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DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
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ANN ARBOR, MICHIGAN

August 30, 1954

Report No. 1431

CREEL CENSUS ON THE BLACK RIVER, MACKINAC COUNTY IN 1953 AND A COMPARISON WITH PREVIOUS YEARS

By

Thomas M. Stauffer

Abstract

A random creel census has been conducted on the Black River, Mackinac County, since 1950. The purpose of this census has been to determine the effects of the special spring and fall seasons on the population of migratory rainbow trout spawning in the Black River. The special seasons have been in effect since 1947. From 1947 to 1951 the special spring season opened on April 15. Starting with 1952, it opened on the second Saturday in April. Since 1947, the special fall season has extended from the end of the regular trout season to November 30. A two-way weir was operated part of the time on the Black River in conjunction with the creel census.

Creel census and counts of migrating rainbow trout indicate generally that the run of rainbows on the Black River is declining both in numbers and in average size of individual fish. Three possible factors causing this decline are: heavy angling pressure, natural fluctuation in the population, and sea lamprey depredation.

Whether or not there is a long-term decline in the population of rainbow trout is unknown. Research over a longer period of time is needed to

make such a determination. However, during the period of study, the data point toward a general decline in the population, both in average age and size, and in numbers. This decline is thought due to a combination of the three probable controlling factors listed above. To what degree each factor limits the population is unknown at present. Therefore, management practices should be directed toward minimizing all three controlling factors. At this point in the study, the available data do not warrant formulating definite management practices, yet they point towards several management steps which may become necessary. These are in brief: (1) limiting the take by anglers, (2) by judicious stocking of hatchery rainbow in Great Lakes waters in proximity to migratory streams, it may become possible to augment weak year classes, and (3) control of the sea lamprey. The latter management practice, however, would be difficult to fully justify in the absence of revenue from Great Lakes sports fishermen.

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Creel census has been taken on the Black River since 1947. The purpose of this census has been to determine the effect of the special spring and fall seasons on the population of migratory rainbow trout spawning in the Black River. These special seasons have been enacted to more fully utilize a population of migratory rainbows which were generally unavailable to the angler. The special seasons have been in effect since 1947. From 1947 to 1951 the special spring season opened on April 15. Starting with 1952, it opened on the second Saturday in April. Since 1947, the special fall season has extended from the end of the regular trout season to November 30.

As the creel census from 1947 to 1949 was rather limited and consequently of dubious value, only the records obtained during the period from 1950 to 1953 will be considered. Emphasis will be placed on the census of 1953, in as much as the censuses of previous years were discussed in detail in previous reports (I. F. R. Report Nos. 1292, 1323 and 1374). However, a summary of the data of previous years will be presented for purposes of comparison with 1953 (Table 4).

In conjunction with the creel census, an experimental sea lamprey barrier and a two-way checking weir have been operated since 1950. While the purpose of these structures was to block or capture sea lampreys, they have also provided valuable information concerning the relative abundance of rainbow trout spawning in the Black River.

Three stockings of rainbow trout have been made in the Black River. All of these fish have been marked by jaw tags. While some of these have been caught by anglers, they have not been included in the tabulations.

Special Spring Season

The creel census during this special season was of the partial type and was made by Albert Vincent and the writer. Anglers were contacted while fishing, so that only records for partially completed angler trips were obtained. An estimated 40 to 60 percent of the total number of anglers were contacted. The census was taken every day, at approximately the same time in the norning and afternoon of each day. The census extended only from the mouth of the river to the sea lamprey barrier (about 1/2 mile upstream). Anglers were concentrated in this area, and very few fished above the barrier dam. When possible, the length, weight, sex, state of maturity, color, number of lamprey scars, a stomach sample, and a scale sample were taken from each fish caught. In some instances, dressed weights were recorded. For the calculations of pounds per hour, these dressed weights were converted to live weights by means of a length-weight curve calculated from fish taken from the Black in 1951.

