Original: Fish Division
cc: Education-Game
Institute for Fisheries Research
J. A. Scully
L. R. Anderson
Marquette Laboratory
T. M. Stauffer

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

ALBERT S. HAZZARD, PH.D.
DIRECTOR

ADDRESS
UNIVERSITY MUSEUMS ANNEX
ANN ARBOR, MICHIGAN

March 20, 1952

Report No. 1323

CREEL CENSUS 1951 BLACK RIVER, MACKINAC COUNTY (WITH A COMPARISON WITH PREVIOUS CREEL CENSUSES)

by

Thomas M. Stauffer

Abstract

The results of the 1951 creel census are compared with those of previous years to determine the effects of the experimental early opening of the season on rainbow trout spawning success in the Black River, Mackinac County. Since 1947, the lower 3 to 4 miles of the river have been opened to the taking of rainbow trout from April 15 to November 30 and have been under creel census. The records of 1950 and 1951 can be directly compared, since they both are extensive and rather random samples. Those of 1947 to 1949 are not directly comparable since it appears that most unsuccessful trips were not recorded.

Summary of 1950 and 1951 creel census records

	Spring[1]		Regular season		Fall[2]		Yearly total	
	1950	1951	1950	1951	1950	1951	1950	1951
Angler trips	205	463	221	348	151	244	577	1,055
Hours fished	773	1,562.5	686	1,131	369.5	681.5	1,828.5	3,375
Rainbow trout	50	164	96	83	43	61	189	308
Rainbows/hour	.062	.105	.140	.073	.116	.090	.103	.091
Rainbows/hour/trip	.046	.122	.151	.124	.111	.087	.103	.112
Pounds of rainbows/hr.	.126	.235	.158	.109	.217	.214	.156	.190

[1] Special spring season.
[2] Special fall season.

The above creel census records suggest that the population of migratory rainbows entering the Black River has remained relatively static. A statistical test (the t test) was applied to data on rainbows/hour/trip for the two spring special seasons, regular seasons, fall seasons and the totals for each year. No significant difference was discovered except in the case of the spring seasons, where there was a highly significant difference, with the average rainbows/hour/trip being higher in the spring of 1951. However the rainbows/hour/trip statistics for the total of the two years showed no significant difference, so it is probable that the difference in the rainbows/hour/trip data for the spring seasons is not due to a numerical change in the over-all population, but is due to some other factor. On the other hand the better fishing in the spring of 1951 was coincident with an appreciably higher average water temperature than in 1950, possibly in a cause-effect relationship.

Original: Fish Division
cc: Education-Game
Institute for Fisheries Research
J. A. Scully
L. R. Anderson
Marquette Laboratory
T. M. Stauffer

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

ALBERT S. HAZZARD, PH.D.
DIRECTOR

ADDRESS
UNIVERSITY MUSEUMS ANNEX
ANN ARBOR, MICHIGAN

March 20, 1952

Report No. 1323

CREEL CENSUS 1951 BLACK RIVER, MACKINAC COUNTY

(WITH A COMPARISON WITH PREVIOUS CREEL CENSUSES)

by

Thomas M. Stauffer

The purpose of this report is primarily to present the results of the 1951 creel census on the Black River and to compare it with previous records, which extend back to 1947. This will be done with a view to evaluating the effect of the special spring and fall seasons on the migratory rainbow trout spawning in the river. Last year the census of 1950 was compared with the census of 1947 to 1949, but since the records of the different years were not directly comparable, no difinite conclusion could be drawn, (I. F. R. Report No. 1292).

The mouth of the Black River is located in T. 44 N., R. 8 W., Section 30. The stream is fairly wide (35 to 45 feet) in the lower one-fourth mile. Here the current is sluggish. Depths range to at least 5 feet, with a proable mean of 2 to 3 feet. The upper and middle reaches of the Black River contain a fair amount of gravel area which is utilized by rainbow trout, sea lampreys and suckers for spawning purposes. The banks are heavily wooded throughout most of the river's length. The accompanying map illustrates points of access and other pertinent features.

