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January 2, 1951

Report No. 1271

BROOK TROUT MANAGEMENT STUDY  
NORTH BRANCH AU SABLE RIVER PROGRESS REPORT

By

Edwin L. Cooper

Abstract

A study of the effect of an increased size limit on the population of brook trout has been in operation on the North Branch Au Sable River since the spring of 1949. This experiment is an attempt to increase the population by permitting more fish to spawn.

An increase in brook trout of spawning size was noticed in 1949 and 1950 over that of 1948. This was due to the 10-inch size limit which prevented exploitation of the population during their second summer of life. What information we have also indicates an increase in the catch of 10-inch fish in 1950 over 1949 and 1948. This was due solely to the 10-inch size limit which permitted the fish to grow to this size before being caught.

The creel census taken during the 1950 season revealed a high rate of exploitation in the 7-inch water. No fish were recorded longer than 10 inches; half of the catch was less than 7 1/2 inches long.

The experiment should be continued at least until the 1952 season to allow the expected increase in the population to become legal size. It should preferably run until the 1954 season to permit the second generation to become legal size.

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Introduction

The North Branch of the Au Sable River in Otsego and Crawford counties is one of the best known of Michigan's trout streams. Its fishing history antedates 1880, when its waters abounded with the now extinct Michigan grayling. In 1885, brook trout were first planted in the Au Sable River system and shortly afterward produced fine fishing. In the "good old days" limit catches of 50 brook trout were not uncommon and large fish were frequently caught. There is reason to believe that the stream supported many more fish than it does at the present time, although exact data on population density are not available. As late as the early 1930's, brook trout fishing here was still considered generally good but by no means what it had been in the past. Brown trout also had been introduced and by 1900 had become well-established in the stream. Most of the fish caught that were large enough to write home about were brown trout. Since 1930 brook trout fishing has declined further and the size of this species taken rarely exceeded 10 inches in length. Intensive study of the species by D. S. Shetter in 1934 to 1937 indicated that very few brook trout ever

attained a length of 10 inches, despite a fast growth rate and abundant food in the stream. In 1946 to the present time, information obtained on the brook trout population in the North Branch reveals the same conditions that prevailed 10 to 15 years ago. The fish are growing at a very rapid rate but very few fish are seen of a size larger than the minimum size limit, suggesting that they are being removed by fishermen nearly as fast as they become of legal size.

### Objectives

The major aim in this study, as in all other attempts at sport-fishing management, is to determine the proper way to manipulate fish populations to get the maximum recreational benefit to the greatest number of fishermen. For the North Branch of the Au Sable we have proceeded with the assumption that the population has been depleted through overfishing and that some sort of angling regulation that will increase the population will be of benefit to the anglers as a whole. It appears to be simply a case of saving enough seed to plant the whole field instead of only a part of it.

In dealing with public waters, management of the native fish stocks may be accomplished by only a relatively few controls. The best method possible, that of limiting the catch to a known fraction of the standing population, is at present not possible. Nor is it practical to limit the fishing pressure to a certain maximum. For population manipulation we must rely mainly on two types of regulations (1) that of a daily creel limit, and (2) a minimum size limit. Information concerning the daily creel limit suggests that it is very ineffective in limiting the catch; with the distribution of angling ability as it is, the daily creel limit would have to be reduced to 2 or 3 fish per day to have any effect simply on redistributing the catch. To attempt to limit the total yield by this means would be even more of a problem.