Regular Trout Season

Creel census was conducted in the same manner as that described for the special season. However, it was extended to cover 3 to 4 miles of the main

Table 1.--Creel Census Summary, Special Spring Season, 1953

Date	Angler trips			Successful anglers		Hours fished	Rainbows taken			Pounds/hr.[1]
	Male	Female	Total	Number	Percentage		Number	Number/hr.	Number/hr./trip	
April 11 (Sat.)	86	5	91	17	18.7	330.0	21	.064	.063	.108
April 12 (Sun.)	61	1	62	11	17.7	169.0	16	.095	.127	.100
April 13 (Mon.)	17	1	18	5	27.8	39.5	7	.177	.162	.255
April 14 (Tues.)	17	3	20	5	25.0	58.5	9	.154	.189	.125
April 15 (Wed.)	19	1	20	4	20.0	55.5	5	.090	.112	.118
April 16 (Thurs.)	12	3	15	3	20.0	73.5	3	.041	.019	.073
April 17 (Fri.)	11	2	13	2	15.4	44.0	3	.068	.020	.145
April 18 (Sat.)	8	1	9	0	0	28.5	0	0	0	0
April 19 (Sun.)	8	0	8	0	0	16.0	0	0	0	0
April 20 (Mon.)	1	0	1	0	0	2.0	0	0	0	0
April 21 (Tues.)	3	0	3	1	33.3	6.0	2	.333	.167	.552
April 22 (Wed.)	9	0	9	2	22.2	19.0	5	.263	.222	.188
April 23 (Thurs.)	17	1	18	5	27.8	35.0	6	.171	.173	.097
April 24 (Fri.)	9	0	9	1	11.1	20.0	1	.050	.032	.144
Total	278	18	296	56	18.9	896.5	78	.087	.098	.113

[1] For this calculation, fish not weighed or measured were assigned the average weight (1.402 pounds) of those fish (47) which were weighed during the period. Dressed weights of 16 fish were recorded on creel census. The live weight of these fish was estimated from a length-weight curve calculated from 312 rainbows caught in the Black River in the spring of 1951.

Table 2.--Summary of Creel Census Data, Regular Season, 1953

Period	Angler trips			Successful anglers		Hours fished	Trout taken				All trout		Rainbows		Pounds/ hr.[1]
	Male	Female	Total	Number	Percentage		Rainbow	Brook	Brown	Total	Number/ hr.	Number/ hr./trip	Number/ hr.	Number/ hr./trip	
April 25-May 1	68	9	77	21	27.3	203.0	25	3	2	30	.148	.149	.123	.119	.185
May 2-8	44	12	56	13	23.2	152.5	11	2	2	15	.098	.191	.072	.138	.088
May 9-15	36	8	44	10	23.8	139.5	7	3	2	12	.086	.086	.050	.051	.044
May 16-22	27	5	32	6	18.8	110.0	4	2	1	7	.064	.095	.036	.069	.086
May 23-29	30	4	34	4	11.8	58.5	3	1	0	4	.068	.133	.051	.127	.050
May 30-June 5	14	5	19	3	15.8	39.0	6	0	0	6	.154	.109	.154	.109	.218
June 6-12	16	2	18	1	5.5	29.5	1	0	0	1	.034	.004	.034	.004	.049
June 13-19	6	0	6	1	16.7	17.5	1	0	0	1	.057	.048	.057	.048	.080
June 20-26	8	5	13	3	23.1	14.5	4	0	0	4	.276	.256	.276	.256	.385
June 27-July 3	16	6	22	4	18.2	46.0	5	2	0	7	.152	.119	.109	.106	.152
July 4-10	11	3	14	1	7.1	22.0	1	0	0	1	.045	.071	.045	.071	.064
July 11-17	5	3	8	0	0	13.0	0	0	0	0	0	0	0	0	0
July 18-24	2	1	3	0	0	3.5	0	0	0	0	0	0	0	0	0
Aug. 31-Sept. 4	17	8	25	4	16.0	54.0	4	0	0	4	.074	.098	.074	.098	.092
Sept. 5-11	49	17	66	10	15.2	211.5	23	0	0	23	.109	.062	.109	.062	.165
Sept. 12-13	17	3	20	6	30.0	59.0	9	0	0	9	.153	.114	.153	.114	.209
Total	366	91	457	87	19.0	1,173.0	104	13	7	124	.106	.115	.089	.097	.125

[1] For this calculation, rainbows not weighed were assigned the average weight (1.397) of those weighed (45) during the period. Dressed weights of 7 rainbow were recorded on creel census. The live weight of these fish was obtained from a length-weight curve calculated from 312 rainbows caught in the spring of 1951 in the Black River.

stream during the morning census. For the most part, the census was taken by Albert Vincent.

Anglers did not disperse very much along the river but fished mostly below the barrier dam. When the spent rainbows began to migrate downstream and to congregate above the checking weir, the anglers fished mostly above the checking weir. The anglers returned to the river below the barrier dam when the fall-run rainbows started to come in during the last week in August.