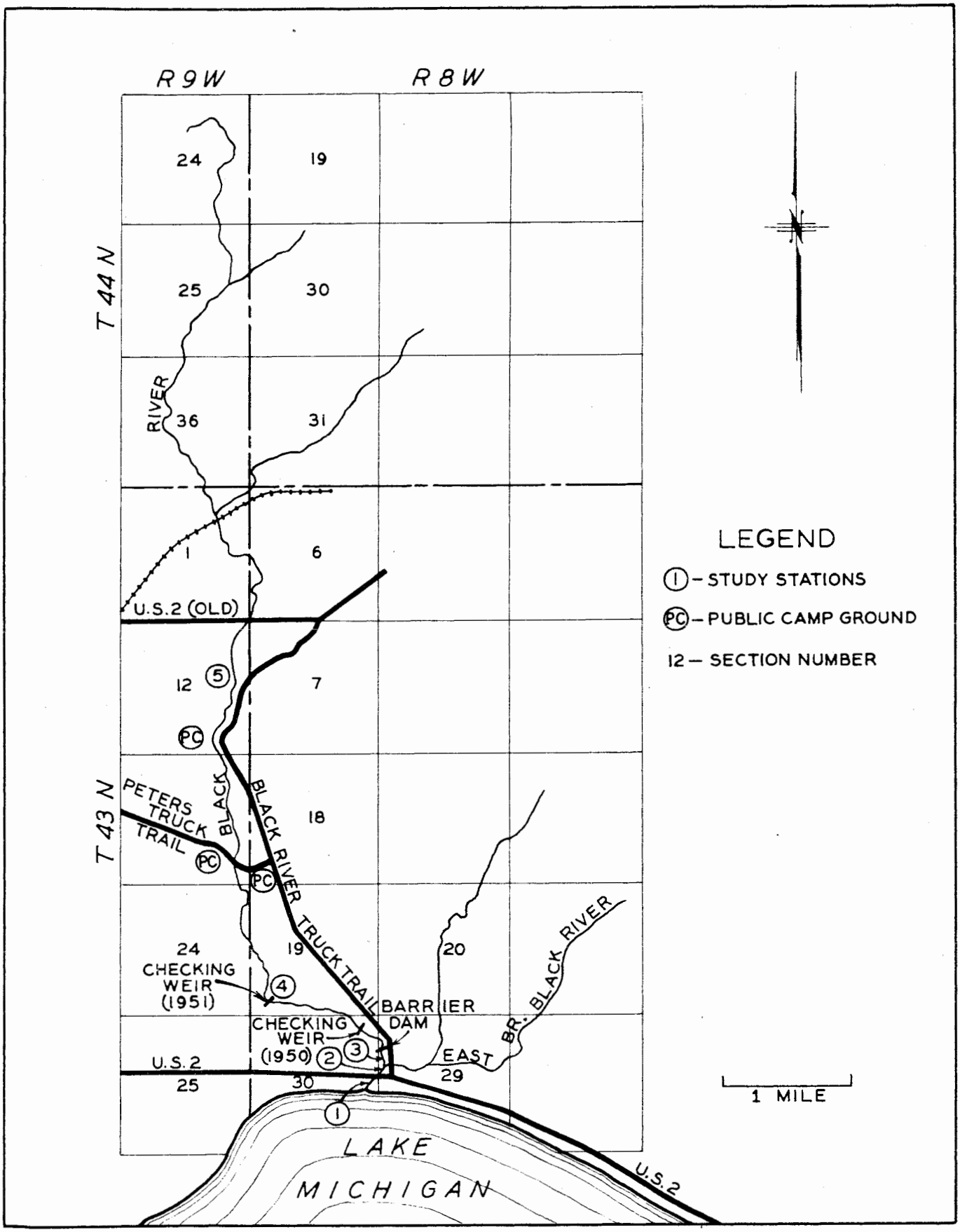

Figure 1. Map of Black River showing stations and landmarks related to the present study.

The special regulations on the river were put in effect in the spring of 1947 and were continued unchanged through 1951. These regulations included a season opening on April 15. Starting in 1952, the special spring season will open the second Saturday in April (April 12 in 1952). Since 1947 the closing date has been November 30. Only rainbow trout may be taken in the periods not covered by the regular trout season. The stream is open for the taking of rainbows from the mouth to Peter's Truck Trail Bridge during the special seasons.

Since the effect of this special season on the rainbow trout is the primary concern of this paper, a brief discussion of the migratory rainbow trout is in order. After hatching in the spring, the young rainbows usually remain in the stream for two years, migrating to the lake at the beginning of the third growing season and usually returning to spawn at the beginning of the fourth growing season. In a study of the migratory rainbow in Michigan. Greeley (1933) found that 62.8 percent of the fish which he studied fell in this category. In 1951 the young taken in the Black River, when migrating downstream to the lake for the first time, ranged in length from 3.9 inches to 10.5 inches. Of 457 young (parrs) taken in the downstream weir on the Black River and scale sampled in the spring of 1951, 196 or 43 percent were sublegal fish (under 7 inches). In a check during 1950 of size on 62 downstream-migrating parrs, 87 percent (54) were sublegal (I. F. R. Report No. 1292). Because it was learned this year (1951) that the average size of the downstream-migrating parrs varied from week to week (the percentage of sublegal fish varied from 8 percent to 65 percent), it is quite apparent that the percentage arrived at in 1950 was erroneous as an indication of the percent of sublegal fish of the

total migration since the sample was small and was taken mostly in one day. The young in the stream are generally sublegal, since those which have attained 7 inches probably do not reach this size until well into the second growing season. Thus, it can be seen that the young are generally unavailable to the angler.

