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THE EFFECTS OF A SPECIAL SEASON ON BROOK TROUT

FISHING IN THREE LAKES IN MARQUETTE COUNTY,

MICHIGAN ↓

By Merle G. Galbraith, Jr.

Introduction

In 1958 the Conservation Commission approved special regulations on Swanzy and Airport lakes. Commencing in 1959 the trout fishing season at Swanzy and Airport lakes opened on May 15 and terminated October 15. The usual trout season remained in effect at Moccasin Lake to provide a control.

The main objective of the study was to determine if the change in season would provide better fishing as measured by such things as the duration of the harvest, stability of fishing quality, and size of the fish caught. (The trout fishery in these lakes is supported by annual plants of hatchery trout.) Previous studies at these three lakes showed that fingerlings planted in the fall provided fishing over a longer time the following year than did legal-size trout planted at the same time. The

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planting of fingerlings, however, resulted in many sublegal trout being hooked and killed the following spring. In an attempt to eliminate this early-season hooking mortality, it was proposed that a delay in the opening date might permit more of these trout to reach legal size before they were exposed to angling. Extension of the fishing season into the fall would allow anglers to catch a maximum number of fish from one planting before the next planting was made. Predation on newly planted fingerlings would be lessened because there would be fewer large trout (survivors from earlier plants) to prey on them. By fall, when the water cools, brook trout come to the surface or to the shallows and are relatively easy to catch. By October, fingerlings planted the preceding fall have attained legal size. Very few planted trout survive in these lakes longer than two summers.

Stocking

Over the past decade Swanzy, Airport, and Moccasin lakes have been stocked with brook trout of three different sizes (fingerling, sublegal, and legal) to learn which size would provide the best return.² For this study the three lakes were stocked each fall with fingerling brook trout (Table 1). Swanzy and Airport lakes were stocked at a rate of 147 fingerlings per acre except in 1958 when a higher stocking rate gave unsatisfactory results in both lakes. Moccasin Lake was stocked at the rate of 500 fingerlings per acre.

² Galbraith, Merle G., Jr. I. F. R. Reports No. 1581, December 10, 1959 and No. 1582, December 18, 1959.

Table 1.--Number, average length (inches), and total weight (pounds) of fingerling brook trout planted in Swanzy, Airport, and Moccasin lakes, 1952-1960

Year	Swanzy			Airport			Moccasin		
	Number	Average length	Total weight	Number	Average length	Total weight	Number	Average length	Total weight
1952	3,000*	3.0	36.7	...	...	...	...	...	...
1953	3,000	3.5	43.5	...	...	...	...	...	...
1954	3,000*	4.3	87.7	...	...	...	...	...	...
1955	...	...	...	...	...	...	3,150*	4.3	132.0
1956	...	...	...	...	...	...	3,150*	4.3	101.0
1957	...	...	...	...	...	...	3,150*	3.9	67.0
1958	6,120*	4.5	224.8	2,010*	4.5	80.4	3,150	4.5	126.0
1959	2,940	4.0	61.7	985	4.0	20.6	3,150*	3.9	72.4
1960	2,940*	4.5	86.0	985	4.6	30.0	3,150*	4.6	97.0

* These plantings provided sufficient returns for analysis; the others did not.

Methods

A creel census was employed to collect the data. The lakes were censused from 1952 through 1961, but the census was discontinued during 1962 and 1963 although the special regulations remained in force on Airport and Swanzy lakes.

One clerk did the census on the lakes according to a prearranged schedule. The schedule was set up to allot more time to weekends and holidays. A stratified random sampling plan which incorporated interviews and hourly counts of the anglers at the different lakes was adopted. The amount of coverage by the clerk varied from lake to lake. At Swanzy Lake the census covered an estimated 22.3 percent of the fishing; at Airport and Moccasin it included 17.9 and 35.1 percent, respectively.

Hourly counts of anglers were used to determine the total fishing pressure. Anglers were interviewed at the completion of a trip to obtain information on individual catches. Fishing pressure and fishing quality varied throughout the season, so each season was divided into four strata (time periods) and separate estimates were computed for each (Tables 2, 3, 4). The data secured in the census were subjected to statistical analysis.³

Fishing pressure in hours and angler trips for each period represents the average for the period, all years included. Average duration of each fishing trip (hours per trip) is the ratio of estimated

³ For information on procedures and methods of computation refer to I. F. R. Report No. 1581.