Special Fall Season

This census was conducted in the same manner as that for the spring season. Anglers concentrated their efforts below the barrier and very few fished above. September saw the heaviest concentration of anglers, but fishing pressure was light in October; it increased again slightly in November. Some deer hunters were observed fishing during the first week of deer season. There was a reliable report of one fish of 9 pounds being caught during the deer season.

Discussion of data pertaining to relative abundance of rainbow trout

The *t* test* was applied to the average rainbow/hour/trip figures (Table 4) of the various seasons and years to determine if there were statistically significant differences. The figure (.098) for the special spring season of 1953 was not significantly different from that (.122) of the spring season of 1951, but was significantly higher than those of 1950 and 1952. The poorer fishing in the special spring seasons of 1950 and 1952 was due to the absence of the lake-run immature fish in the river during the special

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*Skewness in the frequency distribution of catch-per-hour-per-trip data is recognized as a factor complicating the analyses of the significance of *t*; but this does not invalidate conclusions based on differences which are highly significant.

Table 3.--Creel Census, Fall Season, 1953

Period	Angler trips			Successful anglers		Hours fished	Rainbows taken			Pounds/hr.[1]
	Male	Female	Total	Number	Percentage		Number	Number/hr.	Number/hr./trip	
Sept. 14-18	31	7	38	2	5.3	94.5	6	.063	.022	.062
Sept. 19-25	49	6	55	10	18.2	182.0	14	.077	.096	.093
Sept. 26-Oct. 2	35	11	46	9	19.6	124.5	15	.120	.131	.080
Oct. 3-9	17	7	24	2	8.3	89.0	2	.022	.025	.022
Oct. 10-16	7	3	10	4	40.0	25.5	6	.235	.295	.228
Oct. 17-23	18	5	23	2	8.7	79.5	2	.025	.030	.013
Oct. 24-30	0	6	6	3	50.0	16.5	5	.303	.281	.239
Oct. 31-Nov. 6	1	3	4	1	25.0	4.5	2	.444	.333	.320
Nov. 7-13	14	14	28	7	25.0	47.5	11	.232	.260	.284
Nov. 14	7	2	9	4	44.0	18.0	4	.222	.333	.200
Total	179	64	243	44	18.1	681.5	67	.098	.122	.094

[1] For this calculation, fish not weighed were assigned the average weight (0.983 pound) of those weighed (43). Dressed weights of 15 fish were recorded on creel census. The live weights of these fish were estimated from a length-weight curve calculated from 31 fall-run fish caught in the fall of 1951.

Table 4.--Summary of data pertaining to relative abundance of rainbow trout

Summaries	1950	1951	1952	1953
Rainbow/hr./trip				
Special spring season	.046	.122	.030	.098
Regular season	.151	.124	.077	.097
Special fall season	.111	.087	.116	.122
Averages	.103	.112	.063	.103
Pounds of rainbow/hr.				
Special spring season	.126	.235	.085	.113
Regular season	.158	.109	.172	.125
Special fall season	.217	.214	.123	.094
Averages	.156	.190	.122	.113
Average size in inches (from creel census)				
Special spring season	18.0 (50)	17.1 (123)	19.0 (40)	14.7 (63)
Regular season	12.9 (15)[1]	14.0 (56)	17.8 (67)	14.3 (52)
Special fall season	17.2 (25)[1]	17.4 (49)	16.7 (19)	13.1 (58)
Averages	16.9 (90)	16.4 (228)	18.0 (126)	14.0 (173)
Count of downstream migrating parr	432[2]	472	629	2,352
Count of downstream migrating, spent adults	58[2]	161	108	34

[1] From fish caught by anglers and scale sampled.

[2] Entire run not captured because of frequent undercutting of weir.

spring seasons. In 1950, such fish appeared during the early part of the regular season, but in 1952 they never did appear in any numbers.

The figure (.097) for the regular season of 1953 was not significantly different from those of 1951 and 1952. It was, however, significantly lower than that of 1950. The large number of lake-run immatures taken in the regular season of 1950 caused this difference. Usually, lake-run immatures are not taken in any numbers during the regular season.

The figure (.122) for the special fall season of 1953 was not significantly different from the figures for the special fall seasons of 1950, 1951 and 1952.