Adult migratory rainbow trout are also generally unavailable to the angler during the regular trout season. As far as can be determined, most of the life span of adult rainbow trout is spent in the Great Lakes. There they are unavailable to the angler. The activity of these trout in the Great Lakes is somewhat of a mystery. The only time that the adult trout is available to the angler is in the spring and fall when they run up into many streams tributary to the Great Lakes. However, many streams are closed to trout fishing over a large portion of the period when the adults are in the stream. The special season on the Black River has been initiated to determine if the removal of some of the adults in the spring and fall has an adverse effect on the population. If it is apparent that the special season has no adverse effect, other streams may be opened, which will enable anglers to have a fair change at a population otherwise little utilized.

An experimental sea lamprey barrier and a checking weir were operated on the Black River in conjunction with the creel census. The locations of these structures are shown in the accompanying map (Figure 1). The sea lamprey barrier consisted of a dam with an overhanging lip which held back a head of water of 2 to 3 feet. Although it is believed that the dam was not a barrier to migrating rainbows, it did have the effect of concentrating the fish (and fishermen) immediately below it. The checking weir, about 1 1/2 miles upstream from the dam consisted of a two-way sea lamprey type weir. The purposes of this weir were to ascertain

just what fish could surmount the dam and to provide specimens for tagging for a migration study. With few exceptions, all rainbows taken in the weir were tagged. When the downstream migration of spent fish began, a noticeable concentration of adult rainbows was observed immediately above the weir. Local anglers were quick to take advantage of the concentration of large fish. During the downstream run of adult spent fish, I believe that the weir had an adverse effect on the fishing below. One hundred and sixty-one adult rainbows taken in the downstream trap were tagged and released downstream. I believe that these fish would not be inclined to "bite" until sometime after tagging and handling, and when this period was concluded they would be safely in Lake Michigan. No spent adults tagged on the downstream run were known to be recovered by anglers below in the spring or early summer.

Although no records were kept of hatchery brook and brown trout caught by anglers, it is thought that most of the brook trout taken in the lower 3 miles of the stream were hatchery fish. Most of the brooks taken had short gill covers and were not so highly colored as wild fish. It is not known if the brown trout taken by anglers were hatchery fish or not. A very few brook trout taken were lake-run fish, judged so by their silvery coloration. A few lake-run brown trout were present in the river, but none were taken by anglers. No rainbow trout have been planted during the period of study (1947-1951).

Table 1

Stocking records, Balck River[1] Mackinac County, 1950 and 1951

Date	Species[2]	Number	Average length
May 15, 1950	Brook trout	475	7.3
July 11, 1950	Brook trout	500	7.3
August 24, 1950	Brook trout	300	7.3
June 5, 1950	Brown trout	350	9.3
July 19, 1950	Brown trout	500	9.7
Total		2,125	
April 24, 1951	Brook trout	650	7.9
May 28, 1951	Brook trout	300	7.9
April 17, 1951	Brown trout	500	7.6
Total		1,450	

[1] Main stream only

[2] No rainbows were planted

Special spring season

The creel census over this period was of the "random" type and was taken by Arthur Legault and the writer. Anglers were contacted on the stream, and as such, records for partial angler trips were secured. Generally, the whole river open to fishing was checked in the morning, while in the late afternoon or early evening only the area between the

mouth and the barrier dam was covered.

When possible, the length and weight of each fish caught were recorded on the creel census forms. This proved to be impossible in some instances, and the angler's word was taken as to the number of fish caught and the estimated sizes. The records of anglers reporting catches were compared with angler catches which were verified. Anglers, whose fish were not seen, caught fish at a rate of 0.33 fish/hour, while anglers, whose catches were verified, took fish at a rate of 0.41 fish/hour. The explanation for this difference seems to be that the experienced anglers knew the census taker from long association, and consequently were more likely to keep their fish available for examination.

The average length and weight of those fish whose length and weight were reported, but not checked by the clerk, were strikingly different from the averages calculated from fish which were seen and checked. Therefore the estimated lengths and weights which had been recorded on creel census were disregarded. To calculate the pounds of rainbows/ hour, each fish which was recorded on creel census, but that was not weighed and/or measured by the census taker, was assigned an average weight, as determined by the fish weighed during the particular period. This applies to all three seasons. In 1950 almost all rainbows caught by anglers were measured to the nearest inch and recorded on creel census forms. To calculate the pounds of rainbows/hour, the lengths were converted to weights by use of a length-weight curve.