Table 2.--Seasonal analysis of angling effort and total catch of brook trout in Swanzy Lake, 1954-1955 and 1959-1961

Years Period*	Angler trips		Angling hours				Trout caught					
	Num- ber	Percent success- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)	
1954-1955												
1	303	20.5	644	2.13	31.6	37.4	128	0.20	47.0	10.6	7.3	
2	157	7.6	259	1.65	12.7	15.1	19	0.07	7.0	10.2	6.3	
3	392	4.3	608	1.55	29.4	35.3	22	0.04	8.1	10.2	9.0	
4	106	18.2	209	1.97	10.2	12.2	103	0.49	37.9	8.5	3.7	
Total or average	958	11.5	1,720	1.80	84.3	100.0	272	0.16	100.0	9.7	6.0	
95% conf. limits↓	...	...	±27.7	...	...	...	±40.0	±0.03	...	...	...
1959-1961												
1	139	26.2	406	2.92	19.9	15.7	105	0.26	24.0	8.1	3.4	
2	766	7.5	1,569	2.05	76.9	60.7	133	0.08	30.4	7.6	2.6	
3	38	38.1	63	1.66	3.1	2.4	23	0.36	5.2	8.0	2.9	
4	214	39.8	548	2.56	26.9	21.2	177	0.32	40.4	8.6	3.5	
Total or average	1,157	16.7	2,586	2.24	126.8	100.0	438	0.17	100.0	8.2	3.2	
95% conf. limits↓	...	...	±16.6	...	...	...	±27.6	±0.03	...	...	...

* Duration of seasonal periods
1954-1955
1. First weekend
2. Next 17 days
3. Midseason
4. Balance (3 weeks in 1954)
(4 weeks in 1955)

1959-1961
1. First day
2. Midseason
3. Last 3 weeks of regular season
4. Special fall season

↓ Confidence limits are in percentage for number of angling hours and number of fish, but in actual units for catch per hour.

Table 3.--Seasonal analysis of angling effort and total catch of brook trout in Airport Lake, 1959-1961

Years Period*	Angler trips		Angling hours				Trout caught				
	Num- ber	Percent success- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)
1959-1961											
1	82	43.7	156	1.90	23.3	11.7	102	0.65	34.9	8.3	3.4
2	464	14.1	987	2.13	147.3	74.2	147	0.15	50.4	8.6	3.6
3	42	8.7	64	1.52	9.6	4.8	5	0.08	1.7	8.6	3.6
4	61	29.9	124	2.03	18.5	9.3	38	0.31	13.0	8.3	4.0
Total or average	649	19.1	1,331	2.05	198.7	100.0	292	0.22	100.0	8.3	3.4
95% conf. limits [↓]	±21.9	...	...	...	±32.9	±0.04	...	...	...

- * Duration of seasonal periods
1. First day
 2. Midseason
 3. Last 3 weeks of regular season
 4. Special season

[↓] Confidence limits are in percentage for number of angling hours and number of fish, but in actual units for catch per hour.

Table 4. --Seasonal analysis of angling effort and total catch of brook trout in Moccasin Lake, 1956-1957 and 1958-1961

Years Period*	Angler trips		Angling hours				Trout caught				
	Num- ber	Percent success- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)
1956-1957											
1	188	21.3	409	2.09	65.0	20.3	78	0.19	9.2	10.7	8.1
2	152	4.5	261	1.70	41.4	13.0	12	0.05	1.4	11.6	11.6
3	620	47.1	1,154	1.86	183.1	57.3	669	0.58	78.4	7.6	2.7
4	97	52.8	190	1.88	30.0	9.4	94	0.49	11.0	8.3	3.6
Total or average	1,057	36.9	2,014	1.91	319.7	100.0	853	0.42	100.0	8.0	3.9
95% conf. limits [↓]	±22.4	...	...	...	±32.4	±0.04	...	...	...
1958-1961											
1	210	30.0	528	2.51	83.8	23.6	153	0.29	25.8	9.8	4.9
2	172	9.1	288	1.67	45.7	12.9	31	0.10	5.2	9.0	4.0
3	584	23.3	1,168	2.00	185.3	52.3	345	0.30	58.2	7.7	2.9
4	123	23.7	250	2.03	39.7	11.2	64	0.26	10.8	8.2	4.8
Total or average	1,089	22.4	2,234	2.05	354.6	100.0	593	0.27	100.0	8.1	3.7
95% conf. limits [↓]	±16.7	...	...	...	±29.7	±0.03	...	...	...

