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April 11, 1955

Report No. 1443

A PROGRESS REPORT ON THE CREEL CENSUS STUDY OF THREE EXPERIMENTAL BROOK TROUT LAKES, MARQUETTE COUNTY, MICHIGAN, 1953 AND 1954 TROUT SEASONS

By

Merle G. Galbraith, Jr.

Abstract

Two years of a partial creel census study on Moccasin, Swanzy and Airport lakes have now been completed. This census is designed to determine the most effective stocking techniques in terms of the size and number of brook trout planted as well as the possible effect which different regulations might have on returns to the angler.

To date, returns of 26 and 32 percent have been realized from fall fingerling plants made in 1951 and 1952. Recovery from sublegal and legal fall plantings range from 62 to 96 percent. Although the percentage of recovery was greater from sublegal and legal plantings, pound for pound the fingerling trout gave the highest returns at the least cost to the angler. Thus far, for every pound of fingerling trout planted there has been a return to the angler of 4.7 and 9.8 pounds (an increase in weight of 370 to 980 percent). Only 1.1 to 1.6 pounds have been recovered for every pound of sublegal and legal trout planted.

The greatest percentage of sublegal and legal trout plants (in fall) was caught by anglers during the season following stocking, but trout from fingerling plants were generally not available to the angler until the second fishing season following stocking.

Upon completion of the 1955 fishing season, the results from the creel census data collected since 1953 will serve as control data for evaluating different management practices during the balance of the experiment.

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Two years of a partial creel census study on Moccasin, Swanzy and Airport lakes have now been completed. This census is being conducted in order to determine the most effective stocking techniques in regard to size and number of brook trout planted, as well as to test the effect of different regulations on returns to the angler. Upon completion of the census in 1955, the creel census data collected since 1953 will be tabulated and summarized, and will serve as control data with which to evaluate different management practices during the balance of the experiment (i.e., during 1956 and later years).

In order to avoid repetition of previously discussed methods, the reader is referred to I. F. R. Report No. 1401 (Galbraith, 1954).

Methods

Due to insufficient funds in 1954, only two creel census clerks were available to cover the three lakes during the first two weekends of the season when pressure was greatest (in 1953 there were 3 clerks). Otherwise, the methods used in obtaining creel census data this year were very similar to those used last year.

According to a prearranged schedule, one clerk covered one of the lakes for the full day while the other clerk apportioned his time between the remaining two lakes, alternating between them every three hours. During the week days of the first week and for the remainder of the season, one creel census clerk covered all lakes in accordance with a schedule similar to that used the previous season. In addition to covering the lake assigned for the day, the creel census clerk also made daily morning and evening counts of boat and shore anglers at the other two lakes. The morning count was made at 9:00 a.m. but rather than delay the evening count one hour due to the increase in daylight hours as the season progressed (as done last year), the evening count was always taken at 7:00 p.m. It was felt that the majority of anglers who intended to fish these lakes in the evening would arrive by 7:00 o'clock.

Because Swanzy Lake abounds with fathead minnows and Iowa darters, stomach samples were also taken this year in order to determine to what extent the trout were dependent upon these fish for food. Trout planted in the fall of 1953 and marked for the first time by the removal of the left pectoral fin were recovered in 1954 in Airport and Moccasin lakes. Each marked fish was recorded on the creel census sheets in order to distinguish between yearly plantings. Some scale samples of unmarked trout were also taken in order to assist in the breakdown of the unmarked trout by plantings.

Fishing success

Tables 1 and 5 summarize the creel census data and estimates based on these data. Except at Airport Lake, the majority of trout harvested for the season were removed in the first two weeks of the season. Based on actual contacts, 93 percent of the total fish caught at Swanzy Lake were recovered by the second Saturday in May. During the same time, 95 percent of the total catch was removed from Moccasin Lake, and 40 percent of the catch was taken from Airport Lake.

