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**INSTITUTE FOR FISHERIES RESEARCH**  
DIVISION OF FISHERIES  
**MICHIGAN DEPARTMENT OF CONSERVATION**  
COOPERATING WITH THE  
**UNIVERSITY OF MICHIGAN**

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DIRECTOR

May 24, 1954

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UNIVERSITY MUSEUMS ANNEX  
ANN ARBOR, MICHIGAN

REPORT NO. 1401

A REPORT ON THE INTENSIVE CREEL CENSUS OF  
MOCCASIN, SWANZY AND AIRPORT LAKES,  
MARQUETTE COUNTY, MICHIGAN, DURING THE FIRST  
YEAR OF INVESTIGATION, 1953

By Merle G. Galbraith, Jr.

Abstract

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FISH DIVISION

An intensive creel census study is being conducted on Moccasin, Swanzy and Airport lakes in order to determine the most effective stocking techniques as to size and number of brook trout planted, as well as the possible effect of different regulations. The present annual rates of stocking these lakes are as follows: Swanzy Lake—3,000 fingerlings (about 3 inches average length), Moccasin Lake—750 legal trout, and Airport Lake—750 sublegal trout; for all three lakes plantings are to be in the fall. The present rates of stocking will be continued through the 1955 season to establish control data with which to evaluate changes during the balance of the experiment.

All three lakes are similar in that they are seepage basins and their water levels are dependent upon rainfall and the height of the water table. They are situated on rolling jack-pine plains, approximately one-half mile apart. The water in each lake is typically clear and colorless. Moccasin, Airport and Swanzy lakes are soft-water lakes; recorded pH varied from 5.2 to 6.2 in Moccasin and Airport and from 6.8 to 7.4 in Swanzy, at the time of

the last survey. Swanzy Lake is the largest, with an acreage of 20.4; Moccasin Lake has an area of 6.3 acres, and Airport has 6.7 acres. Swanzy and Moccasin lakes are completely surrounded by sandy shoal areas; whereas, Airport Lake is a bog lake surrounded by a leatherleaf bog mat.

Airport and Swanzy lakes were poisoned in 1940 and 1941, respectively; Moccasin Lake was never poisoned. Swanzy and Moccasin Lakes have been stocked with brook trout of various sizes since 1941. Brook trout have been planted in Airport Lake every year since 1940, except in 1952.

An intensive creel census on the three lakes was initiated in 1953. Information obtained by the creel census clerk included the following: name, residence and sex of the angler, date, type of lure used, hours fished, lengths and weights of fish caught, and whether fishing from boat or shore, along with climatological data; hourly counts of boat and shore fishermen were made as a basis for estimating total fishing pressure and total catch.

During 1953, the numbers of anglers interviewed from the three lakes were: Swanzy—304, Moccasin—283, and Airport—200. The averages of catch per hour per angler on these lakes were 0.043, 0.370 and 0.360, respectively. Statistically, there was no significant difference between the catch per hour per angler of boat and shore fishermen on Swanzy lake, but on Moccasin and Airport lakes shore anglers had a higher catch per hour than did boat anglers.

The percentage of successful anglers was 7.2 for Swanzy, 27.2 for Moccasin, and 25.5 for Airport. Successful anglers spent more hours per trip than did unsuccessful anglers. Between 66 and 88 percent of all fishermen used worms. The majority of successful anglers used worms for bait, followed in decreasing order of usage and success by combinations of flies, plugs and other lures. Between 86 and 90 percent of the fishermen were from Marquette County. Five to ten percent came from Delta County and the remainder—a small fraction of the total—from various counties in the upper and lower peninsulas, and from Illinois, Washington and Wisconsin.

Fishing intensity was greatest from April 25 to June 1 on Moccasin and Airport lakes. Fishing pressure was also heaviest during this period on Swanzy Lake but tapered off more gradually during the rest of the season since this lake has a wider recreational attraction than the others. Anglers per hourly count averaged 0.96, 0.97 and 0.54 on Swanzy, Moccasin and Airport lakes, respectively. An estimated 1,257 anglers fished Swanzy Lake with an estimated total effort of 2,055 hours; for Moccasin Lake the figures were 1,101 anglers who fished a total of 2,066 hours; and for Airport Lake, 762 anglers who fished 1,150 hours.

