...
July 16 - 31, 1946	71.8	52.4	4.17	4	...	...	2	4	...
August 1 - 15, 1946	69.0	50.2	4.19	2	...	...	1	2	...
August 16 - 31, 1946	61.4	46.5	4.20	6	1	...	5	1	...
September 1 - 15, 1946	59.5	46.1	4.25	1	...	...	2	1	...
September 16 - 30, 1946	65.1	43.8	4.23	...	...	...	1	2	...
Totals for year	...	...	...	37	27	1	42	68	2

A similar number of wild fingerlings were seined from Section C and marked with different fin combinations. Fish of the various markings surviving to the anglers' creels were later observed in the intensive and random creel census. Because only a maximum of three percent of fall-planted fingerling brook trout were later caught by the anglers, it was concluded that such stocking was not economically justified and not needed in a stream of this type. The results of this study have been published in detail by Shetter (1950).

Stream improvement studies

A detailed study of the effect of stream improvement devices on a 1,605 foot section of stream (Section B) was carried on over an 8-year period, three years prior to improvement and five years afterward, and the creel census data collected since then are still applicable to an evaluation of the study. Section B was modified by the use of current deflectors in the fall of 1941 so that the number of fishable pools was increased from 9 to 29, and the average pool depth was increased by 6 inches. The results (Shetter, Clark and Hazzard, 1949) of the investigations demonstrated an improvement in the total catch of 120 per cent, an increase of 46 percent in the pounds per hour taken by anglers coincident with a 64 per cent increase in angling pressure.

Population studies and population study techniques

For many obvious reasons the personnel of the Institute for Fisheries Research has always been interested in ways and means to determine the size and composition of fish populations, as a review of fisheries literature will attest. In early stream population studies at Hunt Creek the "block-and-seine" or the "block-and-drain" methods (Shetter and Leonard, 1943) were employed. In the late summer of 1942 the first AC electric shocker to

be operated in Michigan waters was utilized in the Section B population studies. Instead of seining the blocked-off sample areas, electricity was used to capture the fish population. Between 1942 and 1946 our attempts at population estimate were by shocking blocked-off sample sections and estimating the total population on the basis of known water acreage of the experimental stream and the numbers and pounds of fishes shocked from the known water acreages of the sample sections.

Various observations and calculations suggested that our estimates by the latter method were not as accurate as desired. The amount of equipment to be handled in the field also was bulky and time consuming to transport from one sample section to another. After some thought it was decided that a Peterson-type study could be made by shocking the entire stream area twice; the first time to mark and measure as many fish as possible, the second trip to record the proportion of marked to unmarked fish present in the various size groups. These data make possible estimates of the population present by direct proportion. The AC shocker and this method of population study have been described by Shetter (1947).

With the aid of the AC shocking unit floated in a shallow-draft boat the brook trout population remaining at the conclusion of the season has been estimated for the portion of the stream between the blocking bulkheads for the past three years. Assuming that the estimates are reasonably accurate it appears that anglers have been removing from 54.5 to 60.5 percent of the brook trout available to them as legal-sized fish during the course of a trout season in this part of Hunt Creek (Table 5).

Our original attempt at population estimates on standing bodies of trout water at Hunt Creek was the poisoning of East Fish Lake in 1941.

TABLE V

Population estimates and catch data for 3.91 acres of Hunt Creek confined between the upper and lower bulkhead traps. (Sections Z, A, B and C) for brook trout 7 inches or larger.

Item	Year		
	1949	1950	1951
Observed mortality.	10	9	21
Number migrating out.	7	13	50
Number migrating in.	20	14	32
Number captured by anglers in year.	361	328	349
Estimated number remaining after season[1]	188	220	188
Number theoretically available to anglers at some time during the season.	586	584	640
Percentage of escapement for spawning.	32.1	37.7	29.4

[1] Estimate made by shocking and marking and subsequent recovery; the Peterson method was used in the calculations.

It was found at that time that the lake was supporting a minimum of 415 pounds of fish of which on 17 pounds were brook trout. Following the success of other Institute personnel in making population estimates of warm-water fishes with fyke and trap nets for the purpose of marking and recapturing resident fish, we decided to try similar techniques on East Fish Lake and on the beaver ponds, and initiated such work in the fall of 1948.

It has been found by experience that with the use of one-half inch meshed hoop nets a relatively high percentage of brook trout larger than 7 inches can be captured just prior to and during the spawning season (mid-October to mid-November). All fish captured are marked by jaw tagging after measurement for length and determination of sex before return to the water. The East Fish Lake data should eventually provide information on the accuracy of the techniques employed there, since movement of fish into or out of the lake is blocked by a fish-trap at the outlet spill, and the population calculations by the various mathematical procedures can be cross-checked by the proportion of tagged fish appearing in later years in the anglers' catches. The population estimates and catch data for East Fish Lake since 1948 are shown in Table 6. The

The studies just discussed constitute some of the more important lines of research on the experimental waters of Hunt Creek. The continuous angling records, yield data, and biological records of the various habitats involved provide an area where trout stream experiments can be carried on under more or less known conditions and where changes in yield to the anglers may be quite accurately evaluated. In addition a considerable file of information has been accumulated on brook trout spawning habits, egg counts on females of all sizes and the results of the spawning of

TABLE VI

Population estimates and catch data for East Fish Lake (16.0 acres) for 1948 to 1951 inclusive.