Apparently, the only practical control left is that of a minimum size limit. This management practice is normally used to ensure enough escapement of individuals of the population of a proper size and age sufficient to maintain the population at what we would like to believe is the maximum standing population that the body of water will adequately support. For the state as a whole and for all three species of trout, the minimum size has been established by law at 7 inches. The original intent of the 7-inch size limit was to allow the fish to mature and spawn once before becoming legal prey for the angler. This it fails to do on the North Branch of the Au Sable and on many more of our best brook trout streams. Therefore, in 1949, as an experimental measure, a 10-inch minimum size limit on brook trout was proposed for a portion of this stream. The fast growth rate of the fish along with abundant food in the stream plus the small number of brook trout larger than the legal limit intimated that the population was being over-fished--perhaps to the point of a depletion of the spawning stock. If this was the case, then more protection in the form of a higher minimum size should increase the population by allowing more fish and/or larger fish to spawn. The main objective of the study, therefore, was to determine whether such an increase in the minimum size for the angler would result in an increase in the population and in the resulting yield to the fishermen. If it would not, then a determination of some other factors responsible for maintaining the population at such a low level would seem to be in order.

Information necessary to establish the minimum size limit on a basis of the size at first maturity was available from previous work. Extensive collections from spawning populations in this stream during 1948, 1947, and 1946 and earlier indicated that no females spawned at the end of their first year but that nearly all of them were mature at the end of their second year.

At this time they were from 5 to 10 inches long. In order to protect most of the brook trout through their first spawning, the minimum size in this stream would have to be about 10 inches. It was thought that this amount of protection would permit a large enough increase in the brood stock to enable one to tell whether such a measure would result in an increase in the population of brook trout in the stream. Such an increase, if it happens at all, will not become apparent to the fishermen until the season of 1952 when the majority of the 1950 year class will have reached the legal size of 10 inches. The 1950 year class resulted from the spawning of the yearling fish in 1949 which were the first group of brood stock to receive protection under the 10-inch size limit. This 1949 group of spawning fish, although augmented by protection due to the 10-inch minimum size, resulted from a limited amount of spawning in 1947. Therefore, we might expect even a larger increase in the catch to occur in 1954 when the second generation of fingerlings attain legal size. Basing predictions on the assumption that the population has been depleted through overfishing and that no other serious limiting factors are involved in holding the population to a low level of productivity we might postulate the turn of events for the next few years (Table 1). One can readily see by this table that the 10-inch minimum size should be continued at least until the 1952 season and preferably until the 1954 season before drawing any conclusions as to the results of the study.

Another objective was to sound out public opinion on greater restrictions to trout fishing. If fishermen were given a choice of catching one 10-inch brook trout or several 7- to 8-inch ones, which would they choose? Also, how many persons would be interested in fishing in a stream where they knew they would have to return 7-, 8-, and 9-inch brook trout as sub-legal? It was believed that opposition to such a program, if at all prevalent, would be soon forthcoming.

Table 1. Fishing predictions for 10-inch brook trout in North Branch Au Sable River for the period 1948 to 1954, due to a change in minimum size limit.

	1948		1949	1950	1951	1952	1953	1954
Fishing predictions for 10-inch trout	No good		No good	Better than 1948-1949	Same as 1950	Better than 1950 - 1951	Same as 1952	Better than 1952 - 1953
Age-group 0 Fingerlings, average size 2-5 inches	Low production of fingerlings	MINIMUM SIZE CLASS CHANGED FROM 7 TO 10 INCHES	Low production of fingerlings - brood stock from 1947 year class.	Increase in production of fingerlings brood stock from 1948 year class.	No increase over 1950 brood stock from 1949 year class	Increase in production of fingerlings		
Age-group I yearlings, average size 5-10 inches. Bulk of spawning done by this group.	High exploitation of this group by anglers removes most of them before spawning for the first time.		Some increase in spawners due to 10-inch size limit.	No increase over 1949.	Increase in spawning stock.	No increase in spawning stock.	Increase in spawning stock.	
Age-group II Two-year-olds, average size 8-12 inches. Bulk of catch under 10-inch limit is from this group.	Very few of this group escape anglers to become 10 inches in size.		Very few of this group left.	Some increase over 1949 due to protection by 10-inch size limit.	No increase over 1950.	Increase in catch over 1951	No increase over 1952.	Increase in catch over 1953.