Based on actual contacts, 85 percent of the total fish harvested from Swanzy Lake were taken during the first 15 days of the season. On Moccasin successful anglers removed 90 percent of the total catch of trout in the first 26 days, while on Airport they removed 98 percent of the catch during the first 29 days. On Swanzy Lake fishermen spent 1.63 hours per trip and took home an average of 0.09 fish. At Moccasin they spent 1.87 hours per trip with an average catch of 0.70. Anglers at Airport fished 1.52 hours per trip, catching 0.60 fish per trip. An estimated total of 969, 944 and 618 shore anglers fished Swanzy, Moccasin and Airport lakes. Boat anglers numbered 288, 157 and 81, respectively. The average size and weight of brook trout taken by anglers were: Swanzy—12.8 inches and 0.96 pound; Moccasin—9.2 inches and 0.33 pound; Airport—8.5 inches and 0.20 pound.

The numbers of trout which were estimated to have been harvested were Swanzy—132(+33), Moccasin—1,005(+244), and Airport—489(+69). Total estimated weight removed from Swanzy was 126.2(+31.6) pounds or 6.2(+1.6) pounds per acre; Moccasin—333.5(+89.0) pounds or 52.9(+14.0) pounds per acre; and Airport—107.6(+15.3) pounds or 16.1(+2.3) pounds per acre. (The preceding figures on number and weight of trout caught include 95 percent confidence limits of the estimates; the numerical limits are computed solely from the

standard error of catch-per-hour data, and weight limits are computed directly from numerical limits.) Providing the assumptions made by the writer are correct—that only the 1951 and 1952 stockings contributed to the catch in 1953—the returns to the angler on Moccasin and Airport lakes were 1.3-2.2 pounds and 3.3-4.4 pounds, respectively, for every pound stocked. Returns from Swanzy Lake were comparatively low—0.48 and 0.81 pound for every pound planted. The low returns from Swanzy can be explained largely on the basis that the 1951 plant of sublegals probably were mostly caught out by the end of 1952, whereas among the 1952 plant of fingerlings most fish did not reach legal size during 1953.

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An intensive creel census is being conducted on Moccasin, Swanzy and Airport lakes as a basis for evaluating present practices and possible future changes in fish plantings and fishing regulations. The creel census is designed to measure total angling pressure and returns to the fishermen (i.e., fishing quality). The present annual rate of stocking brook trout is scheduled as follows: Swanzy Lake—3,000 fingerlings (about 3 inches average length), Moccasin Lake—750 legal trout, and Airport Lake—750 sublegal trout, all to be planted in the fall. The present rate of stocking will be continued through the 1955 season to establish control data with which to evaluate changes during the balance of the experiment. Present fishing regulations on designated trout lakes (including the present three) prohibit the use of live minnows, define the size limit as 7.0" total length, limit the number of trout to 5 per day, and establish the fishing season as opening on the last Saturday of April and terminating on the second Sunday in September. It is anticipated that, beginning in 1956, changes will be made either in stocking procedures or in fishing restrictions, or in both, but the final plans have not been formulated at this time.

All three lakes are similar in that they are seepage basins and their

water levels are dependent upon rainfall and the height of the ground-water table. They are situated on rolling jack-pine plains, approximately one-half mile apart, and are easily accessible to fishermen. The water of all three lakes is colorless and clear. Two of the three lakes, Swanzy and Airport, were poisoned in 1941 and 1940, respectively, in order to eliminate undesirable game fish and minnows. Since that time only one perch has shown up in Swanzy Lake; however, fathead minnows and Iowa darters abound in Swanzy Lake. It is believed that this minnow and darter were introduced by fishermen. Minnows have never been observed in either Moccasin or Airport lakes. There is but one record of a fish kill since the lakes have been managed for trout. During the spring of 1949, remains of trout were found along the shore of Moccasin Lake; the kill was not complete and it is still a matter of conjecture as to the cause.

It is not the intention of this report to make comparisons between these three lakes because each is different ecologically. Instead, each lake will be ~~considered~~ separately so far as their histories and creel census data are concerned. Tables are included whereby comparisons can be made if so desired.

#### History and Description

Swanzy Lake has an area of 20.4 acres. It has but one major depression and at its deepest is 45 feet. The shoal areas (under 10 feet) are sandy to fibrous peat and comprise 38.2 percent of the total area. The lake water is soft and the pH varies only slightly from neutral. Rooted aquatics are sparse. Apparently fish food organisms are abundant. The principal food supply, judging from past records and from a small number of fish stomachs, appears to be minnows, dragonfly, mayfly and caddisfly nymphs, leeches and scuds. A State-owned fishing site on this lake assures public access. Swimming, boating and picnicing are common activities on Swanzy but not on Moccasin and Airport.