* Duration of seasonal periods

- | 1956-1957 | 1958-1961 |
|--|------------------|
| 1. First weekend | 1. First weekend |
| 2. Next 17 days (to approxi-
mately 15 May) | 2. Next 7 days |
| 3. Midseason | 3. Midseason |
| 4. Last 3 weeks | 4. Last 3 weeks |

[↓] Confidence limits are in percentage for number of angling hours and number of fish, but in actual units for catch per hour.

hours to estimated number of trips. Annual estimates of catch per hour, average length, and average weight are weighted averages. To arrive at the overall average, the catch per hour was weighted by the hours of fishing in each period; average length and weight were weighted by the estimated number of fish caught in each period. Percentage of success was determined from interviews.

Results

Results are based on data derived from fall plantings of fingerling brook trout made in the three lakes (Table 1). Of the 15 plants, 10 gave reasonably good returns; 5, for reasons unknown, did not. Here we are concerned with the special season's effect on such things as duration of the harvest and the size of the trout at capture; good survival was assumed as one of the experimental conditions and those plantings which provided little or no fishing were ignored. Failure of certain plantings cannot be attributed to the special season because failures occurred before and after its initiation. Because of intrinsic differences in the lakes themselves and marked variation in fishing pressure between them, the lakes were compared in general terms only. Data collected before the special season began are included for comparison.

Swanzy Lake. --The most significant data are for Swanzy Lake where special-season data for the plantings of 1958 and 1960 can be compared with the normal-season data for plantings of 1952 and 1954.

Most fishing was done during the first half of the season but fishing pressure during the extended fall season was considerable (Table 2). Average fishing pressure in 1959-1961 (special regulations) was about 50 percent greater than in 1954-1955 (Table 5). Fishing pressures in 1959 and 1960 were about equal but in 1961 pressure almost doubled (Table 6). In 1954 the percentage of success was greatest during the opening weekend (Period 1); in 1955 during the final three weeks (Period 4); few successful trips were made at other times (Table 7). During the special seasons of 1959-1961 the greatest success was on opening day (May 15) or after August 21 (Table 2). The average percentage of return (Table 8) from the plants was almost identical in 1953-1956 (14.1) with 1959-1961 (13.9). The trout caught by anglers in 1954 and 1955 (usual regulations) averaged 9.7 inches long; in 1959-1961 (special regulations) they averaged only 8.2 inches (Table 2). Fall-planted fingerlings entered the catch either the first or second season after their release. Many of those planted in 1952 and 1954 were not caught until after 18 to 20 months, whereas most of those planted in 1958 and 1960 entered the catch the ensuing season (Table 9) and thus averaged smaller in size when creeded. Chronology of returns was doubtless influenced by size of the fingerlings at planting as well as by the extension of the season; those planted in 1952 and 1954 averaged 3.6 inches; those planted in 1958 and 1960, 4.4 inches. Before the special regulations (1953-1956) anglers harvested 2.5 pounds of trout for each pound stocked; afterwards (1959-1961) the return to anglers amounted to 0.8 pound for each pound stocked (Table 8). The record of

Table 5. --Quality of fishing, size of fish caught, and fishing pressure at Swanzey, Airport, and Moccasin lakes

Lake, season, and angling years	Angler trips		Angler hours per acre per year	Trout caught [↓]		
	Aver- age number	Percent success- ful		Per hour	Average length (inches)	Average weight (ounces)
<u>Swanzey</u>						
Regular season 1954-1955	958	11.5	84.3	0.16 ±18.8	9.7	6.0
Special season 1959-1961	1,157	16.7	126.8	0.17 ±16.5	8.2	3.2
<u>Airport</u>						
Special season 1959-1961	649	19.1	198.7	0.22 ±15.9	8.3	3.4
<u>Moccasin</u>						
Regular season 1956-1961	1,078	19.7	342.8	0.37 ±6.02	8.2	3.7

[↓] 95 percent confidence limits of catch per hour are expressed in percentage of total; average length and weight represent weighted means of yearly averages.