1947 YEAR CLASS

1948 YEAR CLASS

1949 YEAR CLASS

1950 YEAR CLASS

1951 YEAR CLASS

1952 YEAR CLASS

Methods of Investigation

Accurate estimates of the population of brook trout in portions of the North Branch of the Au Sable have not been made. As indices to population density and of changes in the population of brook trout we are relying on the catch-per-hour with an electric shocker. While it is admitted that the efficiency of the collecting apparatus will vary with conditions of weather, water level and with different personnel, any marked changes in actual population density should be detectable even though their magnitude be only estimated. The collections have been uniformly taken from the same portion of the stream at comparable times of the year with the same type of apparatus in so far as possible.

A partial creel census has been initiated in 1950 to determine the general level of angler success. This census will be continued for the duration of the study. Since conditions made it impossible to obtain a record from everyone fishing in the area, a sampling schedule was prepared to enable the clerk to spend half of his time in the 10-inch water and the other half in the 7-inch water. By this means, the fishing intensity, success, and quality of fishing could be compared between the two types of water even though the total angling was not known. Also, since the amount of trout water in the North Branch Au Sable is about equally divided between the two types of size limit, differences in fishing intensity in the two areas might reflect public willingness to go along with this type of regulation. It is necessary that the operation of this type of creel census be maintained as nearly uniform as possible for the duration of the study, if data on fishing pressure, catch and percent of angler success are to be useful in comparing one year with another. Any major change in density of fish stocks should be reflected in a change in fishing statistics.

As a continuation of studies on the rate of growth and age-composition of the brook trout population, scale samples and other pertinent information are being regularly collected and analyzed. If a noticeable increase in the population can be brought about, it should provide a chance to obtain valuable information concerning the relationship of growth-rate and population density.

#### Preliminary Results

During the season of 1949, as a result of an order by the Conservation Commission, a 10-inch minimum size limit was in effect for brook trout only in that portion of the North Branch of the Au Sable River from the Otsego-Crawford County line downstream to the village of Lovells. Daily creel limit remained at 15 fish, regulations on other species of trout remained unchanged and there were no restrictions as to the type of lure used. Also, as pointed out by the Field Administration Division, the lack of a provision in the order making it illegal to possess brook trout smaller than 10 inches in this portion of the stream rendered law enforcement relatively ineffective. There was considerable criticism of the order with many people suggesting a lower daily limit, restrictions to flies only and application of the 10-inch limit to all species of trout. The general opinion that violations were rampant and undetectable apparently was over-emphasized as was the belief that the bait fishermen were killing nearly all the 7- to 10-inch brook trout. Despite the professed lack of protection from both the violator and the bait-fisherman there was a marked increase in the number of fish from 7 to 10 inches long noticed in the late summer and fall samples of 1949.

In 1949, fishing in the 10-inch section was not very good (an understandable condition) which fact prompted the department to stage a demonstration of the population density to interested parties. This demonstration was done in the vicinity of the Twin Bridges north of Lovells in July, 1949 with an electric shocker and convinced the several hundred people present that there was a very



large population of 7- to 10-inch brook trout present in the stream plus a fair number of brown trout larger than 10 inches. It was explained at the time that samples taken with a shocker during July and August of the previous two years revealed very few fish of the then legal size of 7 inches, and that the marked increase of fish from 7 to 10 inches in length should make fishing much better next year when these same fish would be mostly 10 to 12 inches long.

In November, 1949, a sample was taken in the same area while fish were concentrated on the spawning grounds. The fish taken at this time averaged somewhat longer than during the previous year and there were many more of them present (Table 2). There was not much change in the age-composition of the sample (most of the spawning stock still being yearling fish) indicating that most fish exceeded the 10-inch limit during their third summer and were very quickly caught by anglers. Very few fish longer than 10 inches were taken in the sample (2 out of 103). The increase in average length of the total sample was due to the increase in the numbers of 8- to 10-inch fish present which were for the most part fast-growing yearlings.