The yearly rainbow/hour/trip figure (.103) for 1953 did not differ significantly from those of 1950 and 1951, but was highly significantly greater than the value for 1952. This was due to the limited number of lake-run immatures available to the angler during the special spring season of 1952. Normally, these fish make up a large percentage of the catch. Although the catch/hour/trip figures for 1953 did not drop below the figures for two of the three earlier years (1950 and 1951), the average size of fish caught in 1953 was considerably smaller, which meant poorer fishing quality in terms of weight of fish caught.

The average size of rainbows caught by anglers during 1950 and 1951 was about the same--16.9 and 16.4 inches, respectively. In 1952, the average size increased to 18.0 inches. This increase was due to the larger number of fish in older age groups present in 1952 (Table 5) and to the absence of the younger, immature lake-run fish. An unusual abundance of age-group IV (1948) was responsible for the larger number of older fish. In 1953, the average size dropped to 14.0 inches. Age-group II (year class 1951) was most represented in the catch of 1953 (Table 5), accounting for the smaller average size.

The counts of downstream migrating parr was fairly constant for the first three years of operation; but in 1953, the run increased tremendously due, for the most part, to a successful spawning season in 1952.

The counts of downstream migrating adults, for the years 1950 to 1953, indicate that the spawning runs of rainbow trout are becoming smaller and smaller in the Black River. With the exception of 1950, the downstream trap of the checking weir was operated approximately during the same period each year.

Age analysis

Whenever possible, scale samples were secured from angler-caught fish. These samples are presumed to be representative of the angler's total catch, because anglers were contacted at random. The scales taken in the spring and summer of 1950 are not included because the method of obtaining them was not at random. Ages were read on a "scale machine" at a magnification of 107X, and scale measurements at various annuli were made. Aged rainbows were divided into five groups: (1) parr, defined as immature fish with parr marks and whose scales showed no lake growth, (2) immature males, (3) immature females, with immature fish defined as silvery fish whose scales showed lake growth, (4) mature males, and (5) mature females. Generally, the latter two classes were lake-run, but occasionally also a parr was mature and fell into this group.

At this point, perhaps a brief discussion of the information brought to light by the break-down on maturity would be of value and aid in future regulations of the rainbow trout sports fishery. The parr caught by anglers during the spring and regular season are almost invariably in age-groups II and III. Age-group I is absent because practically all fish of this age group are under 7 inches and cannot legally be kept by anglers. The parr

are almost always sexually immature. Those immature females caught during the spring and regular season are mostly in age-groups II and III, with an occasional IV. Mature females include age groups III and older. Of 111 female lake-run trout in age-group III caught during the spring and regular seasons (1951-1953), 35 or 31.5 percent were mature. By way of generalization, it would be safe to say that all female lake-run trout are mature at the beginning of their fifth summer (age-group IV). The lake-run males apparently mature at an earlier age than do the females. Of 30 age-group II lake-run males examined during the spring and regular season, 9 or 30 percent were mature. In age-group III, 82 males were examined, of which 55 or 67.1 percent were mature. For all practical purposes, all males may be considered to be mature at age-group IV.

A critical analysis of the different age groups and year classes caught during the various seasons revealed several interesting phenomena (Table 5 and Figs. 1 and 2). The most obvious was the dominance of the 1948 year class. Figures 1 and 2 demonstrate this very clearly. Although 1950 was not represented by a very large sample, the analysis of the fall season catch strongly reflected the dominant year class of 1948. This year class comprised the majority of the catch in 1951, and it was still the most numerous year class in 1952, when the fish were four years old, and when their numbers were not sufficient to maintain as high a catch per hour as in 1951 (Table 4). The large size of fish of the 1948 year class, when caught in 1952, resulted in anglers catching the largest fish, on the average, during 1952.

The presence of another dominant year class, that of 1952, is suggested by the large number of age-group I fish appearing in the catch in the fall of 1953. A large 1952 year class had been expected from the results of spot checks with an A.C. shocker made in the stream, and from the presence

Figure 1.--Age frequency distribution (by percentage) of rainbow trout taken by angling from the Black River.