Table 6. --Estimated average pressure, catch, and quality of angling at Swanzy Lake by seasonal periods during 1959-1961

Years Period*	Angler trips		Angling hours				Trout caught				
	Num- ber	Percent success- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)
1959											
1	83	72.0	273	3.28	13.4	13.4	213	0.78	50.3	7.6	2.4
2	627	7.8	1,161	1.85	56.9	57.0	81	0.07	19.1	7.6	2.4
3	45	66.7	83	1.83	4.1	4.1	37	0.45	8.7	7.7	2.5
4	185	33.3	519	2.80	25.4	25.5	93	0.18	21.9	8.3	2.9
Total or average	940	21.3	2,036	2.17	99.8	100.0	424	0.208	100.0	7.8	2.5
95% conf. limits↓	...	...	±14.6	...	...	...	±24.1	±0.043	...	...	...
1960											
1	187	5.7	611	3.26	29.9	30.5	11	0.02	20.0	11.9	11.1
2	442	3.9	1,056	2.39	51.8	52.7	17	0.02	30.9	9.5	5.4
3	16	0.0	24	1.50	1.2	1.2	0	0.00	0.0	0.0	0.0
4	105	16.7	313	2.98	15.3	15.6	27	0.09	49.1	9.6	6.3
Total or average	750	6.0	2,004	2.67	98.2	100.0	55	0.028	100.0	10.0	6.8
95% conf. limits↓	...	...	±15.3	...	...	...	±56.4	±0.014	...	...	...

(continued, next page)

Table 6.--concluded

Years Period*	Angler trips		Angling hours				Trout caught				
	Num- ber	Percent success- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)
1961											
1	146	25.7	333	2.28	16.3	9.0	90	0.27	10.8	8.7	4.7
2	1,230	8.7	2,491	2.03	122.1	67.0	300	0.12	35.9	7.5	2.5
3	52	25.0	81	1.56	4.0	2.2	33	0.40	4.0	8.3	3.4
4	353	50.0	813	2.30	39.9	21.8	412	0.51	49.3	8.6	3.4
Total or average	1,781	18.8	3,718	2.09	182.2	100.0	835	0.225	100.0	8.3	3.3
95% conf. limits ¹	...	...	±18.3	...	...	...	±27.7	±0.053	...	...	...

- * Duration of seasonal periods
1. First day
 2. Midseason
 3. Last 3 weeks of regular season
 4. Special season

¹ Confidence limits are in percentage for number of angling hours and number of fish, but in actual units for catch per hour.

Table 7.--Estimated average pressure, catch, and quality of angling at Swanzy Lake by seasonal periods during 1954-1955

Years Period*	Angler trips		Angling hours				Trout caught				
	Num- ber	Percent success- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)
1954											
1	415	28.6	884	2.13	43.3	46.3	248	0.28	81.3	10.6	7.0
2	192	11.7	315	1.64	15.4	16.5	37	0.12	12.1	10.3	6.7
3	429	2.7	664	1.55	32.5	34.8	20	0.03	6.6	10.9	7.8
4	31	0.0	45	1.40	2.2	2.4	0	0.00	0.0	0.0	0.0
Total or average	1,067	14.3	1,908	1.79	93.5	100.0	305	0.16	100.0	10.5	7.0
95% conf. limits ¹	...	...	±23.9	...	...	...	±32.5	±0.038	...	...	...
1955											
1	191	2.6	403	2.11	19.8	26.3	8	0.02	3.4	12.3	14.5
2	122	1.2	203	1.67	10.0	13.2	1	0.01	1.3	7.3	1.7
3	354	6.0	553	1.56	27.1	36.1	25	0.04	7.3	9.6	9.9
4	181	36.4	373	2.06	18.3	24.4	206	0.55	88.0	8.5	3.7
Total or average	848	11.1	1,532	1.81	75.1	100.0	240	0.16	100.0	8.7	4.8
95% conf. limits ¹	...	...	±32.4	...	...	...	±47.2	±0.048	...	...	...

* Duration of seasonal periods

1. Opening weekend
2. Next 17 days
3. Midseason (13 May-23 August, 1954; 19 May-11 August, 1955)
4. Remainder (24 August-12 September, 1954; 12 August-11 September, 1955)

¹ Confidence limits are in percentage for number of angling hours and number of fish, but in actual units for catch per hour.

Table 8. --Analysis of angling returns from five successful fall plantings of fingerling brook trout in Swanzy, Airport, and Moccasin lakes

Lake, season, and angling years	Years	Planting		Returns [↓]			
		Total number	Total weight (pounds)	Number	Percent	Total weight (pounds)	Pound per pound planted
<u>Swanzy</u>							
Regular season 1953-1956	1952, 1954	6,000	124.4	847	14.1	314.5	2.5
Special season 1959-1961	1958, 1960	9,060	310.8	1,261	13.9	234.5	0.8 [∂]
<u>Airport</u>							
Special season 1959-1961	1958	2,010	80.4	693	34.5	120.7	1.5
<u>Moccasin</u>							
Regular season 1956-1961	1955- 1960	15,750	469.4	3,829	24.3	741.9	1.6 [∂]

[↓] Returns from plantings made in 1954 and 1959 in Swanzy Lake, in 1959 in Airport Lake, and in 1958 in Moccasin Lake were not considered in computing the total returns.