In Swanzy, subsequent to the poisoning and restocking with brook trout in 1941, records show that the fishing quality was good through 1945. In 1946 and 1947 stocking rates were increased from 3,000 to 6,000 fingerlings. Reports were received by the Department complaining about the large number of sublegal fish caught and killed the year following the plants, and in 1948 stocking rates were reduced to 3,000 fingerlings; subsequently, fishing quality became progressively better according to reports and a partial creel census. All stockings were made in the fall after the fishing season ended. In 1950 and 1951, fingerling stocking ceased and 3,000 and 2,000 sublegals, respectively, were planted (see Table 5). Then in 1952, plantings reverted back to fingerling-size trout.

Gill nets were set in Swanzy Lake for short periods during the following years: 1941, 1942, 1944, 1947, 1948, 1950 and 1953. Nets (4) set during September 1950 yielded 16 trout between 10.1 and 16.2 inches in length. During the spring and fall of 1953 nets were set in Swanzy Lake in order to obtain trout for an organoleptic test. Only 4 trout (12.0"-14.9") were collected in the spring, but in the fall after the completion of a "comparatively poor" fishing season, 170 brook trout between 9.0 and 12.0 inches (estimated size) were collected.

Moccasin Lake (shaped like a moccasin), located to the northeast of Swanzy Lake, is 6.3 acres in size and lies in a deep depression. There are two distinct depressions connected by a shallow channel. The larger of the two is approximately 26 feet deep and the smaller is 10 feet. Rooted aquatic vegetation is abundant during the summer months when surface waters become quite warm. Shoal area, less than 15 feet in depth, comprises 80 percent of the area. The entire lake is bordered by sand, but bottom soils for the most part consist of fibrous and pulpy peat. The water is very soft and has a pH range of approximately 5.2-5.9. Repeated observations and survey # records indicate that fish food organisms—mayfly and dragonfly nymphs, scuds,

leeches and caddisfly larvae are abundant. Public access is assured because this land was conveyed by the State to Marquette County in 1948 for forestry purposes; and, should its use for forestry cease, the land will be reverted to the State of Michigan.

Moccasin Lake has received trout plantings since 1941, at which time it came under trout management. No more than 2,100 brook trout were ever stocked in one year. Except for the years 1941, 1942, 1946 and 1952 all trout were of legal size. During the former three years, plantings consisted of fingerlings whereas in 1952 they were of sublegal size.

Test nets were set in 1947, 1948 and 1949. Four gill nets set in 1949 yielded twenty-five 8.0- to 15.0-inch trout. All fish were heavily infested with gill lice; this condition is typical during the warm summer months and is esthetically objectionable to many fishermen. Survey records and fishermen complaints also indicate an abundance of turtles in the lake.

Airport Lake lies to the west of Swanzy and Moccasin lakes. It is a typical bog lake surrounded on all sides by a floating leatherleaf mat. Except for a small depression (28 feet deep) in the northwestern end, the entire lake is less than 20 feet in depth. The drop-off at the edge of the boggy mat is very abrupt (five feet or more in depth). Thirty-nine percent of the area is 10 feet or less in depth. Bottom types consist of fibrous and pulpy peat. Like Moccasin Lake, the water is exceptionally soft and the pH ranges between 5.4 and 6.2. Roelofs and Locke (I.F.R. Report No. 772) reported that, except for a small area in the lake, the major portion is marginal for trout during warm weather. They found bottom temperatures at 12 feet to be 71° F. Warm temperatures may be a chief factor contributing to the apparent slow growth rate of trout in this lake. It would appear from the survey of this lake that, during extended hot spells, trout would be limited to a zone of water about 8 feet in thickness—between depths of 12 and 20 feet.

In Airport, rooted aquatics are sparse but fish food organisms—both



phytoplankton and zooplankton—were abundant according to the survey in 1940. Submerged deadheads and the bog mats which extend from 10 feet to 15 feet out from shore afford adequate cover for fish.

Airport was poisoned in 1940, and brook trout have been stocked every year since then, except in 1952. During the 1951 and 1952 fishing seasons, trout taken from this lake were reported to be thin and in poor condition; thus plantings were discontinued in 1952. Adult trout were planted in 1940 through 1942, and in 1945 and 1946; sublegals were planted in 1941 and 1950. It is believed that the initial planting which followed lake poisoning was a complete failure due to the prolonged toxic effect of the poison. Fingerling plants were made in 1941 through 1944, 1947 through 1949 and in 1951—the last planting was responsible for most of the 1953 harvest. Test nets were set in Airport Lake in 1941, 1942, 1944, 1947 and 1949. Trout taken during these years were reported to be in good condition, in contrast to those taken by anglers in 1951 and 1952.