Table 1.--Summary of creel census data, 1954

	Swanzy	Moccasin	Airport
Successful and unsuccessful anglers			
Number of anglers interviewed	356	144	122
Number of fish caught	97	119	110
Average length, inches	10.5	8.9	8.4
Average weight, pounds	0.43	0.28	0.22
Angler hours	431.0	254.5	194.5
Hours/trip	1.21	1.77	1.59
Fish/trip	0.27	0.83	0.90
Catch/hour/angler (standard error)	0.12 (±0.02)	0.44 (± 0.08)	0.48 (0.03)
Successful anglers			
Catch/hour/angler (standard error)	0.85 (±0.11)	1.68 (± 0.20)	1.47 (± 0.20)
Hours/trip	3.16	2.16	2.22
Percent of anglers successful	14	26	33
Unsuccessful anglers			
Hours/trip	0.89	1.63	1.29
Percent of anglers unsuccessful	86	74	67
Boat anglers			
Number of anglers	54	7	13
Number of fish caught	2	10	10
Catch/hour/angler (standard error)	0.01 (± 0.01)	0.57 (± 0.37)	0.28 (± 0.10)
Hours/trip	1.54	2.07	2.65
Fish/trip	0.04	1.43	0.77
Shore anglers			
Number of anglers	302	137	109
Number of fish caught	95	109	100
Catch/hour/angler (standard error)	0.14 (± 0.03)	0.44 (± 0.08)	0.51 (± 0.10)
Hours/trip	1.15	1.75	1.47
Fish/trip	0.31	0.80	0.92

Table 2.--Breakdown of types of fishing gear used, anglers, sex and the residence of the anglers by state and counties, 1954

	Swanzy	Moccasin	Airport
Fishing gear			
Worms	204	104	84
Flies	11	11	4
Plugs	18	1	1
Combination	123	28	33
Residence			
Michigan (Upper Peninsula)			
Delta	18	6	2
Marquette	318	130	118
Menominee	2	2	0
Michigan (Lower Peninsula)			
Calhoun	0	0	1
Ionia	1	0	0
Kent	5	0	0
Montcalm	1	0	0
Muskegon	1	0	0
Ottawa	1	0	0
Washtenaw	0	0	1
Illinois	2	1	0
Indiana	2	0	0
Minnesota	2	0	0
Wisconsin	3	0	0
California	0	1	0
Mississippi	0	4	0
Male anglers	328	142	119
Female anglers	28	2	3

Again this year 90 percent or more of the anglers contacted were from Marquette County. The greater proportion of successful anglers used worms or combinations of worms with other lures. Table 2 summarizes, for the three lakes, the different types of fishing gear and the extent to which they were used by fishermen, as well as the residence and sex of the angler.

Fishing intensity

The 1954 trout season opened on April 24 and ended midnight of September 12, a season total of 142 fishing days. The average length of a fishing day remained the same as in 1953 (15 hrs.). Creel census started the opening day at 6:00 a.m. but from then on the working day started at 7:00 a.m.

Methods used in arriving at the estimates of the number of anglers and angler-hours were similar to those used in the 1953 progress report. Number of counts made, angler counts, and anglers per hour are given in Table 3.

Fishing pressure on Swanzy Lake increased greatly over 1953. In 1953 an estimated 1,257 anglers fished, as compared to 2,523 anglers who fished in 1954. Angling pressure as measured in hours of effort per surface acre for the two years was 100.7 in 1953, and 147.3 in 1954. This increase in pressure was presumably due to a much higher catch-per-hour during the beginning of the 1954 season as compared to the previous year, thus attracting more anglers. Ninety percent of the estimated total number of anglers at Swanzy Lake fished from shore. Of the total number of angling hours (3,004), shore anglers fished 2,599 hours and boat anglers fished 405 hours (see Table 5 for separate estimates).

At Moccasin Lake a striking decline in fishing pressure was noted in 1954 when only 554 anglers fished as compared to 1,101 anglers who fished in 1953. Fishing pressure in terms of hours effort per surface acre was 155.6 in 1954 and 327.9 in 1953. The underlying cause for the reduced pressure in 1954 is

Table 3.--The average daily number of counts of fishermen, total numbers of boat and shore fishermen, and anglers per count for the entire year

Lake and day	Number of counts	Shore fisherman	Boat fisherman	Anglers/count
Swanzy Lake				
Sunday	130	274	82	2.74
Monday	43	25	6	0.72
Tuesday	31	20	4	0.78
Wednesday	31	7	3	0.33
Thursday	45	72	2	1.64
Friday	33	17	3	0.61
Saturday	140	395	31	3.04
Total or average	453	810	131	1.41
Moccasin Lake				
Sunday	147	90	4	0.64
Monday	41	0	0	0.00
Tuesday	43	4	0	0.09
Wednesday	38	7	2	0.23
Thursday	31	5	0	0.16
Friday	43	6	2	0.19
Saturday	138	255	11	1.93
Total or average	481	367	19	0.46
Airport Lake				
Sunday	134	63	12	0.56
Monday	37	41	9	1.35
Tuesday	38	7	1	0.21
Wednesday	45	2	0	0.04
Thursday	40	7	0	0.18
Friday	39	13	0	0.33
Saturday	135	116	22	1.02
Total or average	468	249	44	0.53

believed to have been the abrupt drop in the catch per hour after the first day with a subsequent transfer of angling effort to Johnson Lake--a nearby rainbow lake which offered phenomenal fishing.