In some instances the weights of rainbows recorded on creel census were dressed weights, and occasionally only length or weight was recorded. The live weights of these fish were estimated from a

length-weight curve calculated from 312 lake-run ripe adults, spent adults and immature fish taken April 15 to July 5, 1951. This curve was also used to secure live weights of dressed rainbows taken during the regular season. The specimens used to calculate the curve were not exactly representative of the anglers' catch for the spring and regular seasons, since many spent fish were used in calculating the curve and few spent fish were taken by anglers. Those weights of angler-caught fish which were secured by the length-weight curve are therefore minimal.

On the first day of the special season 138 anglers were interviewed in the area between the mouth and the sea lamprey barrier, a distance of less than three-fourths of a mile by stream. Most anglers during the entire season were concentrated in this area. This concentration was apparently by choice since the roads to other sections of the stream were in excellent condition. The immediate area below the sea lamprey barrier was fished very heavily. Apparently the rainbow trout were concentrated by the dam, and many fine catches were made. Counties most represented by anglers were, in descending order: Luce, Mackinac, Wayne, Schoolcraft, Chippewa and Genesee.

Almost all the fish taken during this season were lake-run fish. The largest fish caught during this period was a 9 pound 4 ounce female. The average length of fish taken by anglers was 17.12 inches. This average is derived from 123 fish whose weights and/or lengths were recorded on creel census. These same fish averaged 2.24 pounds in weight. Thirty-nine were over 20 inches in length (Figure 2). Of 178 rainbows which were taken by anglers and which were scale sampled, 82 or 46 percent were ripe and had not yet spawned. All other fish taken were immature.