#### Creel Census Methods

Past experiences have shown that trout lakes receive tremendous pressure during the opening two weekends. Therefore, a creel census clerk was assigned to each lake during the first nine days of the season. After that, one creel census clerk covered all three lakes. A heavy snowstorm during the first two days of the season rendered the lakes inaccessible to the creel census clerks and to all but a few fishermen who possessed heavy-duty vehicles.

Information obtained by the clerks included the following: name, residence and sex of the angler, date, type of lure used, hours fished, length and weight of fish caught, and whether fishing was from shore or boat. A creel census slip was filled out for each individual angler, except where a family did not keep their catch separated. In the latter case, records for the family were recorded on a single slip. Baits used were recorded as either

worms, plugs, flies, insects, or combinations thereof, e.g., spinner and worms. Creel data were recorded separately for each trip and only upon the completion of a trip. If an angler ceased fishing for a half hour or more and then resumed fishing, he was credited with two fishing trips.

The creel census clerk covered but one lake a day according to a pre-arranged schedule. During this day, he attempted to contact all anglers for their individual records. In addition, he made hourly counts of both boat and shore anglers. At 7:00 A.M. and 7:00 P.M. the clerk left the lake assigned to him for that day in order to make boat and shore counts on the other two lakes. Because of the increase in daylight hours as the season progressed, the evening count was delayed one hour (to 8:00 P.M.) beginning with the middle of May and again delayed another hour (to 9:00 P.M.) beginning with June. Estimates of total fishing were based on these hourly angler counts and on data from individual angler records.

In addition, a record of climatological data was kept by the clerk, which was to be taken between 1:00 and 2:00 P.M. on the lake assigned for the day. Information included wind direction, wave action, air and water temperature, time, percentage of overcast, and precipitation.

The clerk worked four days a week. Census effort was concentrated on Saturday and Sunday as compared to week days, as an adjustment to fishing intensity—the clerk worked every Saturday and Sunday and on two week days each week, with the two week days rotated on a sampling schedule to include equal numbers of Monday's, Tuesday's, etc. On Saturday and Sunday the clerk worked from 7:00 A.M. to 9:00 P.M., whereas during the two remaining week days he worked from 7:00 to 10:00 A.M. and from 4:00 to 9:00 P.M. From observations made during the first week of the season, it was determined that, between the hours of 10:00 A.M. and 4:00 P.M., fishermen were few in number; and due to a limit on the number of hours (40 per week) the creel census

clerk could work, it was felt that sampling during these hours could not be justified at the expense of other hours when fishing intensity would be greater.

#### Fishing Success

Swanzy Lake received the highest number of fishing trips, estimated at 1,257, from which individual angling records (actual contacts) were obtained on 24.2 percent (see Tables 1 and 4 for summaries). Each fisherman spent an average of 1.63 hours per trip and took home 0.09 fish per trip. The catch per hour per angler was 0.043 with a standard error of 0.010. Only 7.2 percent of the fishermen were successful and each caught trout at the rate of 0.59 fish per hour. Successful fishermen spent more hours per trip (2.43) than did the unsuccessful fishermen (1.57). Based on actual interviews, 85 percent of the fish were caught in the first 15 days of the season.

Of the 304 anglers contacted on Swanzy, 64 fished from boats and 240 from shore. A boat angler caught fish at the rate of 0.074(+0.026) fish per hour as compared to a catch per hour for a shore angler of 0.035(+0.010). This difference, however, was not statistically significant, based on the "t" test. Boat anglers spent 1.55 hours per trip and averaged 0.14 fish per trip. Shore fishermen spent slightly more time per trip, 1.66 hours, but brought home only 0.08 fish per trip.

Moccasin Lake was fished by an estimated 1,101 fishermen of which 25.7 percent were interviewed and 27.2 percent were successful. Each angler fished 1.87 hours per trip, brought home 0.70 fish per trip and caught trout at the rate of 0.370(+0.051) fish per hour. Successful anglers fished 2.49 hours as against an average of 1.65 hours of effort spent by the unsuccessful angler; the successful angler caught fish at the rate of 1.35(+0.134) fish per hour. Of the season's catch, 90 percent were taken by anglers during the first 26 days.