Shore anglers constituted 94 percent of the total estimated number of anglers at Moccasin Lake, and anglers fishing from boats made up the other 6 percent. Shore anglers fished an estimated 916 hours and boat anglers 64 hours.

Fishing pressure at Airport Lake remained relatively the same as it was in 1953. It was fished mainly by residents of nearby Gwinn and is the closest lake of the three to Gwinn. Apparently a cliche of anglers from this town maintain a steady and equal pressure on this lake. However, hourly-count records indicate a decline in pressure during the beginning of the season similar to that at Moccasin Lake. The reason for this early season decline in pressure probably can be accounted for by the unusually good rainbow fishing at Johnson Lake which is also near the town of Gwinn. After interest in rainbow fishing subsided, the anglers apparently returned to Airport Lake. This abrupt drop in early season pressure probably accounts in part for the low percentage of recovery (40 percent) by the second Saturday in May as compared to the much higher percentage of recovery by this date in 1953 (95 percent).

An estimated 708 anglers fished Airport Lake in 1954 for a total of 1,107 hours of effort as compared to an estimated 762 anglers who fished 1,150 hours in 1953. Each surface acre of water received 165.2 hours of effort in 1954; in 1953 each surface acre received 121.6 hours. Shore anglers, who made up 92 percent of the total estimated number of anglers, fished 958 hours, and boat anglers fished 149 hours.

Estimated harvest

Test for skewness (Snedecor, 1946) of the catch-per-hour figures for all anglers contacted again showed that the sample population at all three lakes

was highly asymmetrical (see Table 4). Therefore, estimates of the total number (with confidence limits) of fish taken were again based only on the population of successful anglers. Total estimates of the number of hours fished, number of trout harvested, pounds of trout and pounds per acre of trout, were computed separately for boat and shore anglers (see Table 5).

This year, however, the method used in computing pounds of trout taken separately by boat and shore anglers varied from last year's method. In the 1953 report, the estimated pounds of trout listed separately was found by multiplying the average empirical weight for shore-caught trout and boat-caught trout by the estimated number of fish taken by each group of anglers. This year, because of the small number of fish caught by boat anglers, it was decided that a combined average weight of all trout taken by both boat and shore anglers should be used and would be more accurate. Thus, in order to make this year's estimates comparable to last years, tables 4 and 5 of the 1953 report were revised according to the method of computation used in the present report. The differences between the two were almost negligible.

An error was made in the 1953 report in the method of computing the confidence limits of the estimates of the total catch. Revised tables 4 and 5 for the 1953 report are given as appendices to the present report. Likewise, corrections in the written text of the 1953 report (No. 1401) are in order, in accordance with revised tables 4 and 5.

In addition to estimating the total harvest, a breakdown of the catch by age groups was also made in order to show the percentage returns to the angler of trout from different plants. All unmarked trout recorded by the creel census clerk during the 1953 and 1954 seasons were separated by age groups on the basis of scale samples and an inspection of a length-frequency table (trout were grouped in 10-millimeter classes). In general, fish three years old (age-group II) or less were easy to distinguish, and they comprised by

Table 4.--Frequency distribution of catch-per-hour data for individual angler trips for the season of 1954, Swanzy, Moccasin, and Airport lakes

Catch per hour per angler trip	Number of anglers interviewed		
	Swanzy	Moccasin	Airport
0.00	305	106	82
0.11	1	0	0
0.12	1	0	0
0.20	1	0	0
0.22	1	0	0
0.24	2	0	0
0.29	2	1	0
0.33	7	0	2
0.36	1	0	0
0.40	2	2	2
0.50	5	5	6
0.67	7	1	2
0.75	1	0	0
0.80	2	1	2
1.00	11	5	8
1.14	0	1	0
1.20	0	1	3
1.33	0	3	2
1.50	1	1	1
1.60	0	2	1
1.67	0	1	0
2.00	3	6	4
2.50	0	1	1
2.67	1	0	2
3.33	1	5	1
4.00	1	0	0
5.00	0	2	3
Total	356	144	122

Table 5.--Total estimate of the number of hours fished, the number of trout harvested, pounds of trout and pounds per acre of trout, computed separately for boat and shore anglers, 1954