For the season of 1950, some changes were made in the Commission order regulating trout fishing on the North Branch of the Au Sable River. Minimum size on all species of trout was 10 inches; daily creel limit of 10 trout, of which not more than 5 could be brook trout; the fishing method to be restricted to the use of artificial flies only and the restricted area was extended to include that portion of the stream from the village of Lovells downstream to Eaman's. Also, provision was made in the order making it illegal to possess trout below the legal length in these waters.

It is interesting to note that most of these additional restrictions were suggested by the Lovells Hook and Trigger Club, the local sportsman's organization. The extension of the order to cover brown trout was done to eliminate the problem

Table 2. Size frequency distribution and age-composition of collections of spawning brook trout in North Branch of the Au Sable River. Discrepancies in total fish collected for size frequency and age distribution summaries are due to the fact that all fish collected were not scale sampled.

Size-range in inches	Date and number of fish collected		
	September, 1948	November, 1949	October, 1950
5.0 - 5.9	7	4	20
6.0 - 6.9	28	15	10
7.0 - 7.9	50	36	21
8.0 - 8.9	6	35	23
9.0 - 9.9	2	11	8
10.0 - 10.9	0	2	8
11.0 - 11.9	0	0	1
Total fish collected	93	103	91
Time spent in collecting	2 hours	40 minutes	45 minutes
Number of fish per hour of sampling	47	155	121

  

Age-group	Date, number and size of brook trout taken								
	September, 1948			November, 1949			October, 1950		
	Number	Size-range	Average size	Number	Size-range	Average size	Number	Size-range	Average size
I	91	5.2 - 9.3		60	5.6 - 9.9		34	5.6 - 9.0	
II	2	7.6 - 9.7		12	7.3 - 10.1		3	10.2 - 10.5	
I and II combined			7.1			8.2			7.8

of identification, as it was apparent that many fishermen could not distinguish between brook and brown trout. Rainbow trout do not occur in that portion of the North Branch under observation. The limit of 10 trout but not more than 5 brook trout, also suggested by the local club, and the "fly-fishing only" restriction both were adopted although neither regulation was believed to furnish much additional protection to the brook trout population. The collection made in October, 1950 indicated that there were a few less fish present on the spawning grounds in 1950 than there were in 1949 but that the population was still much greater than in 1948. Although the small difference noted between 1949 and 1950 may reflect only the inaccuracy of the collecting method, it is evident that the additional protection afforded by the reduction in the daily limit from 15 to 5 and a further restriction to fly fishing only did little or nothing in allowing a larger proportion of the yearling fish to escape anglers. It seems hardly justifiable to maintain the fly-fishing only restriction in the face of considerable opposition, despite the local sentiment in favor of such a proposal.

#### Creel Census of 1950

During the season of 1950, 892 fishermen were contacted at the end of their fishing trips and data on their success tabulated. (Table 3). The distribution of the fishing intensity between the two types of water (487 trips in open section; 405 in restricted water) indicated very little opposition to the 10-inch size limit although some criticism was voiced against the fly-fishing only rule. Also, it should be remembered that hatchery plantings were made in the 7-inch water and no fish were planted in the 10-inch water. It has been observed, elsewhere, that hatchery plantings tend to attract fishing pressure to that portion of the stream, and the fact that there was little difference in fishing intensity in the two areas is indication that there was considerable satisfaction with the angling that the 10-inch water afforded.

Table 3. Results of creel census on North Branch of the Au Sable River, season of 1950.