Shore anglers on Moccasin Lake had a catch per hour of 0.402(+0.057) as compared to only 0.166(+0.087) fish per hour for boat anglers, and the

Table 1. Creel census summary

	Swanzy	Moccasin	Airport
<u>Successful &amp; unsuccessful anglers</u>			
Number of anglers interviewed	304	283	200
Number of fish caught	27	199	121
Average length	12.8	9.2	8.5
Average weight	0.96	0.33	0.20
Anglers hours	497.0	530.5	305.0
Hours/trip	1.63	1.87	1.52
Fish/trip	0.09	0.70	0.60
Catch/hour/angler (standard error)	0.043 (+0.010)	0.370 (+0.051)	0.360 (+0.051)
<u>Successful anglers</u>			
Catch/hour/angler (standard error)	0.59 (+0.078)	1.35 (+0.134)	1.41 (+0.100)
Hours/trip	2.43	2.49	1.80
Percent of anglers successful	7.2	27.2	25.5
<u>Unsuccessful anglers</u>			
Hours/trip	1.57	1.65	1.43
Percent of anglers unsuccessful	92.8	72.8	74.5
<u>Boat anglers</u>			
Number of anglers	64	42	24
Number of fish caught	9	17	4
Catch/hour/angler (standard error)	0.074 (+0.026)	0.166 (+0.037)	0.055 (+0.077)
Hours/trip	1.55	2.04	2.27
Fish/trip	0.14	0.40	0.17
<u>Shore anglers</u>			
Number of anglers	240	241	176
Number of fish caught	18	182	117
Catch/hour/angler (standard error)	0.035 (+0.010)	0.402 (+0.057)	0.394 (+0.057)
Hours/trip	1.66	1.85	1.42
Fish/trip	0.08	0.76	0.66

difference is significant statistically. Actual contacts included 42 boat fishermen and 241 shore fishermen. Boat anglers put more effort into fishing probably because of the hardships which accompany the use of a boat. They fished 2.04 hours per trip and creeled 0.40 fish per trip. The average shore angler fished 1.85 hours and caught 0.76 fish per trip.

Airport Lake was fished by the least number of anglers (762). Two hundred anglers, or 26.3 percent of the estimated total, were contacted and 25.5 percent of these were successful. By May 23, or during the first 29 days of the season, 98 percent of the total trout tallied were caught. Anglers fished 1.52 hours per trip, and caught 0.60 fish per trip. The catch per hour per angler  $0.360(\pm 0.051)$  was approximately the same as for Moccasin Lake. A successful fisherman caught 1.41( $\pm 0.100$ ) fish per hour and expended 1.80 hours per trip. Unsuccessful fishermen again spent less effort than the successful anglers, or 1.43 hours per trip.

On Airport, the difference in catch per hour per angler of shore and boat fishermen was statistically significant. The rate of catch for shore anglers was  $0.394(\pm 0.057)$  fish per hour per angler, each trip entailed 1.42 hours, and 0.66 trout were taken per trip. Shore angler contacts numbered 176 as compared to 24 for boat anglers. Anglers fishing from boats brought home 0.17 fish per trip, had a catch per hour of  $0.055(\pm 0.077)$  and fished an average of 2.27 hours per trip.

Table 2 summarizes, for the three lakes, the different types of fishing gear and the extent to which they were used by fishermen, along with the residence and sex of the anglers. The majority of fishermen on these lakes resided in Marquette County. Between 5 and 10 percent came from Delta County and the remainder—a small fraction of the total—from various counties in the upper and lower peninsulas of Michigan and from Illinois, Washington and Wisconsin. Male anglers constituted more than 90 percent of those interviewed on each of the three lakes.

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

	Swanzy	Moccasin	Airport
<u>Fishing gear</u>			
Worms	202	205	177
Flies	22	25	5
Plugs	17	7	2
Combination	60	45	16
Other	3	1	0
<u>Residence</u>			
Michigan (Upper Peninsula)			
Marquette	261	244	179
Alger	0	1	0
Chippewa	1	0	0
Delta	21	28	11
Dickinson	0	0	1
Houghton	0	0	2
Luce	1	0	0
Menominee	0	3	0
Michigan (Lower Peninsula)			
Charlevoix	1	0	2
Grand Traverse	1	0	0
Kalamazoo	1	0	0
Kent	2	0	0
Oakland	0	1	0
Washtenaw	2	0	0
Wayne	2	0	2
Illinois	3	3	1
Washington	0	1	0
Wisconsin	5	2	2
Unknown	3	0	0
Male anglers	277	271	185
Female anglers	27	12	15

### Fishing Intensity

Creel census during the first nine days, which started at 6:00 A.M. rather than 7:00 A.M., revealed that the latter time was early enough to cover the majority of fishermen arriving before 7:00 A.M., and that the number of anglers who continued to fish after 9:00 P.M. were too few to justify the additional time to "wait them out." Therefore, a fishing day constituted an average of 15 hours beginning with 7:00 A.M. and ending at 9:00 P.M. The 1953 season opened April 25 and ended on midnight of September 13, giving a total of 142 fishing days. The majority of anglers on each lake were local fishermen and not tourists.