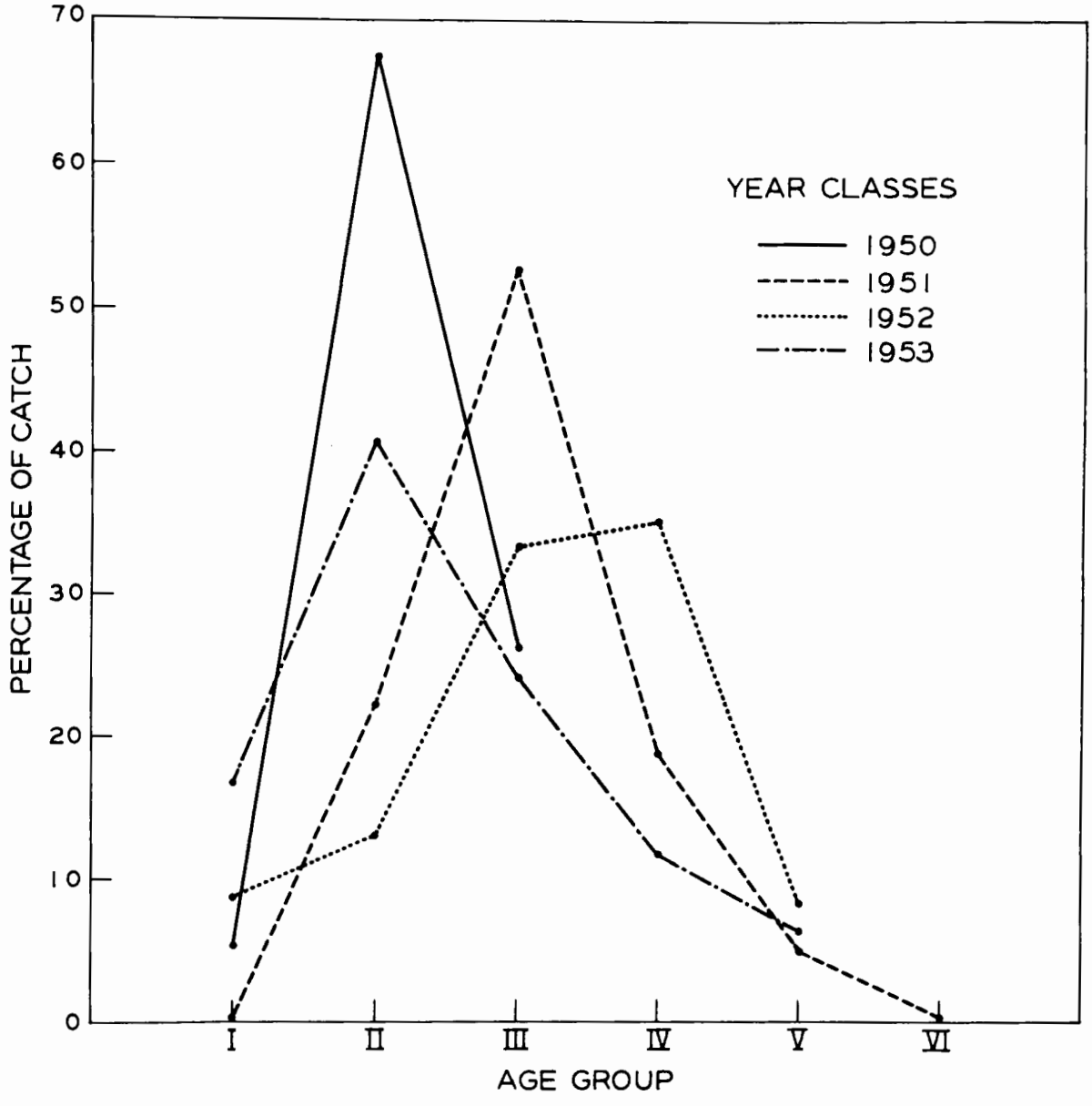
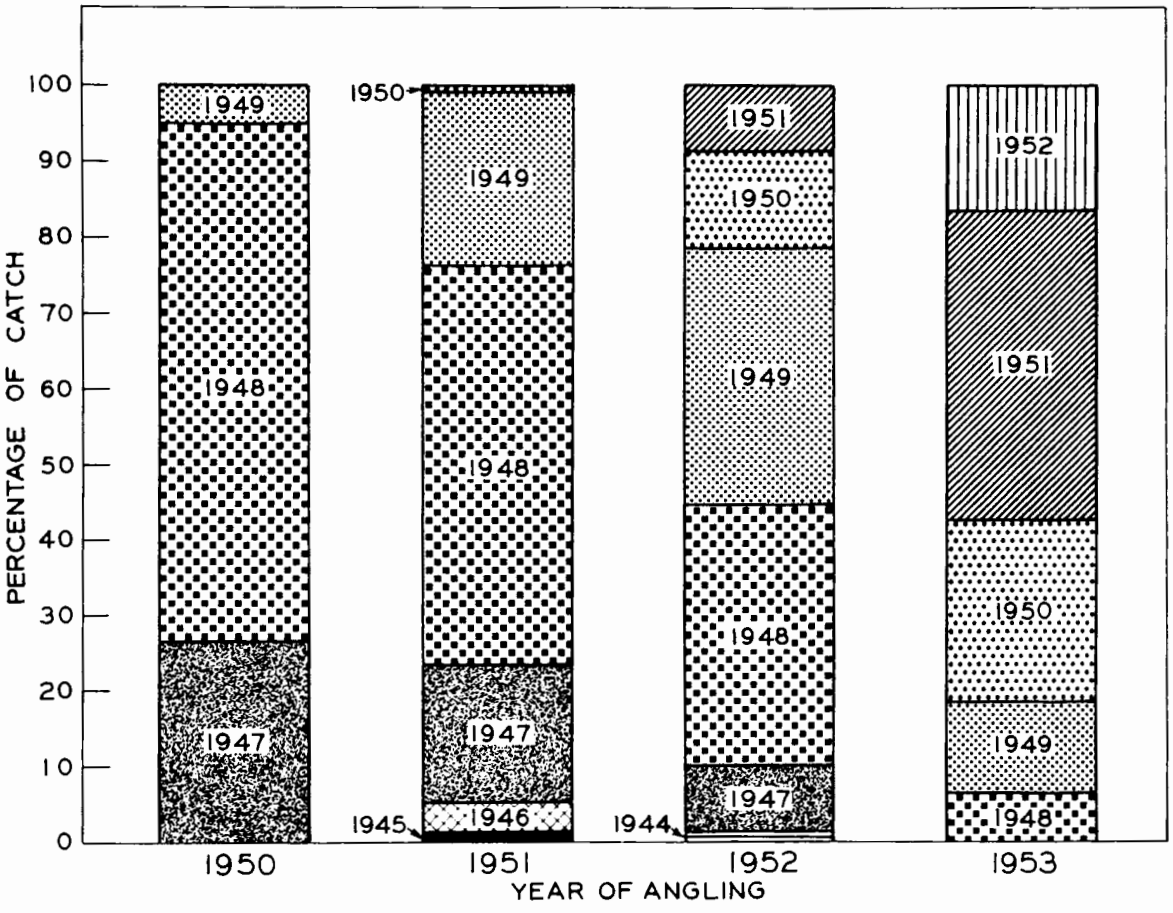