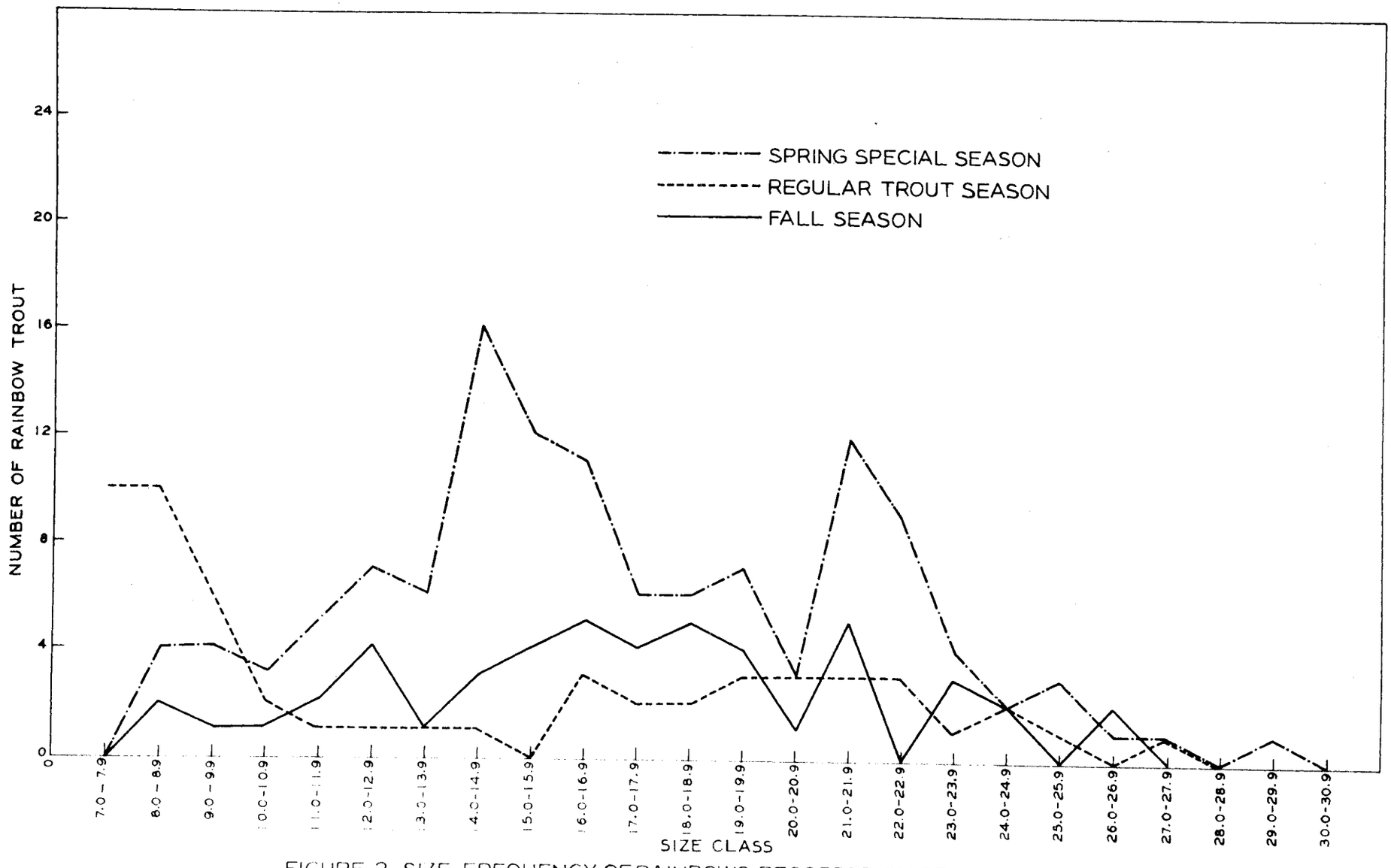

FIGURE 2. SIZE-FREQUENCY OF RAINBOWS RECORDED ON CREEL CENSUS 1951

Plate 1. View of mouth of Black River; 8:30 a.m., April 15, 1951

Plate 2. Downstream view from U.S. 2 bridge; 9:00 a.m., April 15, 1951.

Table 2

Creel census summary April 15 to 27, 1951.
(Special spring season)

Period	Sun. 15	Mon. 16	Tues. 17	Wed. 18	Thur. 19	Fri. 20	Sat. 21	Sun. 22	Mon. 23	Tues. 24	Wed. 25	Thur. 26	Fri. 27	Total
Male angler trips	136	38	22	18	22	22	54	62	17	16	14	21	13	455
Female angler trips	3	1	0	1	2	0	0	0	0	1	0	0	0	8
Totals	139	39	22	19	24	22	54	62	17	17	14	21	13	463
Successful	26	14	11	6	5	6	5	7	2	3	5	2	3	95
Unsuccessful	113	25	11	13	19	16	49	55	15	14	9	19	10	368
Percent successful	18.7	35.9	50.0	31.6	20.8	27.3	9.3	11.3	11.8	17.6	35.7	9.5	23.1	20.5
Hours fished	582.5	135.5	72.5	56.0	70.5	50.5	190.5	166.0	30.5	51.0	48.0	66.5	42.5	1,562.5
Rainbows taken	45	23	23	9	10	10	9	10	2	3	14	2	4	164
Rainbows/hour	.0772	.1697	.3172	.1607	.1418	.1980	.0472	.0602	.0656	.0588	.2917	.0301	.0941	.1050
Rainbows/hour/trip	.073	.204	.394	.125	.168	.321	.051	.066	.043	.064	.292	.026	.210	.122
Pounds/hour [1]	.144	.370	.612	.241	.417	.467	.117	.128	.207	.137	.930	.107	.219	.235
Number of rainbows weighed and/or measured	29	14	21	5	7	10	9	7	2	3	10	2	4	123
Average weight of rainbows weighed	1.87	2.18	1.93	1.50	2.94	2.36	2.47	2.13	3.15	2.33	3.19	3.55	2.32	2.24

[1] For this calculation, fish not weighed were assigned the average weight of those weighed in each period.

Regular trout season

During this period creel census was again taken by Arthur Legault and the writer from April 28 to July 5 and from September 5 to 9. Usually the river was checked in the morning from the mouth to the third state camp grounds and in the late afternoon or evening from the mouth to the sea lamprey barrier dam.

During the first two days of the period anglers were present in large numbers, but they dropped off sharply thereafter. In April and approximately the first two weeks in May, the anglers were usually found between the mouth and the barrier dam. The heaviest concentration was immediately below the dam. From about the third week in June to July 5 anglers fished mostly above the weir. Since the downstream-migrating spent trout were somewhat wary of the weir, they tended to concentrate in the holes immediately above this structure. As soon as word got around, the local anglers fished almost exclusively above the weir. In September the anglers fished between the barrier dam and the mouth for the fresh, fall-run rainbows. Over the entire season most of the anglers were from Mackinac, Genesee, Luce, Schoolcraft, Wayne and Oakland counties.

Most of the catch was made up of adults and lake-run immatures, although some parrs were recorded. The average length of 56 rainbows taken by anglers, whose length and/or weight of catch were recorded on creel census, was 14.02 inches. The average weight of these same fish was 1.48 pounds. Fourteen were over 20 inches. Of 86 rainbows taken by anglers, which were scale sampled, 23 or 26 percent were ripe and had not yet spawned, 11 or 13 percent were spent, and 52 or 61 percent were immature.