[∂] Returns incomplete.

Table 9. --Number, average length (inches), and total weight (pounds) of angler-caught brook trout returned from plants of fall fingerlings. Records are summarized by year of capture and year of planting.

Lake	Year of return to anglers	Num-ber	Average length	Total weight	Num-ber	Average length	Total weight	Num-ber	Average length	Total weight
		<u>1952 planting</u>			<u>1953 planting</u>			<u>1954 planting</u>		
Swanzy	1953	18	8.1	3.4	...	...	...	...	...	...
	1954	296	10.3	119.7	...	...	...	...	...	...
	1955	8	17.2	20.1	10	11.9	7.6	216	8.2	39.0
	1956	...	...	...	...	...	...	304	10.5	129.3
Total or average		322	10.4	143.2	10	11.9	7.6	520	9.5	168.3
		<u>1958 planting</u>			<u>1959 planting</u>			<u>1960 planting</u>		
	1959	421	7.7	64.7	...	...	...	...	...	...
	1960	24	11.6	16.2	31	8.6	24.1	...	...	...
	1961	2	15.8	3.5	19	12.4	13.5	814 [↓]	8.2	170.1
Total or average		447	7.9	84.4	50	10.0	37.6	814	8.2	170.1
Airport	1959	168	7.3	25.6	...	...	...	...	...	...
	1960	522	8.4	93.4	14	8.2	3.2	...	...	...
	1961	3	11.4	1.7	79	9.1	21.8	54 [↓]	7.5	8.0
Total or average		693	8.5	120.7	93	9.0	25.0	54	7.5	8.0
		<u>1955 planting</u>			<u>1956 planting</u>			<u>1957 planting</u>		
Moccasin	1956	937	7.8	158.6	...	...	...	...	...	...
	1957	144	9.9	48.6	556	7.3	78.6	...	...	...
	1958	...	...	...	160	10.0	52.8	580	7.8	108.0
	1959	...	...	...	...	...	...	23	10.8	10.0
Total or average		1,081	8.0	207.2	716	7.9	131.8	603	7.9	118.0
		<u>1958 planting</u>			<u>1959 planting</u>			<u>1960 planting</u>		
	1959	105	7.9	20.9	...	...	...	...	...	...
	1960	75	13.3	70.2	319	7.6	55.5	...	...	...
	1961	...	...	...	639	9.2	160.7	471 [↓]	7.5	68.7
Total or average		180	10.2	91.1	958	8.7	216.2	471	7.5	68.7

[↓] Returns incomplete.

returns from the plant of 1960 was incomplete because the creel census was terminated in 1961, but it is unlikely that the ratio of pounds harvested to pounds planted would have approached the 2.5 to 1 of 1953-1956.

Airport Lake. --Most fishing was done during the first half of the season and on this small lake anglers did not take advantage of the extended fall season (Table 3). Amount of fishing (hours) was about the same in each of the three years of the study (Table 10). The percentage of return from the plants (34.5, Table 8) was more than double that of Swanzy Lake and appreciably higher than that of Moccasin Lake. The trout caught by anglers averaged 8.3 inches (Table 3). In this lake trout grow slowly and most fall-planted fingerlings do not attain a length of 7 inches until they have been in the lake for 18 to 20 months. An exception occurred in 1959 when an appreciable number of the fingerlings planted in September, 1958 were caught; nevertheless the bulk of them were not harvested until 1960 (Table 9). On the average, 1.5 pounds of trout were harvested for each pound of trout stocked in Airport Lake (Table 8).

Moccasin Lake. --In contrast to the other lakes, the pattern of fishing pressure at Moccasin Lake varied from year to year. Each year, at Swanzy and Airport lakes, most fishing was done early in the season, but at Moccasin Lake the most intense fishing pressure occurred at different times in different years (Tables 11, 12). Considerably more

Table 10.--Estimated average pressure, catch, and quality of angling at Airport Lake by seasonal periods during 1959-1961