70
60
50
40
30
20
10
0
PERCENTAGE OF CATCH
YEAR CLASSES
1950
1951
1952
1953
I
II
III
IV
V
VI
AGE GROUP

Figure 2.--Year-class distribution of rainbow trout caught by anglers from the Black River during the years 1950-1953


PERCENTAGE OF CATCH
100
90
80
70
60
50
40
30
20
10
0
1949
1948
1947
1950
1949
1948
1947
1946
1945
1951
1950
1949
1948
1947
1944
1952
1951
1950
1949
1948
1950
1951
1952
1953
YEAR OF ANGLING

of many 1952 parr in the downstream trap of the weir. In 1955 this year class is expected to produce excellent fishing, judging from the records on the 1948 year class.

The 1951 year class showed some indication of being a larger than normal year class, although not nearly so large as that of 1952. The 1951-fish first appeared in the catch in the fall of 1952, and an increased number of them appeared in the catch of 1953. Further data are necessary to classify this year class as dominant.

There might be a relationship between the dominant year classes of 1948 and 1952. It might be argued that the dominant 1948 year class produced another dominant year class of 1952, since the 1948 year class reached the age of four years (when all were sexually mature) in 1952, and consequently might have produced a large number of young. However, by the same token, the 1951 fish should have been even more abundant than 1952 fish, for a noticeably larger number of adults were observed to have spawned in 1951 than in 1952. Murphy and Shapovalov (1951), in a study of king salmon, silver salmon and steelhead trout reported that the relationship between the size of a parental run and the offspring run is not very close. In other words, a large spawning run does not necessarily produce a large return. This is apparently substantiated by the studies on the Black River.