	Swanzy	Moccasin	Airport
Estimated number of angling hours			
Shore anglers	2,598.6	915.9	958.5
Boat anglers	404.7	63.9	149.1
Number of anglers			
Shore anglers	2,260	523	652.0
Boat anglers	263	31	56.3
Total number of anglers	2,523	554	708.3
Percent of estimated total anglers contacted	14.1	25.9	17.2
Number of trout[1]			
Shore anglers	1,004(±254)	488(±121)	472(±124)
Boat anglers	10(±0)	44(±0)	18(±9)
Total	1,014(±254)	532(±121)	490(±125)
Pounds of trout[1]			
Shore anglers	430.6(±108.9)	136.5(±33.8)	105.4(±27.7)
Boat anglers	9.6(±0)	12.3(±0)	4.0(±2.0)
Total	440.2(±108.9)	148.8(±33.8)	109.4(±27.8)
Pounds per acre[1]			
Shore anglers	21.1(±5.3)	21.7(±5.4)	15.7(±4.1)
Boat anglers	0.5(±0.0)	2.0(±0.0)	0.6(±0.3)
Total	21.6(±5.3)	23.7(±5.4)	16.3(±4.1)

[1] Figures given within parentheses in this table are 95 percent confidence limits of the estimates, whereas figures given parenthetically elsewhere in this report, appended to catch-per-effort averages, are standard error.

far the majority of the total number of unmarked fish. Trout of doubtful age, usually fish older than age-group II, were not used in computing the estimates in Table 6. Their exclusion, therefore, accounts for the differences between the totals of estimated fish--and respective weights--caught each year in tables 5 and 6. The estimates of trout caught by anglers in Table 6 were obtained by simply applying the percentages that each age group represented of the total catch recorded (the number of fish in each age group over the total number recorded for the year) to the estimated total number of trout caught. The average empirical weight of trout in any one age group was then used in computing the total weight.

Trout stocked in Airport, Moccasin and Swanzy lakes were marked for the first time in 1953. Although none of these trout was harvested in Swanzy Lake in 1954, they did comprise the majority of fish taken from Airport and Moccasin lakes. Based on actual contacts, 92 percent of the total fish caught in Moccasin Lake and 94 percent of those caught in Airport Lake in 1954 were marked. This made the breakdown of the catch by age groups for these two lakes relatively simple and accurate.

Brook trout from Swanzy Lake averaged 10.8 inches in length and 0.43 pound in weight. There were an estimated 1,014 ± 254 trout taken which weighed 440.2 ± 108.9 pounds. This was a sizeable increase over the number taken last year, which can be attributed to the fact that this was the first year that fingerlings planted in 1952 had attained legal size. The small number of trout caught in 1953 was the remainder of the 1951 sublegal plant--the majority of which were probably harvested in 1952.

At Moccasin Lake, brook trout averaged 8.9 inches and weighed 0.28 pound. The estimated number of trout removed was 532 ± 121 for a total weight of 148.8 ± 33.8 pounds. The only apparent reason for this decrease in catch is the marked drop in fishing pressure after the first of the season. There is

Table 6.--Recovery of trout from specific plantings expressed in terms of estimated numbers caught, total weights, and pounds taken per pound planted for each lake

Lake	Year stocked	Number planted and average total length	Weight of plant	Estimates of trout caught				Estimated percentage of fish caught to date	Estimated gain in weight (pounds per acre)	Pounds taken per pounds planted
				1953		1954				
				No.	Wt.	No.	Wt.			
Moccasin	1952	750 (6.5)	90	702	146.8	14	1/	96	9.0	1.63
6.3 acres	1953	750 (7.7)	120	...	...	491	126.5	66	1.0	1.05
Swanzy	1951	2,000 (5.8)	160	109	115.5	33	...	2/	...	...
20.4 acres	1952	3,000 (3.0)	36	20	1/	926	352.9	32	15.2	9.80
Airport 6.7 acres	1951	2,000 (3.5)	28	498	107.5	29	24.1	26	15.5	4.70
	1953	750 (6.5)	75	...	...	461	85.3	62	1.5	1.14

1/ The sample was considered to be too small to justify an accurate computation of the estimated weight.

2/ It is believed that the majority of fish from this planting were caught before this study commenced.

no reason to believe that it was due to a difference in winter survival because the winter of 1953-1954 was less severe than the previous one.

In terms of total numbers and weights of fish caught, the estimated harvest in 1954 from Airport Lake was very similar to the 1953 harvest. The average size of the trout was 8.4 inches, and the average weight was 0.22 pound. Anglers caught an estimated 490 ± 125 trout and the total weight amounted to 109.4 ± 27.8 pounds.

No evidence of natural reproduction in these lakes has ever been obtained. Therefore, it has been assumed that all trout from these lakes are of hatchery origin.

