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

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March 29, 1954

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UNIVERSITY MUSEUMS ANNEX  
ANN ARBOR, MICHIGAN

Report No. 1413

THE EFFECTS OF AN INCREASE IN THE MINIMUM SIZE LIMIT OF  
TROUT UPON ANGLING IN THE RIFLE RIVER, RIFLE RIVER AREA

By

Howard Gowing

Abstract

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For eight years, from 1945 to 1952, complete creel census data are available for stream angling on 4.6 miles of the Rifle River within the Rifle River Area.

From 1945 to 1947 inclusive, trout stream angling regulations were: 15 trout per day with a minimum size limit of 7 inches. From 1948 to 1952, the regulations were: minimum size limit of 8 inches, and a daily creel limit of 10 trout, or 10 pounds and one trout. Creel census data were examined to determine the effects of an increase in the minimum size limit upon angling. Only the catch of native brown trout was considered.

During the 8 years, there has been a general upward trend in angling intensity, while the annual catch and the mean total length of the catch have tended to fluctuate.

No relationship appears to exist between angling intensity and the annual catch of trout during this period.

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In the three years, 1945 to 1947, the percentage contribution of 7- to 7.9-inch trout to the total catch amounted to only 7.7 percent. The total harvest of trout for this period was 2,047, or an average annual catch of 682 trout. The mean total length of the catch was 10.6 inches. From 1948 to 1952, when an 8-inch minimum size limit was in effect, 2,820 trout were caught, or an average annual catch of 564. During this period, the mean total length of the catch was also 10.6 inches.

There was no significant difference in the average annual catch before or after the change in regulations. An increase in the minimum size limit from 7 to 8 inches did not have any appreciable effect upon angling in the Rifle River within the area.

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The Rifle River Area, formerly a private estate known as "Grouse-haven", was purchased by the Department of Conservation in 1945. Since that time it has been administered by the Fish Division. Fishing within the boundaries of this 4,318-acre tract of land is handled by a compulsory permit system. Complete creel census data are obtained and recorded for each angler-trip in the area.

From 1945 to 1947, the daily creel limit was 15 trout and the minimum size limit was 7 inches. These same regulations were in effect throughout the state. During 1948, the daily creel limit was reduced to 10 trout, or 10 pounds and one fish, and the minimum size limit was increased to 8 inches on the Rifle River. These changes in regulations were effective only on that portion of the Rifle River within the boundaries of the area, and were not applicable state-wide. In 1952, the daily creel limit was reduced to 10 trout on all streams in the state.

The discussion that follows is an attempt to evaluate the effects, if any, of the change in the minimum size limit. The period under consideration includes the years 1945 through 1952 and involves only the catch of native brown trout in the Rifle River within the censused

area. Native rainbow trout represent a small proportion of the anglers' catch from this river. Brook trout are somewhat of a rarity in the Rifle River.

The years 1945 to 1947 inclusive, hereinafter will be referred to as the pre-period. The following five years, 1948 to 1952 will be referred to as the post-period.

Fishing intensity on the Rifle River for the 8-year period averaged 1,804 angling trips per year. During the opening year (1945), angling trips on the river totaled 1,227. In the succeeding three years, fishing intensity steadily increased, and by 1948 reached 1,932 angling trips (Table 1). Fishing intensity declined during 1949 only to rise sharply again to an 8-year peak of 2,498 angling trips in 1951. A 21.2 percent drop in the number of fishing trips occurred during 1952. The general trend of fishing over the eight years can be characterized as one of increasing angling intensity.

From 1945 through 1952, catch records show an annual variability in the (1) total catch, (2) size composition of the catch, and (3) mean total length of the catch.

As observed in Table 1, the total harvest of brown trout has fluctuated annually during the 8-year period from a low of 306 in 1945 to a high of 937 in 1947. There appears to be no relationship between the observed total catch and angling intensity (trips) in this period as indicated by the coefficient of correlation,  $\sqrt{r_{xy}} = 0.048$ . A significant

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$\sqrt{r_{xy}}$  Simple coefficient of correlation =  $r_{xy} = \frac{a}{\sqrt{bc}}$ ,

where

$$a = N \sum xy - \sum x \sum y$$

$$b = N \sum x^2 - \sum x \sum x$$

$$c = N \sum y^2 - \sum y \sum y$$

Table 1.--Number and percentage (in parentheses) of brown trout by one-inch classes from the Rifle River during the years 1945-1952