Years Period*	Angler trips		Angling hours				Trout caught				
	Num- ber	Percent success- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)
1959											
1	56	26.1	118	2.11	17.6	9.4	29	0.25	14.4	8.2	4.0
2	543	14.9	995	1.83	148.5	79.1	98	0.10	48.5	9.0	5.9
3	25	20.0	37	1.50	5.5	2.9	10	0.27	4.9	7.6	2.4
4	61	34.8	108	1.52	16.1	8.6	65	0.60	32.2	7.3	2.4
Total or average	685	17.8	1,258	1.84	187.8	100.0	202	0.143	100.0	8.2	4.3
95% conf. limits_↓	...	...	±22.9	...	...	...	±43.6	±0.056	...	...	...
1960											
1	139	55.6	269	1.94	40.1	21.2	236	0.88	44.1	8.2	3.2
2	378	17.7	848	2.24	126.6	67.0	273	0.32	50.9	8.5	2.7
3	19	33.3	56	3.00	8.4	4.4	6	0.11	1.1	10.2	5.7
4	42	50.0	94	2.25	14.0	7.4	21	0.22	3.9	11.1	9.3
Total or average	575	29.8	1,267	2.20	189.1	100.0	536	0.423	100.0	8.4	2.9
95% conf. limits _↓	±19.5	±27.6	±0.088

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Table 10.--concluded

Years Period*	Angler trips		Angling hours				Trout caught				
	Num- ber	Percent success- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)
1961											
1	52	31.7	81	1.55	12.1	5.5	42	0.52	30.0	9.1	4.3
2	470	10.3	1,117	2.38	166.7	76.3	69	0.06	49.3	8.4	3.7
3	83	00.0	98	1.18	14.6	6.7	0	0.00	0.0	0.0	0.0
4	81	15.2	169	2.09	25.2	11.5	29	0.17	20.7	8.4	3.6
Total or average	686	11.2	1,465	2.14	218.7	100.0	140	0.096	100.0	8.6	3.8
95% conf. limits [↓]	±23.3	...	...	...	±38.2	±0.033	...	...	...

* Duration of seasonal periods

1. First day
2. Midseason
3. Last 3 weeks
4. Special season

[↓] Confidence limits are in percentage for number of angling hours and number of fish, but in actual units for catch per hour.

Table 11.--Estimated average pressure, catch, and quality of angling at Moccasin Lake by seasonal periods during 1956-1957

Years Period*	Angler trips		Angling hours				Trout caught				
	Num- ber	Percent success- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)
1956											
1	123	8.0	226	1.83	35.9	10.8	31	0.14	3.1	13.3	18.0
2	185	2.0	322	1.74	51.1	15.4	14	0.04	1.4	13.5	17.4
3	650	51.4	1,273	1.96	202.0	61.0	802	0.63	79.9	7.8	3.0
4	121	57.1	268	2.21	42.5	12.8	157	0.59	15.6	8.3	3.5
Total or average	1,079	38.7	2,089	1.94	331.5	100.0	1,004	0.485	100.0	8.2	4.7
95% conf. limits [↓]	±22.3	...	...	...	±31.0	±0.078	...	...	...
1957											
1	253	27.7	592	2.34	94.0	30.6	124	0.21	17.6	10.0	5.6
2	119	8.5	199	1.67	31.6	10.3	11	0.06	1.6	9.1	4.2
3	590	42.4	1,035	1.75	164.2	53.4	536	0.52	76.2	7.3	2.3
4	72	45.5	111	1.54	17.6	5.7	32	0.29	4.6	8.3	4.2
Total or average	1,034	35.1	1,937	1.87	307.5	100.0	703	0.364	100.0	7.8	3.0
95% conf. limits [↓]	±22.5	...	...	...	±34.3	±0.052	...	...	...

- * Duration of seasonal periods
1. First weekend
 2. Next 17 days
 3. Midseason
 4. Last 3 weeks of season

[↓] Confidence limits are in percentage for number of angling hours and number of fish, but in actual units for catch per hour.

Table 12. --Estimated average pressure, catch, and quality of angling at Moccasin Lake by seasonal periods during 1958-1961