Table 5.--Age composition of rainbow trout taken by anglers, 1950-1953

Year class, season	I		II		III		IV		V		VI		VII		VIII		Total number
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
1950																	
Fall[1]	1	5.3	13	68.4	5	26.3	...	...	...	...	...	...	...	...	...	...	19
1951																	
Spring[2]	...	...	28	16.1	99	56.9	38	21.8	8	4.6	1	0.6	...	...	...	...	174
Regular[3]	1	1.2	23	26.4	46	52.9	12	13.7	5	5.8	...	...	...	...	...	...	87
Fall	...	...	18	52.9	12	35.3	4	11.8	...	...	...	...	...	...	...	...	34
Total	1	0.3	69	23.4	157	53.3	54	18.3	13	4.4	1	0.3	...	...	...	...	295
1952																	
Spring	...	...	1	1.9	25	46.3	24	44.4	4	7.4	...	...	...	...	...	...	54
Regular	...	...	8	11.8	23	33.8	28	41.2	8	11.8	...	...	...	...	1	1.4	68
Fall	15	32.6	13	28.3	8	17.4	7	15.2	3	6.5	...	...	...	...	...	...	46
Total	15	8.9	22	13.1	56	33.4	59	35.1	15	8.9	...	...	...	...	1	0.6	168
1953																	
Spring	1	1.4	27	38.6	27	38.6	13	18.6	2	2.8	...	...	...	...	...	...	70
Regular	...	...	25	45.4	15	27.3	5	9.1	10	18.2	...	...	...	...	...	...	55
Fall	30	49.2	24	39.3	3	4.9	4	6.6	...	...	...	...	...	...	...	...	61
Total	31	16.7	76	40.9	45	24.2	22	11.8	12	6.4	...	...	...	...	...	...	186
Grand total	48	7.2	180	27.0	263	39.4	135	20.2	40	6.0	1	0.1	...	...	1	0.1	668

[1] Special fall season
[2] Special spring season
[3] Regular trout season

Table 6.--Comparison of ages of lake-run rainbow trout in different streams in Michigan

Age group	Black River[1]	Huron River[2]	Big Carp River[3]	AuGres River[4]	Platte River[5]	Total
I						
Number	48	0	0	44	1	93
Percentage	7.2	0	0	19.5	0.2	6.2
II						
Number	180	0	0	108	4	292
Percentage	27.0	0	0	47.8	0.7	19.4
III						
Number	263	5	2	52	61	383
Percentage	39.4	9.6	18.2	23.0	11.1	25.4
IV						
Number	135	7	5	17	178	342
Percentage	20.2	13.5	45.4	7.5	32.5	22.7
V						
Number	40	21	4	4	144	213
Percentage	6.0	40.4	36.4	1.8	26.3	14.2
VI						
Number	1	10	0	1	95	107
Percentage	0.1	19.2	0	0.4	17.3	7.1
VII						
Number	0	4	0	0	61	65
Percentage	0	7.7	0	0	11.1	4.3
VIII						
Number	1	4	0	0	3	8
Percentage	0.1	7.7	0	0	0.6	0.5
IX						
Number	0	0	0	0	1	1
Percentage	0	0	0	0	0.2	< 0.1
X						
Number	0	1	0	0	0	1
Percentage	0	1.9	0	0	0	< 0.1
Total number	668	52	11	226	548	1,505

[1] Mackinac County, scale samples at random from anglers, fall of 1950 through the fall of 1953.
[2] Baraga County, scale samples at random from anglers, spring of 1953.
[3] Gogebic County, scale samples from anglers, May 7, 1953.
[4] Iosco County, scale samples generally from anglers, spring and fall, 1950.
[5] Benzie County, scale samples from fish caught by a weir with 1.5" spaced grates, 1942.

Table 7.--Lamprey scarring on lake-run rainbows in Black River, Mackinac County

Period	Number examined	Number lamprey scarred	Percent lamprey scarred	Lamprey scars/fish	Average length of fish examined, inches
	Rainbows 14.9" and under				
1951	78	1	1.3	.013	13.1
1952	78	5	6.4	.090	12.6
1953	222	8	3.6	.036	12.3
Total	378	14	3.7	.042	...
	Rainbows 15.0" and over				
1951	336	73	21.7	.306	20.0
1952	325	115	35.4	.717	22.3
1953	187	83	44.4	.759	20.7
Total	848	271	32.0	.564	...

Discussion and summary

The creel census results indicated that angling improved in 1953 over that of 1952. However, it has improved only in numbers of fish taken but not in the average size of the catch. The average size of the catch declined from 18.0" in 1952 to 14.0" in 1953, due to the absence of the older age groups.