Numbers of counts made, angler counts, and anglers per hour are given in Table 3. Although the angler-count schedule was set up on an hourly basis, it was decided that a more reliable estimate could be made by stratifying the angler-count data by days of the week rather than by hours of the day. Also, the average counts per hour for each day were calculated separately for boat and shore anglers. These daily averages were totalled and divided by seven to obtain yearly averages of anglers per hour for boat and shore fishermen. Separate estimates of shore and boat angling hours were computed by multiplying the average shore anglers and boat anglers per hour by the hours per day and days in the season. Estimates of the number of boat and shore anglers were calculated by dividing the estimated angler hours for each by the average hours per trip observed for each type of fishing.

The estimated 1,257 angler trips made to Swanzy Lake represented a total of 2,055 hours of effort. Of this total number of hours, 1,608 hours were by 969 shore fishermen and 447 hours were by 288 boat fishermen (Table 4 and 5). Shore anglers were counted at the rate of 0.75 per hour and boat fishermen at 0.21 per hour.

At Moccasin Lake, the 1,101 anglers fished an estimated total of 2,066 hours. Boat anglers, numbering 157, fished for a total of 319 hours, and 944

shore anglers fished 1,747 hours. The average number of boat anglers per hour was 0.15, and of shore anglers per hour, 0.82.

Airport Lake, fished by the least number of fishermen (762) was fished for an estimated 1,150 hours. Shore anglers fished the lake at the rate of 0.45 fishermen per hour and boat fishermen at 0.09 anglers per hour. There were 81 boat anglers who fished 183 hours, and 681 shore fishermen who fished 967 hours.

#### Estimated Harvest

The "t" test for significance (Snedecor, 1946) was applied to the catch-per-hour-per-angler figures of boat and shore fishermen on each lake. There was a significant difference between boat and shore anglers on Moccasin Lake but not for Swanzy and Airport. Therefore, estimated total hours of effort and averages of catch per hour by boat and shore fishermen for the latter two lakes were combined in order to obtain total catch estimates but they were not combined in the case of Moccasin Lake; for purposes of comparison, separate estimates were also made for both boat and shore anglers on Swanzy and Airport lakes (see Table 5). Test for skewness of the catch-per-hour figures for the sample populations were made and in all cases the populations were highly skewed (see Table 6). This was discussed with Dr. C. C. Craig of the University of Michigan Statistical Research Laboratory, who suggested that in view of this, estimates of the total number of fish taken should be based on the population of successful anglers alone. The fiducial limits for the catch per hour of successful fishermen were set for an unlimited size sample at the 95 percent level. The total catch was then computed by multiplying the total estimated hours of angling, by the percentage of hours successful anglers fished of the total hours fished by anglers contacted, multiplied by the catch per hour of successful anglers. Confidence limits for total catch were computed by the same procedure but with the substitution of the upper and lower fiducial limits of mean catch.



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 1953

Lake and day	Number of counts	Shore fisherman	Boat fisherman	Anglers/count
<u>Swanzy Lake</u>				
Sunday	169	299	85	2.27
Monday	46	16	11	0.59
Tuesday	55	12	5	0.31
Wednesday	49	29	6	0.71
Thursday	45	19	4	0.51
Friday	59	28	0	0.48
Saturday	179	261	76	1.88
Total or av.	602	664	187	0.96
<u>Moccasin Lake</u>				
Sunday	153	134	35	1.11
Monday	40	2	1	0.07
Tuesday	57	63	15	1.37
Wednesday	52	70	3	1.41
Thursday	34	18	3	0.62
Friday	37	14	0	0.38
Saturday	151	216	56	1.80
Total or av.	524	517	113	0.97
<u>Airport Lake</u>				
Sunday	168	113	31	0.85
Monday	46	16	3	0.42
Tuesday	66	32	4	0.54
Wednesday	55	9	0	0.16
Thursday	59	39	0	0.66
Friday	61	7	4	0.18
Saturday	182	136	40	0.97
Total or av.	637	352	82	0.54

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 ✓	132(+33)	1,005(+244)	489(+69)
Pounds of trout ✓	126.2(+31.6)	333.5(+89.0)	107.6(+15.3)
Pounds/acre ✓	6.2(+1.6)	52.9(+14.0)	16.1(+2.3)

✓ 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.