Years Period*	Angler trips		Angling hours				Trout caught				
	Num- ber	Percent success- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)
1958											
1	187	34.5	398	2.13	63.2	17.2	138	0.34	18.6	10.0	5.3
2	106	0.0	166	1.57	26.3	7.2	5	0.03	0.7	... ²	... ²
3	587	32.8	1,281	2.18	203.3	55.1	481	0.38	65.0	7.6	2.7
4	215	29.4	475	2.20	75.4	20.5	116	0.24	15.7	8.8	4.3
Total or average	1,095	29.2	2,320	2.12	368.2	100.0	740	0.310	100.0	8.2	3.5
95% conf. limits [↓]	±24.0	...	...	...	±35.1	±0.084	...	...	...
1959											
1	172	9.5	469	2.73	74.4	30.9	24	0.05	18.8	9.9	5.8
2	248	7.7	239	1.47	37.9	15.7	19	0.08	14.8	8.0	3.5
3	636	14.9	725	1.14	115.1	47.7	85	0.12	66.4	8.1	3.5
4	42	0.0	87	2.05	13.8	5.7	0	0.00	0.0	0.0	0.0
Total or average	1,098	11.8	1,520	1.38	241.3	100.0	128	0.085	100.0	8.4	3.9
95% conf. limits [↓]	±19.8	...	...	...	±47.0	±0.034	...	...	...
1960											
1	188	14.2	401	2.13	63.6	22.0	48	0.12	12.2	11.3	8.8
2	108	5.3	153	1.41	24.3	8.4	6	0.04	1.5	9.1	4.4
3	469	24.3	1,001	2.13	158.9	54.9	274	0.27	69.5	8.2	4.0
4	132	18.8	269	2.04	42.7	14.7	66	0.25	16.8	7.6	2.7
Total or average	897	19.1	1,824	2.03	289.5	100.0	394	0.216	100.0	8.5	4.3
95% conf. limits [↓]	±14.9	...	...	...	±36.3	±0.069	...	...	...

(continued, next page)

Table 12.--concluded

Years Period*	Angler trips		Angling hours				Trout caught				
	Num- ber	Percent succes- ful	Number	Per trip	Per acre	Percent by season	Number	Per hour	Percent by season	Average length (inches)	Average weight (ounces)
1961											
1	294	49.2	844	2.87	133.9	25.8	403	0.48	36.3	9.5	4.3
2	227	16.8	592	2.61	94.0	18.1	95	0.16	8.6	9.2	4.1
3	642	22.3	1,665	2.59	26.4	50.9	540	0.32	48.6	7.6	2.5
4	104	28.1	171	1.64	27.1	5.2	72	0.42	6.5	7.9	3.0
Total or average	1,267	28.0	3,271	2.58	519.3	100.0	1,110	0.339	100.0	8.4	3.3
95% conf. limits ¹	...	...	±11.0	...	...	...	±21.8	±0.045	...	...	...

* Duration of seasonal periods

1. First weekend
2. Next 7 days
3. Midseason
4. Last 3 weeks

¹ Confidence limits are in percentage for number of angling hours and number of fish, but in actual units for catch per hour.

² Five fish taken but none were measured or weighed.

fishing (hours per acre per year) was done at Moccasin Lake than at the other lakes (Table 5). Fishing quality (percentage of success, catch per hour) also was better at Moccasin than at the other lakes (Table 5). For five plants the percentage of return averaged 24.5 (Table 8). The trout caught averaged 8.2 inches (Table 5) and anglers harvested 1.6 pounds of trout for each pound planted (Table 8).

Summary. --Interpretation of results at these lakes was complicated by the almost total failure of some plants, by intrinsic differences in the lakes, by overstocking in Swanzy and Airport lakes in 1958, and by significant differences in fishing pressure between lakes or from season to season on a particular lake. Nevertheless, certain general conclusions can be made from the records.

Average fishing quality (catch per hour) at all three lakes was good on the opening weekend and during the final three weeks of the season; or, when the special season was in force, during a 4- to 5-week period at the end of the season. At Moccasin Lake (no special season) fishing was fairly good over the entire season, but at Swanzy and Airport lakes fishing was poor in midseason--the special season made no difference. However, the special season provided an extra 4 to 5 weeks of good fishing, about as good as that of the opening weekend.

At Swanzy Lake, during the period of special regulations, the catch increased by about 50 percent over the period before special regulations were inaugurated (Table 8); the increased catch was

accompanied by a 50-percent increase in pressure (Table 5). The 1958 fall planting was double the usual rate but the return (number) to anglers (Table 9) was no greater than might have been expected from a "normal" plant; thus the low percentage of return (13.9) in 1959-1961 is somewhat misleading (Table 8). Most probably, if the usual number of fingerlings had been stocked in 1958, the percentage of return in 1959-1961 would have been higher and would have compared favorably with the 34.5 percent return recorded at Airport Lake. Also the ratio of pounds stocked to pounds harvested would have been better than the 1 to 0.8 recorded.