One-inch class	Year							
	1945	1946	1947	1948	1949	1950	1951	1952
7 - 7.9	43 (14.1)	57 (7.1)	58 (6.2)					
8 - 8.9	56 (18.3)	178 (22.1)	129 (13.8)	173 (28.0)	123 (21.1)	170 (30.3)	96 (14.5)	38 (9.5)
9 - 9.9	68 (22.2)	207 (25.8)	195 (20.8)	160 (26.0)	175 (30.0)	160 (28.5)	150 (22.8)	74 (18.5)
10 - 10.9	45 (14.7)	148 (18.4)	192 (20.5)	93 (15.0)	121 (20.8)	75 (13.4)	158 (24.0)	68 (17.0)
11 - 11.9	28 (9.2)	77 (9.6)	106 (11.3)	67 (10.8)	72 (12.3)	50 (8.9)	109 (16.6)	49 (12.2)
12 - 12.9	22 (7.2)	54 (6.7)	101 (10.8)	36 (5.8)	39 (6.7)	36 (6.4)	63 (9.6)	55 (13.8)
13 - 13.9	9 (2.9)	32 (4.0)	56 (5.9)	37 (6.0)	23 (3.9)	29 (5.3)	41 (6.2)	46 (11.5)
14 - 14.9	5 (1.6)	18 (2.2)	38 (4.1)	18 (2.9)	12 (2.1)	18 (3.2)	17 (2.6)	32 (8.0)
15 - 15.9	4 (1.3)	15 (1.9)	24 (2.6)	12 (1.9)	7 (1.2)	12 (2.1)	5 (0.8)	22 (5.5)
16 - 16.9	4 (1.3)	3 (0.4)	15 (1.6)	6 (1.0)	7 (1.2)	4 (0.7)	5 (0.8)	9 (2.2)
17 - 17.9	8 (2.6)	2 (0.2)	12 (1.3)	5 (0.8)	2 (0.3)	3 (0.5)	6 (0.9)	3 (0.8)
18 - 18.9	3 (1.0)	7 (0.9)	4 (0.4)	3 (0.5)	1 (0.2)	3 (0.5)	4 (0.6)	2 (0.5)
19 - 19.9	3 (1.0)	4 (0.5)	1 (0.1)	3 (0.5)	1 (0.2)	1 (0.2)	3 (0.4)	
20 - 20.9	7 (2.3)	1 (0.1)	4 (0.4)	3 (0.5)			1 (0.2)	2 (0.5)
21 - 21.9								
22 - 22.9	1 (0.3)	1 (0.1)		2 (0.3)				
23 - 23.9			1 (0.1)					
26 - 26.9			1 (0.1)					
Total number	306	804	937	618	583	561	658	400
Number angling trips	1,227	1,243	1,746	1,932	1,546	2,275	2,498	1,966

positive correlation between total catch and fishing intensity might be expected to occur if all other contributing factors remained constant. However, other variable factors were operative in the Rifle River during this time. The yearly fluctuation in catch suggests that possibly the number of trout available to anglers has varied from year to year.

From 1945 to 1947, when the 7-inch minimum size limit was in effect, the contribution of 7- to 7.9-inch trout to the annual total catch has varied from 14.1 percent in 1945, to 7.1 percent in 1946, to 6.2 percent in 1947 (Table 1). A significant decline in the numerical abundance of the 7- to 7.9-inch trout from 1945 (14.1%) to 1946 (7.1%) was indicated by a Chi-square value of 12.26. During 1946 and 1947, the contribution of the 7-inch class to the total catch remained approximately the same.

During the pre-period, angler reports have shown that only 31 sub-legal trout (less than 7 inches) were caught and released. Evidence of the scarcity of trout less than 7 inches in length in the Rifle River can be demonstrated by samples of trout taken from this stream within as well as outside of the area by electro-fishing in the fall of 1950 and 1952. From a total of 313 trout sampled, only 8.9 percent represented trout less than 7 inches in length. Trout from 7.0 to 7.9 inches constituted 20.1 percent of the total sample.

The average catch of 7- to 7.9-inch trout during the pre-period amounted to 7.7 percent of the total catch.

During 1948, when the minimum legal length was increased to 8 inches, the total catch of trout declined to 618, or a decrease of 34 percent from the previous year's catch of 937 trout. It is doubtful if this loss in 1948 can be attributed solely to the removal of 7- to 7.9-inch trout from the catch. The 34 percent decrease in the catch of

1948 was more than double the percentage contribution that the 7- to 7.9-inch trout made to the total catch in any one of the years preceding the change in regulations (Table 1). The greatest number of trout caught in 1948 were in the 8- to 8.9-inch size range. This 8-inch class represents a significant increase over that of 1947. A small fraction of this increase might conceivably be attributed to the recruitment of 7- to 7.9-inch trout into catchable-size groups during the open season. However, examinations of the yearly percentage capture of 8- to 8.9-inch trout before and after the change in minimum size limit shows that an irregular rate of exploitation occurred irrespective of year or period (Table 2).