Table 3

Creel census summary April 28 to September 9, 1951.
(Regular season)

Period	April 28 to May 4	May 5 to 11	May 12 to 18	May 19 to 25	May 26 to June 1	June 2 to 8	June 9 to 15	June 16 to 22.	June 23 to 29	June 30 to July 5	Sept. 5 to 9	Total
Male angler trips	121	44	21	8	25	24	8	17	15	2	33	318
Female angler trips	8	7	2	0	1	6	3	0	1	0	2	30
Totals	129	51	23	8	26	30	11	17	16	2	35	348
Successful	16	8	4	2	9	12	3	6	6	1	6	73
Unsuccessful	113	43	19	6	17	18	8	11	10	1	29	275
Percent successful	12.4	15.7	17.4	25.0	34.6	40.0	27.3	35.3	37.5	50.0	17.1	21.0
Hours fished	474	228.5	82.5	34	54.5	62.5	15.5	38.5	30	1.5	109.5	1,131
Brook trout	2	2	13	2	9	5	2	5	0	0	0	40
Brown trout	7	8	2	2	1	1	0	4	1	0	0	26
Rainbow trout	14	7	2	0	17	10	3	14	6	1	9	83
Total trout taken	23	17	17	4	27	16	5	23	7	1	9	149
All fish/hour	.048	.074	.206	.118	.495	.256	.323	.597	.233	.667	.082	.132
Rainbows/hour	.030	.031	.024	. 0	.312	.160	.194	.364	.200	.667	.082	.073
All fish/hour/trip	.066	.100	.102	.118	.377	.519	.303	.604	.424	.500	.064	.189
Rainbows/hour/trip	.041	.029	.011	. 0	.221	.372	.227	.475	.393	.500	.064	.124
Pounds of rainbows/hour [1]	.116	.083	.036	0	.596	.061	.048	.600	.117	.117	.130	.109
Number of rainbows weighed and/or measured	11	3	0	0	13	9	3	5	6	1	5	56
Average weight of rainbows weighed	2.39	2.70	1.48 [2]	0	1.91	0.38	0.25	1.65	0.58	0.25	1.58	1.48

[1] For this calculation, fish not weighed were assigned the average weight of those fish weighed in each period.

[2] Average weight for entire regular season used, since no average is available for this period.

Fall special season

Creel census was taken by the writer from September 10 to November 14, exclusive of the dates October 1 and October 25 to 28. It was usually taken twice a day, once in the morning and once in the late afternoon or early evening. The area censused included only the area from the mouth to the barrier dam, where practically all of the anglers were concentrated. When possible, the rainbows taken were weighed and measured. In some instances dressed weight only could be obtained. For calculation of pounds/hour the dressed weight was converted to live weight by use of a length-weight curve calculated from 16 mature fish and 15 immature fish taken in the fall. The live weight of dressed parrs was obtained by use of a length-weight curve calculated from 10 parrs taken during the period.

From September 9 to October 12 many anglers were present. During the partridge season many of these anglers were from the Lower Peninsula. Apparently they came up with the idea of combining rainbow fishing with hunting. After the partridge season, few anglers were present, perhaps due to the return of hunters to the Lower Peninsula and due to the cold and inclement weather. Counties most represented were: Mackinac, Luce, Midland, Schoolcraft, Tuscola and Wayne.

Most of the rainbows taken were fresh, lake-run fish and were in excellent condition. The average length of 49 fish whose lengths and/or weights were recorded on creel census was 17.37 inches. The average weight of these fish was 2.39 pounds. Thirteen were over 20 inches in length. The largest fish recorded was 7 pounds 1 ounce, although 4 others were reliably reported as ranging in weight from 8 to 12 pounds. Of 35 rainbows taken by anglers, which were scale sampled, 21 or 60 percent were maturing, and 14 or 40 percent were immature.

Table 4

Creel census summary September 9 to November 14, 1951
(Special fall season)

Period	Sept. 10 to14	Sept. 15 to 21	Sept. 22 to 28	Sept. 29 to Oct. 5	Oct. 6 to 12	Oct. 13 to 19	Oct. 20 to 26	Oct 27 to Nov. 2	Nov. 3 to 9	Nov. 10 to 14	Totals
Male angler trips	34	37	22	42	38	12	6	4	11	6	212
Female angler trips	2	2	3	4	13	6	0	1	1	0	32
Totals	36	39	25	46	51	18	6	5	12	6	244
Successful	4	11	5	9	14	2	1	1	3	0	50
Unsuccessful	32	28	20	37	37	16	5	4	9	6	194
Percent successful	11.1	28.2	20.0	19.6	27.4	11.1	16.6	20.0	25.0	0	20.5
Hours fished	71.0	114.5	78.5	131.0	151.0	65.0	20.0	9.00	32.0	9.5	681.5
Rainbows taken	4	14	8	10	16	3	1	1	4	0	61
Rainbows/hour	.056	.099	.102	.076	.106	.046	.050	.111	.125	0	.090
Rainbows/hour/trip	.089	.103	.064	.080	.132	.026	.037	.100	.075	0	.087
Pounds/hour [1]	.177	.351	.239	.192	.228	.059	.025	.133	.290	0	.214
Number of rainbows weighed and/or measured	4	11	6	7	13	2	1	1	4	0	49
Average weight of rainbows weighed and/or measured	3.15	2.87	2.35	2.51	2.14	1.28	0.50	1.20	2.32	0	2.39

[1] For this calculation, fish not weighed were assigned the average weight of fish weighed in each period.