Data presented in Table 6 suggest, thus far, that in terms of numbers of fish, both sublegal and legal-size-trout plants give the highest percentage of recovery to the angler, and that the majority of these trout are caught in the first year following planting. An estimated 96 percent of the 1952 sublegal plant in Moccasin Lake were caught out in 1953 and 1954; 94 percent were caught in the first year (1953) following planting. Of the 1953 legal plant in Moccasin Lake, 66 percent were recovered in the following year. At Airport Lake in 1954, anglers removed 62 percent of the 1953 sublegal planting. At Swanzy Lake a combined total of only 7 percent of the 1951 sublegal planting were caught during 1953 and 1954--two to three years after the planting was made.

Most trout from the fingerling plants evidently did not attain legal size until some time after the middle of their first year in the lake. As a result they did not contribute significantly to the catch until the second season after stocking. Of the fingerling plant in Swanzy Lake in the fall of 1952, only an estimated twenty legal-size trout were taken in the following season, 1953. In 1954, none of the fingerling trout from the 1953 planting was caught. Since the growth rate is much higher for trout in Swanzy Lake as compared to

the growth rate in Airport Lake, it is felt that few, if any, fingerling trout planted in Airport Lake in 1951 were caught in the following year (1952) either.

Although the percentage of trout returned from legal and sublegal plantings was much higher than the percentage returned from fingerling plantings, at the present rate of stocking, fingerling plants gave a much higher recovery rate of pounds returned per pound stocked. Recoveries of 880 and 370 percent in excess of poundage of fingerling trout planted in Swanzy during 1952 and in Airport during 1951, respectively, have been realized thus far. The percentage gain in weight for trout recovered from the 1952 fingerling plant in Swanzy Lake will probably be increased next year by additional returns. Similarly, additional returns from the 1953 plantings (legal and sublegal) in Moccasin and Airport lakes can be expected in 1955. However, even if the total weight of trout recovered thus far from the 1953 sublegal and legal plants were doubled by the returns in 1955, the percentage gain in weight would not approach in magnitude the weight returned from the two fingerling plants. Hence, the cost to the angler for every pound of fish creeled was much less when fingerlings were planted than when sublegal or legal trout were planted.

Results thus far on the three lakes may be summarized briefly by the following:

1. Although not conclusive, evidence is presented which shows that the highest percentage of recovery of sublegal and legal fall plantings was made the year following stocking.
2. Returns from fingerling plants indicate that the majority of fingerlings did not attain legal size until the latter part of the fishing season following planting, and/or were not available to the angler until the second season after stocking.
3. Whereas sublegal and legal brook trout plantings gave the highest numerical percentage of recovery, fingerling trout gave a higher percentage recovery in

terms of the total weight caught to the total weight stocked.

4. The cost to the angler for every fish creeled was much less from fingerling plants than from sublegal and legal plants.

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Appendix

Table 4.--Total estimates of the number of hours fished, the number of fishermen, and the estimated number and pounds/acre of brook trout harvested during the 1953 fishing season

	Swanzy	Moccasin	Airport
Estimated number of angling hours	2,055	2,066	1,150
Shore anglers	969	944	681
Boat anglers	288	157	81
Total number of anglers	1,257	1,101	762
Percent of estimated total anglers contacted	24.2	25.7	26.3
Number of trout[1]	132(±33)	1,005(±194)	502(±70)
Pounds of trout[1]	126.2(±35.4)	347.6(±66.9)	110.6(±15.4)
Pounds/acre[1]	6.2(±1.6)	55.2(±10.6)	16.5(±2.3)

[1] While the figures given within parentheses in this table are 95 percent confidence limits of the estimates, figures given parenthetically elsewhere in this report, appended to catch-per-effort averages, are standard errors.

Appendix

Table 5.--Total estimates of the number of hours fished, the number of trout harvested, pounds of trout and pounds per acre of trout, computed separately for boat and shore anglers

1953	Swanzy	Moccasin	Airport
Estimated number of angler hours			
Shore anglers	1,608	1,747	967
Boat anglers	447	319	183
Number of trout			
Shore anglers	90(±35)	929(±184)	489(±70)
Boat anglers	44(±12)	76(±60)	13(±0)
Pounds of trout			
Shore anglers	86.0(±33.5)	321.3(±63.6)	107.7(±15.4)
Boat anglers	42.1(±11.5)	26.3(±20.7)	2.9(±0)
Pounds per acre			
Shore anglers	4.2(±1.6)	51.0(±10.1)	16.1(±2.3)
Boat anglers	2.1(±0.6)	4.2(±3.3)	0.4(±0)