The mean total length of the annual catch has varied significantly over the 8-year period. Differences in the mean length of the catch also occurred within the pre-period and post-period years. Comparisons of the mean total length of the annual catch by the "t" test (95% level) indicate that the mean for 1947 was significantly greater than that of 1946, 1948, 1949, and 1950 (Table 3). The mean for 1948 was not significantly greater than that of 1946. The year 1952 produced a catch with the highest average total length, 11.7 inches, exceeding significantly that of 1947 (10.8).

The observed fluctuations in the mean total length of the annual catch offset each other when the mean for the pre-period and post-period years are compared. The mean total length of the entire catch under a 7-inch minimum size limit was 10.6 inches. During the 5 years when an 8-inch minimum size limit was in effect, the mean was also 10.6 inches.

During the pre-period, 2,047 trout were caught, which is equivalent to an average annual catch of 682 trout. The post-period produced

Table 2.--Significant Chi-square differences<sup>√</sup> in the rates of exploitation of brown trout in the 8-inch class from the Rifle River during the 8-year period from 1945-1952 (Percentage values of P given in parentheses)

Year	1946	1947	1948	1949	1950	1951	1952
1945	2.38 (87.0)	3.39 (93.0)				1.89 (83.0)	
1946		<u>20.29</u> (99.9+)	<u>6.12</u> ((98.6)			<u>13.04</u> (99.9+)	
1947			<u>47.13</u> (99.9+)	<u>13.14</u> (99.9+)			<u>4.29</u> (96.0)
1948				<u>7.30</u> (99.3)	0.53 (50.0)		
1949					<u>11.71</u> (99.9+)	<u>8.56</u> (99.7)	
1950						<u>41.96</u> (99.9+)	
1951							<u>5.37</u> (97.8)

<sup>√</sup>Underscored figures indicate a significant difference (95% level) computed by Chi-square as set forth by Snedecor (1946)



Table 3.--Comparison of the mean<sup>√</sup> total length of the catch for the years 1945 through 1952

Year	Number of fish	Mean	Standard deviation	Standard error of mean
1945	306	10.6	2.994	0.171
1946	804	10.3	2.185	0.077
1947	937	10.8	2.412	0.078
1948	618	10.5	2.239	0.090
1949	583	10.4	1.833	0.076
1950	561	10.3	2.084	0.088
1951	658	10.8	2.003	0.078
1952	400	11.7	2.302	0.115

<sup>√</sup>The mean and standard deviation were computed from grouped data. The assumption that the items within each one-inch class is equal to the class mark in determining the mean and standard deviation of the catch involves relatively little error.

a total catch of 2,820 trout, or an average yearly catch of 564 trout. This is equal to an average annual catch difference between the two periods of 118 trout, or an average percentage decline of 17.3 percent during the post-period.

Length-frequency distributions of the average annual catch by one-inch classes for the two periods tend to level off yearly fluctuations in the composition of the catch, and indicate where average differences, if any, occur. The length-frequency distributions, Figure 1, show that the average number of 8- and 11-inch trout were similar during the two periods. The greatest differences occurred in the 9-, 10- and 12-inch classes. Trout comprising these one-inch classes during the pre-period exceeded numerically those of the post-period.

The average annual catch for the two periods were compared by means of the "t" test. With the great variability in the annual catch, no significant difference was found between the average annual catch of the pre-period and post-period years ("t" = 0.60, P = 45.1 percent).

The effects of the change in minimum size limit from 7 to 8 inches might be summarized as follows: Under a reasonably intensive fishery, the average number of 7- to 7.9-inch trout caught yearly during the period of a 7-inch size limit constituted a very small proportion of the total catch.

During the 8-year period the general trend of angling pressure has increased. The annual total catch, the average length of the catch, and the size composition have varied rather markedly throughout these years.

The total catch of the pre-period was 2,047, or an average annual catch of 682 trout. The mean total length of the catch was 10.6 inches.

Figure 1.--Length-frequency distribution of the average  
catch during periods of 7- and 8-inch minimum size limits  
(Average number by one-inch classes)



The post-period produced a total catch of 2,820 with an average annual catch of 564 trout. The mean length of the total catch for this period also was 10.6 inches.

Differences in the average annual catch, although amounting to 118 trout, were found to be statistically non-significant. The increase in the minimum size limit from 7 to 8 inches has produced no significant effect upon angling in the Rifle River within the area.

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