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

	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	84.6(+32.9)	306.9(+60.8)	107.9(+15.4)
Boat anglers	43.5(+11.9)	38.8(+30.7)	2.6(+0)
Pounds per acre			
Shore anglers	4.1(+1.6)	48.7(+9.7)	16.1(+2.3)
Boat anglers	2.1(+0.6)	6.2(+4.9)	0.4(+0)

Total lengths of trout were recorded to the nearest millimeter and total weights to the nearest gram except for those trout exceeding one pound. Trout exceeding a pound were weighed to the nearest ounce and converted to grams. A number of dressed weights and/or lengths of trout were recorded at Moccasin Lake on opening day. Live weights for these fish were computed from a length-weight curve based on all "undressed" trout taken from Moccasin Lake during the first 16 days of the season.

Brook trout taken from Swanzy Lake averaged 12.8 inches in length and 0.96 pound in weight. There were an estimated 132(+33) trout taken, totalling 126.2(+31.6) pounds, or 6.2(+1.6) pounds per acre. From Moccasin Lake, fishermen took an estimated 1,005(+244) trout for a total weight of 333.5(+89.0) pounds. The average fish measured 9.2 inches and weighed 0.33 pound. This lake yielded 52.9(+14.0) pounds per acre. An estimated 489(+69) brook trout were caught in Airport Lake. The average weight per fish was 0.20 pound and the average length was 8.5 inches. The total weight harvested amounted to 107.6(+15.3) pounds or 16.1(+2.3) pounds per acre.

As stated previously, except for Moccasin Lake, estimated numbers and pounds of trout harvested by fishermen were not computed separately for boat and shore anglers in arriving at the figures contained in the preceding paragraph. However, it is felt that for comparative purposes in later years estimates of angling hours and the number of trout and pounds per acre of trout harvested should be computed separately for boat and shore anglers (Table 5). For Swanzy and Airport lakes, these figures differ slightly from those in Table 4.

The brook trout, which were planted in the three lakes in time so that they might have contributed to the catch during 1953, were not marked because it was not known in time that funds would be available for this study. However, fish planted in the fall of 1953 were marked, and a 10 percent sample

Table 6. Frequency distribution of catch-per-hour data for individual angler trips for the season of 1953, Swanzy, Moccasin and Airport lakes

Catch per hour per angler- trip	Number of anglers interviewed		
	Swanzy	Moccasin	Airport
0.00	282	206	149
0.18	1		
0.22		1	
0.24		2	
0.25		1	
0.29	2		
0.33	3	5	1
0.35		1	
0.38		1	
0.40	1	5	1
0.50	6	11	2
0.67	6	6	6
0.80			1
0.86			1
0.89		2	
1.00	2	11	12
1.11		1	
1.20		2	1
1.33		1	7
1.50		4	
1.60			1
1.67		1	2
2.00	1	8	9
2.50		4	3
2.67		1	2
3.00			1
3.33		6	1
5.00		3	
Total	304	283	200

of each plant was measured for length. Plantings will be marked during the balance of the study.

Assuming that most brook trout do not survive beyond their fourth year of life in heavily fished waters, and that judging from the size distribution and several age determinations of trout taken, it would appear that few, if any, trout planted in 1950 contributed to the 1953 harvest in any of these lakes. (See Table 7 for stocking record, 1949-1953.)

Considering the average size and size distribution of trout taken from Moccasin Lake, it would appear that trout caught were from the 1951 (legal size) and 1952 (sub-legals) stockings. Based on this assumption, every pound of fish planted in Moccasin Lake gave a return to the angler of 1.3 to 2.2 pounds. In numbers of fish returned, 51-83 percent of the fish stocked were caught. This surely represents a minimum because some of the 1951 trout plants should have been caught in 1952 since they were of legal size when planted the previous fall, and a number of trout from the 1952 stocking probably survived the 1953 season.

Trout were planted in Airport Lake in 1951 (fingerlings) but none were planted in 1952. Assuming that all fish taken in 1953 originated from the 1951 plant, 21-28 percent of these 1951 fish were harvested during 1953, and there was a return of 3.3-4.4 pounds of trout for every pound stocked.

Both the 1951 (sub-legals) and 1952 (fingerlings) plants contributed to the 1953 harvest at Swanzy Lake. For every pound stocked during 1951 and 1952, there was a return of 0.48-0.81 pound of trout in 1953. The low returns from Swanzy can be explained largely on the basis that the 1951 plant of sub-legals probably were mostly caught out by the end of 1952, whereas among the 1952 plant of fingerlings most fish did not reach legal size during 1953.

Table 7. Stocking record, 1949-1953, giving number, size (inches) and average weight (pounds) of brook trout planted and estimated record of recoveries by anglers in 1953.