Average size of trout in the creel was influenced less by the special regulations than by growth rate and season of capture. At Swanzy Lake trout caught in 1954-1955 were larger (9.7 inches) than those caught during the special seasons of 1959-1961 (Table 2). From the 1952 fall planting, only 18 were caught in 1953 whereas 296 were caught in 1954 by which time they had grown to an average length of 10.3 inches. Many of the fingerlings planted in 1954 were caught in 1956 when they had reached an average length of 10.5 inches (Table 9). In contrast, in 1959-1961 most of the trout from Swanzy Lake were caught the first season after planting and before they had reached a length of as much as 9 inches. At Airport Lake, under special regulations, the trout averaged 8.3 inches at capture--in this lake, trout grow slowly and even those which were caught in the second season after planting averaged only 8.4 inches (Table 9).

When trout are planted as fingerlings in the fall most do not attain a length of 7 inches until the middle of the following season, and in relatively infertile lakes, such as Airport, it may take even longer. Under "normal" regulations, by midseason the surface waters may have warmed and the trout become difficult to catch, especially from shore. If the surface waters do not cool before late August, the trout will not be harvested until early in the ensuing season. Extension of the season to October 15 permitted an appreciable harvest of fish in the fall and the removal of many of the larger (predatory) trout before a new batch of fingerlings was planted.

Lures used

Type of lure used (worms, flies, spinner, and so forth) was recorded for each angler interviewed at each lake in 1959-1961. Data from the interviews are summarized in Table 13. Worms were the preferred lure; at the three lakes over the entire period an average of 73 percent (range 64-82) used worms. Use of other lures varied from lake to lake and from year to year. Few anglers used flies exclusively (average 5 percent, range 1 to 10 percent).

Residence and sex of anglers

Information obtained from interviews is summarized in Table 14. More than 88 percent of the anglers who fished in the lakes were residents

Table 13. --Number of anglers using each type of lure at Swanzy, Airport, and Moccasin lakes, 1959-1961

Lake and year	Type of lure						Total contacts
	Worms	Worms and spinner	Flies	Artificial	Combination	Unknown	
<u>Swanzy</u>							
1959	136	22	19	4	1	...	182
1960	128	12	12	4	17	...	173
1961	278	7	26	12	35	1	359
<u>Airport</u>							
1959	84	12	1	4	1	...	102
1960	67	7	3	4	8	...	89
1961	128	8	10	8	40	1	195
<u>Moccasin</u>							
1959	199	69	11	6	25	...	310
1960	166	58	10	8	16	...	258
1961	396	15	26	7	44	4	492

Table 14. --Residence and sex of the anglers interviewed by the creel census clerk at Swanzy, Airport, and Moccasin lakes, 1959-1961

Lake and year	Residence of anglers						Sex of anglers		
	Upper Peninsula		U.S. Air Force Base	Lower Peninsula	Other states	Unknown	Male	Female	Total
Marquette	Other								
<u>Swanzy</u>									
1959	173	7	...↓	2	0	0	168	14	182
1960	139	5	24	2	3	0	162	11	173
1961	217	11	122	4	4	1	332	27	359
<u>Airport</u>									
1959	93	5	...↓	3	1	0	98	4	102
1960	65	1	20	3	0	0	84	5	89
1961	125	7	49	0	14	0	182	13	195
<u>Moccasin</u>									
1959	275	27	...↓	5	3	0	266	44	310
1960	238	5	9	2	2	2	240	18	258
1961	331	23	129	4	4	1	432	60	492

↓ Anglers residing at the Air Force Base were not designated as such in 1959.

of Marquette County, and more than 92 percent came from the Upper Peninsula. The number of anglers from Marquette County may have been somewhat inflated because anglers from the U. S. Air Force Base were recorded as Marquette County residents.

Most of the anglers were men (or boys); only about one in ten was a woman (or girl).

Conclusions and recommendations

Apparently anglers were not critical of the special season at Swanzy and Airport lakes. At adjacent lakes, i. e., Moccasin Lake, they could "open the season" at the usual time, so they had no reason to be overly perturbed by the special season; in fact many took advantage of two "opening days."

Results to date indicate that the special regulation did not alleviate the mortality from hooking sublegal brook trout. Some benefit was derived from the special season, however, especially at Swanzy Lake. Fishing quality (catch per hour) was about the same as it had been before the special regulations were adopted, but anglers were able to catch fish throughout a longer period of time, rather than just during the opening weekend or the last 2-3 weeks of the season. Finally, the special season provided not only the popular "opening day" but also a bonus of an extra month of fishing at a time when fishing is almost certain to be good.

To verify present results it is recommended that the special season (May 15 to October 15) be continued on Swanzy and Airport lakes for at least two more seasons. The special season should be imposed at Moccasin Lake also to provide more "before" and "after" comparisons. The creel census should be resumed.

INSTITUTE FOR FISHERIES RESEARCH

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