The number of downstream migrating young in 1953 (as shown by the catch of the downstream trap of the weir) increased well over three-fold above that of 1952. This, undoubtedly, was the result of successful spawning in 1952. The number of spent adults trapped in the downstream trap of the weir is becoming progressively smaller each year. This scarcity of adults was reflected in the smaller average size of fish in the angler's catch.

Analysis of the age of angler-caught fish revealed two dominant year classes (1948 and 1952). The 1951 year class also appeared to be larger than average. The 1948 year class provided relatively good fishing in 1951 and also raised the average size of fish in the angler's catch in 1952. The 1952 year class provided almost half the catch in the fall of 1953, when this year class would normally enter the fishery only in limited numbers. The 1951 year class composed 41 percent of the catch in 1953; this percentage is considerably higher than normal for age-group II (the percentage was high also in 1950, but the sample that year was too small to be very reliable).

It might be argued that the general decline in size and the shift to younger age groups in the angler's catch indicate definite depletion. However, Rounsfell and Everhart (1953) pointed out that a decrease in size and age is not valid evidence of over-exploitation in a population in which the success of spawning is highly variable. Judging by the analysis of age and other observations, the success of spawning on the Black River is highly variable. The data available probably do not cover a long enough period of

time to ascertain definitely if there is an actual decline in the rainbow population spawning in the Black River. Judging from reliable reports it seems probable, however, that the population was larger (both in numbers and size) in the past when the stream was lightly fished. Charles Vanderstar, local conservation officer, believes that the decline was first noticeable in 1950.

Proceeding on the assumption that the rainbow trout population has been reduced in the Black River, the next problem is to determine just what may have been the cause of the decline. The data indicate that there are three possible causes: heavy angling pressure during the special spring season, fluctuation caused by success of spawning, and sea lamprey predation (scarred fish have been observed). All these are probably acting to reduce the rainbow trout population utilizing the Black River for spawning. A discussion of these factors follows.

It is apparent that the Black River during the special spring season is subject to an extremely heavy angling pressure. The angling is generally limited to the lower 1/2 mile of stream where the mature trout are usually concentrated at that time of year. These fish are caught in large numbers before they spawn (46.1% in 1951 and 62.5% in 1952 of the catch were mature adults). In Table 6, note the younger and consequently smaller fish caught in the streams which have been heavily fished for some time previous to the sampling as compared to streams that have not been exploited. Those streams considered to have been lightly exploited previous to the date of sampling are the Huron, Big Carp and Platte rivers. Lamprey predation was not a factor on the Huron, Big Carp and Platte, whereas it may have been a factor on the Black and AuGres rivers. It will be significant to note whether or not the Huron River angling quality holds up under the heavy pressure which it has been subjected to during the past two years. Inasmuch as lamprey

predation is light there, it should be possible to decide whether or not sea lamprey predation is a significant cause of fluctuations, and this will considerably facilitate analysis of angling pressure as a cause of depletion.

Analysis of age of angler-caught rainbow trout, and other investigations, revealed the presence of two dominant year classes, 1948 and 1952. The 1948 year class was, undoubtedly, responsible for the large spawning run in 1951 and for the larger average size of the fish caught in 1952. However, the 1948 year class was not abundant enough in 1952 to produce a high catch per hour, and by 1953 this year class had largely disappeared. The next dominant year class (1952) did not enter the catch in any great numbers until the fall of 1953; consequently, the lack of successful spawning seasons would be expected to cause a decline in the number and/or size of trout available to the angler, as was apparent in 1952 and 1953.

The data available indicate that the sea lamprey is playing an important role in the reduction of size and numbers of rainbow trout spawning in the Black River. The larger fish, when in Lake Michigan, are very much subject to lamprey predation (Table 7). On fish 14.9" and under, no trend is clear, but on fish of 15.0" and over, a definite upward trend in incidence of lamprey scarring, for the years 1951-1953, is present. This is coincident with the progressively smaller runs and/or smaller average sizes of fish taken. Sea lamprey predation could have played an important role in the reduction of the migratory rainbow trout spawning in the Black River.

Whether or not there is a long-term decline in the population of rainbow trout is unknown. Research over a longer period of time is needed to make such a determination. However, during the period of study, the data suggest a general decline in the population, both in average age and size, and in numbers. This decline is thought due to a combination of the three probable controlling factors discussed above. To what degree each factor limits the

population is unknown at present. Therefore, management practices should be directed toward minimizing, when possible, all three controlling factors. At this point in the study, the available data do not warrant formulating definite management practices.

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