Conclusion

In Table 4 the summary for the creel census records is presented. In 1947 and 1948 the creel census records were taken by Charles Vanderstar (Conservation Officer, District 4) as a part of the general creel census. It is significant to note that, of 47 parties interviewed, 45 were successful. In 1949, creel census was taken by Leland Anderson, Cecil Gill and Charles Vanderstar. Leland Anderson recorded 5 personal trips and 87 trips of other persons on general creel census forms. Cecil Gill recorded 107 trips. Mr. Gill's record apparently was a personal creel census with other members of his party being included; of 50 records (party or self), only in one instance were fish not recorded. The above indicates that unsuccessful trips frequently were not recorded in the census data for 1947 to 1949, therefore the records for 1947 to 1949 are not included. More detailed information on the 1947 to 1950 creel census is available in I. F. R. Report No. 1292. The creel census taken in 1950 and 1951 was of the random type, and therefore the data are comparable for these two years, but are not comparable with the census of 1947 to 1949.

With only two seasons of comparable creel census records, a definite conclusion cannot be drawn as to the effect of the special seasons. At best, the records of these two years can give only an indication of population trends. With minor variation, the catch/hour of rainbows does not differ greatly for the two years. However, upon comparing the rainbows/hour for the spring seasons, it was found that the figure for 1951 is 0.105 or 0.043 greater than for the spring of 1950. This is more or less balanced by the regular season where the rainbows/hour for 1950 exceeds that for 1951. The rainbow/hour figures for the fall seasons are not greatly different. The t test of significance was

was employed to determine if there was a significant difference between the average rainbows/hour/trip figures for 1950 and 1951. The test was further applied to differences between the two spring, two regular and two fall seasons. The formula for t, and associated formulae used to determine values to be used in the solution of t are as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\sigma^2_{\bar{X}_1} + \sigma^2_{\bar{X}_2}}}$$

$$\bar{X} = \text{mean} = \frac{\Sigma X}{N}$$

where:

X = rainbow/hour/individual trip
N = total number of trips

$$\sigma^2_{\bar{X}} = \text{standard error of mean squared} = \frac{\sigma^2}{N}$$

where:

σ = standard deviation

The application of the t test shows that there were no significant differences between the averages of rainbows/hour/trip for the two years as a whole, for the two regular seasons, or for the fall seasons. However, for the special spring seasons there was a highly significant difference, with a higher catch in 1951. The reason for this difference is somewhat obscure, due to the many variables involved. The most probable measurable variable responsible for the difference is temperature. We find that the average of the daily mid-point temperature during the spring special season of 1951 was 39.62° F., while that of 1950 was 34.64° F. It is possible that in 1950, the temperature of the river

was not sufficiently high to induce the lake-run rainbows to enter the river to spawn until after the special spring season. In other words, the entire spawning population and accompanying immatures were not in the stream during the spring special season, and it would be expected that the average for rainbows/hour/trip would be lower than in the spring of 1951, when due to the warmer temperature of the river the entire population presumably would be in the river. On this basis, differences in abundance of rainbows in the river, which in turn might have been due to differences in water temperatures, would be the explanation for the better catch in 1951.

Another possibility is that the lower catch in 1950 was a reflection of slow feeding rate correlated with low temperatures, rather than being due to the presence of fewer fish. Needham (1938) stated that lowered water temperatures naturally tend to slow up feeding, and trout examined in the late fall, winter and early spring had little food in them. He bases his figures on 3 series of trout stomachs (251 brooks, 46 browns, and 80 rainbows) taken at varying seasons of the year, from streams of central New York.

Another factor of possible significance is water level, which was recorded daily for the spring special seasons. It was discovered that the average of the daily water levels for the special spring season of 1950 was 13 inches above that for 1951. Presumably the higher water would so scatter the fish that they would not be so available to the angler as in lower water, which in this way could explain the better catch in 1951.

The number of unmeasurable variables entering into the cause of the difference of the rainbows/hour/trip for the different springs makes it impossible to draw a clear-cut conclusion. However, it is felt that water temperature (as affecting migration) is

the key to the solution. Perhaps further study of the life history of the rainbow trout will result in clarification of the problem.