Lake, year	Stocking Record			
	Number	Average size	Age group	Weight
Swanzy				
1949	3,000	3.0-5.0"	0	128.0
1950	3,000	6.6"	I	360.0
1951	2,000	5.8"	I	160.0
1952	3,000	3.0"	0	36.0
Moccasin				
1949	800	7.2"	I	128.0
1950	750	7.4"	I	127.5
1951	750	7.0"	I	105.0
1952	750	6.5"	I	90.0
Airport				
1949	2,000	3.0-5.0"	0	37.0
1950	1,000	6.6"	I	120.0
1951	2,000	3.5"	0	28.0
1952	---	---	-	---

Stocking ↓				Estimated recoveries by anglers - 1953		
	Number	Av. size	Total weight	Av. size	Number of trout	Total weight
Swanzy						
1951	2,000	5.8	160.0			
1952	3,000	3.0	36.0			
Total						
or av. 5,000		4.4	196.0	12.8	132(+33)	126.2(+31.6)
Moccasin						
1951	750	7.0	105.0			
1952	750	6.5	90.0			
Total						
or av. 1,500		6.8	195.0	9.2	1,005(+244)	345.7(+91.5)
Airport						
1951	2,000	3.5	28.0	8.5	489(+69)	107.6(+15.3)

↓ Only stockings are included which are believed to have contributed to the catch during 1953.

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### Summary

1. This paper reports the first year's results of a proposed long-term study to determine correct stocking procedures as to the number and size of plantings of brook trout, and to determine the most effective regulations as to seasons, size limits and methods of angling.

2. The numbers of anglers interviewed from the three lakes were: Swanzy—304, Moccasin—283 and Airport—200. The averages of catch per hour per angler on these lakes were 0.043, 0.370 and 0.360, respectively.

3. Statistically, there was no significant difference between the catch per hour per angler of boat and shore fishermen on Swanzy lake, but on Moccasin and Airport lakes shore anglers had a higher catch per hour than boat anglers.

4. The percentage of successful anglers was 7.2 for Swanzy, 27.2 for Moccasin, and 25.5 for Airport.

5. Between 66 and 88 percent of the fishermen used worms, and the majority of successful anglers used worms for bait followed in order by combinations of flies, plugs and others.



6. Between 86 and 90 percent of the fishermen were from Marquette County (i.e., local residents).

7. Fishing intensity was greatest from April 25 to June 1 on all three lakes, but on Swanzy Lake it tapered off more gradually during the remainder of the season since this lake has a wider recreational attraction than the others.

8. Anglers per hourly count numbered 0.96, 0.97 and 0.54 on Swanzy, Moccasin and Airport lakes, respectively. An estimated 1,257 anglers fished Swanzy Lake with an estimated total effort of 2,055 hours. At Moccasin Lake there were 1,101 anglers who fished a combined total of 2,066 hours. At Airport, 762 anglers fished 1,150 hours.

9. Based on actual contacts, 85 percent of the total fish harvested from Swanzy Lake were taken during the first 15 days of the season. On Moccasin successful anglers removed 90 percent of the total trout in the first 26 days. On Airport they removed 98 percent of the trout during the first 29 days.

10. On Swanzy Lake fishermen spent 1.63 hours per trip and took home 0.09 fish. At Moccasin they spent 1.87 hours per trip with an average catch of 0.70. Anglers at Airport fished 1.52 hours per trip catching 0.60 fish per trip.

11. An estimated total of 969, 944 and 618 shore anglers fished Swanzy, Moccasin and Airport lakes. Boat anglers numbered 288, 157, and 81, respectively.

12. The average size and weight of brook trout taken by anglers were: Swanzy—12.8 inches and 0.96 pound; Moccasin—9.2 inches and 0.33 pound; Airport—8.5 inches and 0.20 pound.

13. The number of trout which were estimated to have been harvested were Swanzy—132(+33), Moccasin—1,005(+244), and Airport—489(+69). Total estimated weight removed from Swanzy was 126.2(+31.6) or 6.2(+1.6) pounds per acre; Moccasin—333.5(+89.0) pounds or 52.9 (+14.0) pounds per acre; and Airport—107.6(+15.3) pounds or 16.1(+2.3) pounds per acre.

14. Providing the assumptions made by the writer are correct concerning

the stockings responsible for fish caught in 1953, the return to the angler on Swanzy Lake was 0.48-0.81 pound for every pound of fish planted. At Moccasin and Airport, every pound of fish planted gave a return of 1.3-2.2 pounds and 3.3-4.4 pounds, respectively.

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