Portion of stream sampled	Total fishing trips	Percent successful	Hours fished	Total trout	Wild brook trout	Hatchery brook trout	Wild brown trout
7-inch water - Dam 2 to Otsego-Crawford County Line; Eamans to Kelloggs.	487	43	1,682	754	313	345	96
10-inch water - Otsego-Crawford County Line to Eamans.	405	11	1,050	77	29	0	48

This satisfaction evidently was not derived from the fishing quality as customarily computed, for only one out of 10 fishermen caught a legal fish; at a rate of less than one fish for each 10 hours of fishing. Of these, brown trout outnumbered brook trout 48 to 29. However, reports from usually reliable fishermen indicated that considerable sport was to be had in catching 7- to 10-inch brook trout although it was a bit difficult at times to release these fish as undersized. Despite heated arguments to the contrary, there seems to be some evidence that a portion at least of the trout fishermen are principally interested in the recreational aspects of trout fishing rather than taking home a creel full of fish to eat. It would otherwise be difficult to explain the continued popularity of the sport in the face of the low level of angler success even in heavily-planted trout streams.

Angler success in the 7-inch water was about average for other Michigan trout streams that are planted heavily. About 40 percent of the anglers caught fish. The fishing quality was at the rate of one fish to about 2 1/2 hours of fishing. Nearly half of these fish had been planted during the open season.

It is interesting to analyze the size-frequency and the age-composition of the wild brook trout caught by anglers in that portion of the stream under the 7-inch minimum size (Table 4). These conditions reflect what was happening to the restricted area before the change in management. This evidence from the 1950 creel census substantiates earlier conclusions that the brook trout are being rapidly exploited in this stream; about half of the catch is less than 7 1/2 inches long and 3/4 of the catch is less than 8 inches long. There were no brook trout larger than 10 inches recorded in this section. As regards the age of the fish, age-group III disappears from the catch early in the season and age-group II is not important in the catch after June. Notice that the bulk of the catch in July, August and September is made up of fast-growing individuals of age-group I (7.0 to 8.7 inches in length). It should be remembered that members of age-group I will not yet have spawned for the first time.

Table 4. Size distribution and age-composition of wild brook trout taken by anglers in North Branch of the Au Sable River, season of 1950. Entire catch was not scale sampled.

Size range inches	7-inch water				Total	Percent of total
	April-May	June	July	August-September		
7.0 - 7.4	20	14	39	72	145	48.2
7.5 - 7.9	18	11	10	41	80	26.6
8.0 - 8.4	12	4	9	19	44	14.6
8.5 - 8.9	5	3	3	12	23	7.6
9.0 - 9.4	2	1	2	2	7	2.3
9.5 - 9.9	1	0	0	1	2	0.7
10.0 - larger	0	0	0	0	0	0
<b>Total</b>	<b>58</b>	<b>33</b>	<b>63</b>	<b>147</b>	<b>301</b>	

Age-group  
(size range in parentheses)

I	0	12 (7.0-7.5)	10 (7.0-7.6)	6 (7.0-8.7)
II	28 (7.0-9.6)	9 (7.1-8.7)	4 (7.9-9.2)	3 (8.8-9.6)
III	2 (9.3-9.6)	0	0	0

10-inch water

Age-group                      Total number of fish scale sampled

I	0
II	36 (9.6-10.5)
III	1 (11.5)

Average size of catch in 7-inch water:      7.7 inches

Average size of catch in 10-inch water:      10.3 inches

Public Relations

Public criticism of the program on the North Branch of the Au Sable River during the season of 1950 was very light, according to contacts made by the department representatives. This is due in large part to the Lovells Hook and Trigger Club which campaigned actively in support of the program. Many of the favorable comments received by the Department should be discounted for the same reason in that few of them are believed to have been spontaneous. Some of the comments noted by fishermen long acquainted in the area appear to be biased and more the result of wishful thinking rather than accurate observations. It should be emphasized that what we are after in this experimental study is information upon which to base intelligent management practices of our trout populations for the benefit of the greatest number of fishermen and not the furtherance of a set of local conditions that are favorable to a large and industrious tourist business. It is believed that if we can measurably improve the recreational values of trout fishing, no better tourist advertising is available.

Acknowledgments

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