The comparison of the creel census records of 1950 and 1951 seems to indicate that the rainbow population is holding its own against an extremely heavy fishing pressure. More records are needed to definitely substantiate or disprove this conclusion.

If the number of rainbow trout spawning in the Black River is being reduced (depleted), it should be reflected in a decrease of the average size of fish taken. The catch for the opening day of 1949 (April 15) by 49 fishermen totaled 73 rainbow trout averaging about 17 inches in length and up to 7 pounds in weight (Hazzard, 1950). In the spring special season of 1950 the rainbows taken by anglers averaged 18 inches in length, in the regular season they averaged 13 inches, and in the fall they averaged 15 inches. In 1951 the average length for the spring special season was 17.12 inches, for the regular season 14.02 inches and for the fall season 17.37 inches. These data indicate that the average size of rainbow trout taken by anglers is not decreasing.

Observations at the weir and in the middle and upper reaches of the river indicate that considerable numbers of rainbow trout were spawning successfully in the river. In 1950 some 432 immature rainbow trout were taken in the downstream weir trap during their first migration to the lake. The entire run was not captured because of frequent undercutting of the weir. In 1951, 472 downstream migrating parrs were captured; this is thought to represent the entire run, although a few stragglers may have been missed. Many redds were observed during the spring and early summer of 1951. A total of 161 spent adults were counted through the downstream weir trap in the spring and early summer of 1951.

This is a minimum of the total number spawning, since some spawned below the weir and others undoubtedly remained upstream or were caught by anglers. A minimum estimate of the total adult spring spawning run is approximately 298, based on angler catch and those counted through the weir. An additional 121 lake-run immatures were taken by anglers in the spring. A minimum of 253 mature and immature fish based on angler catch and counts at the weir comprised the fall run of 1950 (I. F. R. Report No. 1292). Thirty-three of these fish were included in the minimum number of spring-run (1951) fish. There was a combined minimum of 639 mature and immature lake-run trout making up the spring and fall run. (1950-51). In view of these large runs it would not appear that depletion is taking place, although, of course, we have no information concerning the size of the runs previous to the inauguration of the special season.

To summarize, the various records of 1950 and 1951 suggest that the population of migratory rainbow spawning in the Black River is remaining static. The catch by anglers was about the same. There was no decrease in average size of rainbow trout taken by anglers. Counts of downstream-migrating young at the weir and observations of many redds in the river, in 1951, indicated that the rainbows are spawning successfully and in considerable numbers. Minimum counts of the fall run of 1950 and spring run of 1951 show that some 639 adult and immature trout made up the spring and fall runs. These observations suggest that depletion is not taking place. Additional study planned for the next few years, is needed to confirm or disprove this tentative conclusion.

Table 5

Creel census summary, 1950 and 1951

	Spring[1]		Regular		Fall[2]		Total	
	1950	1951	1950	1951	1950	1951	1950	1951
Total angler trips	205	463	221	348	151	244	577	1,055
Hours fished	773	1,562.5	686	1,131	369.5	681.5	1,828.5	3,375
Brook trout	0	0	52	40	0	0	52	40
Brown trout	0	0	17	26	0	0	17	26
Rainbow trout	50	164	96	83	43	61	189	308
Total fish taken	50	164	165	149	43	61	258	374
All fish/hour	.062	.105	.240	.132	.116	.090	.141	.111
Rainbows/hour	.062	.105	.140	.073	.116	.090	.103	.091
All fish/hour/trip	.046	.122	.295	.187	.111	.087	.216	.174
Rainbows/hour/trip	.046	.122	.151	.124	.111	.087	.103	.112
Pounds of rainbow/ hour	.126	.235	.158	.109	.217	.214	.156	.190

[1] Special spring season

[2] Special fall season

Table 6

Values of t and P

Samples compared	N[1]	t	P[2]	Interpetation of P
Spring 1950	205	3.707	0.01	highly significant difference
Spring 1951	463			
Regular 1950	221	0.921	.3	no significant difference
Regular 1951	348			
Fall 1950	151	0.836	.4	no significant difference
Fall 1951	244			
Total 1950	577	0.596	.6	no significant difference
Total 1951	1,055			

[1] Number of items

[2] Level of significance

Literature cited

Greeley, John R.

1933. The growth rate of rainbow trout from some Michigan waters. Trans. Am. Fish. Soc., Vol. 63, 1933 pp. 361-378.

Hazzard, A. S.

1950. The rainbow problem. Mich. Cons., Vol. 19, No. 2, pp. 12-14, 33-34.

Needham, Paul R.

1938. Trout Streams. Comstock Publishing Co., Ithaca, N. Y. 233 pp.

INSTITUTE FOR FISHERIES RESEARCH

Thomas M. Stauffer

Approved by: A. S. Hazzard

Typed by: M. C. Tait