Item	Year			
	1948	1949	1950	1951 [2]
Anglers' catch of legal trout in year.	108	93	47	56
Estimated number left at end of season [1]	175 ± 6	244 ± 28	123 ± 24	95 ± 14
Total legal trout available during year.	283 ± 6	347 ± 28	170 ± 24	151 ± 14
Percentage escapement for spawning.	61.8	70.3	72.4	62.9

[1] Estimates made by netting, marking and subsequent recapture and calculations, follow the technique suggested by Schumacher and Eschmeyer (1943).

[2] Legal size limit, 10 inches in this year; 7 inches in prior years.

known numbers of males and females of known sizes in screened off stream sections. The detailed stream maps, ecological observations, limnological data and creel census records on the various beaver dams will provide material for evaluating beaver-trout relationships. A detailed analysis of the catch records of three of the experimental sections under a 6-inch size limit and under a 7-inch size limit also has been completed.

A number of short-term studies have been successfully carried out, such as the determination of the toxicity level of various insecticides and wood preservatives to brook trout, tests on various methods of marking brook trout, and various experiments involving food consumption studies of hatchery-reared brook trout fingerlings and wild fingerlings confined in the same waters.

During the 1951 trout season considerable time was spent in determining the mortality among various groups of hatchery-reared brook trout when hooked with a No. 12 artificial fly and with different sizes of hooks baited with worms. These experiments, conducted under rather closely-controlled conditions, will be continued during 1952.

The direct feeding of the resident brook trout population of Section Z, the lowermost of the experimental sections, is planned for the spring and summer of 1952. We desire to learn if the growth rate of the brook trout and the anglers' catch can be immediately affected by supplementing the natural food available. The 1951 fall population estimate for Section Z provided the basis for estimating the amount of food to be fed.

Cooperation with other researchers

The facilities of the station have been used from time to time by other members of the Department and various universities and colleges, both for consultation and research, and we attempt to lend all possible aid. An example of such mutual cooperation is to be found in the stream

gaging program carried on with the U. S. Geological Survey. The federal agency installed the various gages and has worked up flow tables from the daily water level readings taken by the station staff inspecting the weirs and fish-traps. The station and the experimental waters have served as a base of operations for several graduate students working on doctoral problems. During the summer of 1941, Dr. Ira T. Wilson made an intensive study of the sedimentation in the Fish Lakes.

Research undertaken away from Hunt Creek

The record would not be complete without mention of some of the investigations away from the Hunt Creek drainage assigned to the resident biologist and/or some of his staff members. These include the exploratory field researches on the sea lamprey problem, the large-scale lake trout fingerling marking for Lakes Michigan and Huron in the period 1944 to 1948, control experiments on the various fin-clip combinations employed on the fingerling lake trout, responsibility for tabulation and analysis of the game and creel records taken on the Rifle River Area and also for what limited field investigations we have been able to perform there, and general supervision of and tabulation of the trap records and creel census figures from Guiley Pond. In addition members of the Hunt Creek staff have aided in tagging or marking a high percentage of legal trout released in the period 1944 to 1951 in streams outside the Hunt Creek drainage. During the past decade a number of lakes in the vicinity have been surveyed at the request of the Fish Division in connection with other problems, and short-term studies of a number of trout streams in both the Upper and Lower Peninsulas have been conducted by staff members or assistance has been given to such studies. At the request of the Conservation Commission a year-long random creel census was planned and operated on the Fletcher Floodwaters by members of the station staff during 1948.

I believe that it may be said in all fairness that the Hunt Creek Fisheries Experiment Station has served not only as a brook trout research station but also as a biological field station for the Department of Conservation in northern Michigan.

A number of the investigations dealing with brook trout problems of the Hunt Creek drainage have not yet been published. These will be reported on as rapidly as time permits. Those who are interested in what has already been published are referred to the journals of the American Fisheries Society, the Progressive Fish Culturist, Michigan Conservation, and the American Society of Ichthyologists and Herpetologists since 1940, where most of the papers dealing with research done at Hunt Creek have appeared.

Although the station has been in existence almost thirteen years there are still many facts yet to be learned concerning brook trout and their proper management for the angler. It is generally agreed by trout researchers that the scientific attack on many of these problems can best be conducted from a field research station where the biological background and the fishing history have been recorded. The Hunt Creek Fisheries Experiment Station stands ready to continue such service in brook trout studies.

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