Original: Fish Division
cc: Education-Game
Inst. for Fish. Res.
D. S. Shetter
Rifle River Area
C. T. Yoder--2
Howard Gowing

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

February 3, 1954

Report No. 1397

TROUT STREAM ANGLING RESULTS, RIFLE RIVER AREA, DURING THE 1950, 1951, AND 1952 SEASONS

By

Howard Gowing

Abstract

Within the Rifle River Area, the importance of the Rifle River to trout stream angling can be summed up by the following points: (1) the mainstream comprises about one-half of the 9.1 miles of stream in the Area, (2) it supports approximately 90 percent of the fishing pressure, and (3) it produces about 87 percent of the total catch of trout.

In the three-year period, fishing pressure increased from 2,274 angling trips in 1950 to 2,497 in 1951, and diminished in 1952 to 1,966 angling trips. The yearly harvest of trout followed this same pattern: 900 trout in 1950; 1,139 in 1951; and 516 during the 1952 season.

Fishing pressure was greatest during the first half of the trout season, producing 68 percent of the total catch of 1950, 90.5 percent in 1951, and 83.6 percent in 1952.

The quality of trout fishing, as measured by the catch/hr./angler-trip, was significantly better (based on the "t" test) than in either 1950 or 1952. Angling quality was the same for the latter two years.

Plantings of hatchery rainbow trout during 1949, 1950, and 1951 contributed 34.1 percent to the total catch of 1950, 38.3 percent of the 1951 catch, and 16.8 percent of the season's catch of 1952.

Spring and fall plantings of legal-length rainbow trout in Devoe Lake are generally recaptured in the Rifle River. Present records indicate that spring plantings gave a better return than fall plantings.

Native brown trout harvested by anglers from the Rifle River ranged in age from 2 to 7 years, with the largest percentage composed of 3- and 4-year-old fish. A comparison of the age composition of the 1951 and 1952 crop of wild brown trout indicated that in 1952 the numbers in age-group II decreased while age-group III remained approximately the same as in 1951. These 3- and 4-year-old fish showed an accompanying increase in average calculated length. There was a significant (Chi-square) increase in the number of 5-year-old fish in the 1952 catch, although these fish showed no increase in average length over that of 1951. During the three-year period, the average total length of each succeeding year's catch of native brown trout has increased.

The cause of these changes in the population of brown trout are not understood at present but should be clarified by further study. The recruitment of brown trout into the Rifle River from tributaries appears to be an important factor in the abundance of this species in the river.

Original: Fish Division
cc: Education-Game
Inst. for Fish. Res.
D. S. Shetter
Rifle River Area
C. T. Yoder--2
Howard Gowing

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

February 3, 1954

Report No. 1397

TROUT STREAM ANGLING RESULTS, RIFLE RIVER AREA, DURING THE 1950, 1951, AND 1952 SEASONS

By

Howard Gowing

The purpose of this report is twofold: (1) to supplement the yearly summary reports of the recreational use of the Rifle River Area, and (2) to complement these reports by elaborating in greater detail upon the results of trout fishing in the streams of the Rifle River Area beginning with the year 1950.

The Rifle River Area is the site of 4,288 acres of state-owned land in Ogemaw County east of Rose City. Complete creel census is obtained for the lakes and streams in the Area by a system of permits. The angler, upon arrival at the checking station, is issued a permit entitling him to fish any of the lakes and streams within the Area. Before departing, the angler is checked out and an individual record is kept of the waters fished, the time, and the catch.

According to Shetter (1951) there are 9.1 miles of streams, with an area of 33.1 acres, within the boundaries of the Rifle River Area. The Rifle River comprises about one-half of the total stream mileage. The lengths and areas of the trout streams are as follows:

Stream	Length (miles)	Area (acres)
Rifle River	4.6	22.8
Gamble Creek	1.5	5.9
Houghton Creek	0.2	0.8
Fontinalis Creek	0.8	0.9
Brown Trout Creek	1.9	2.5

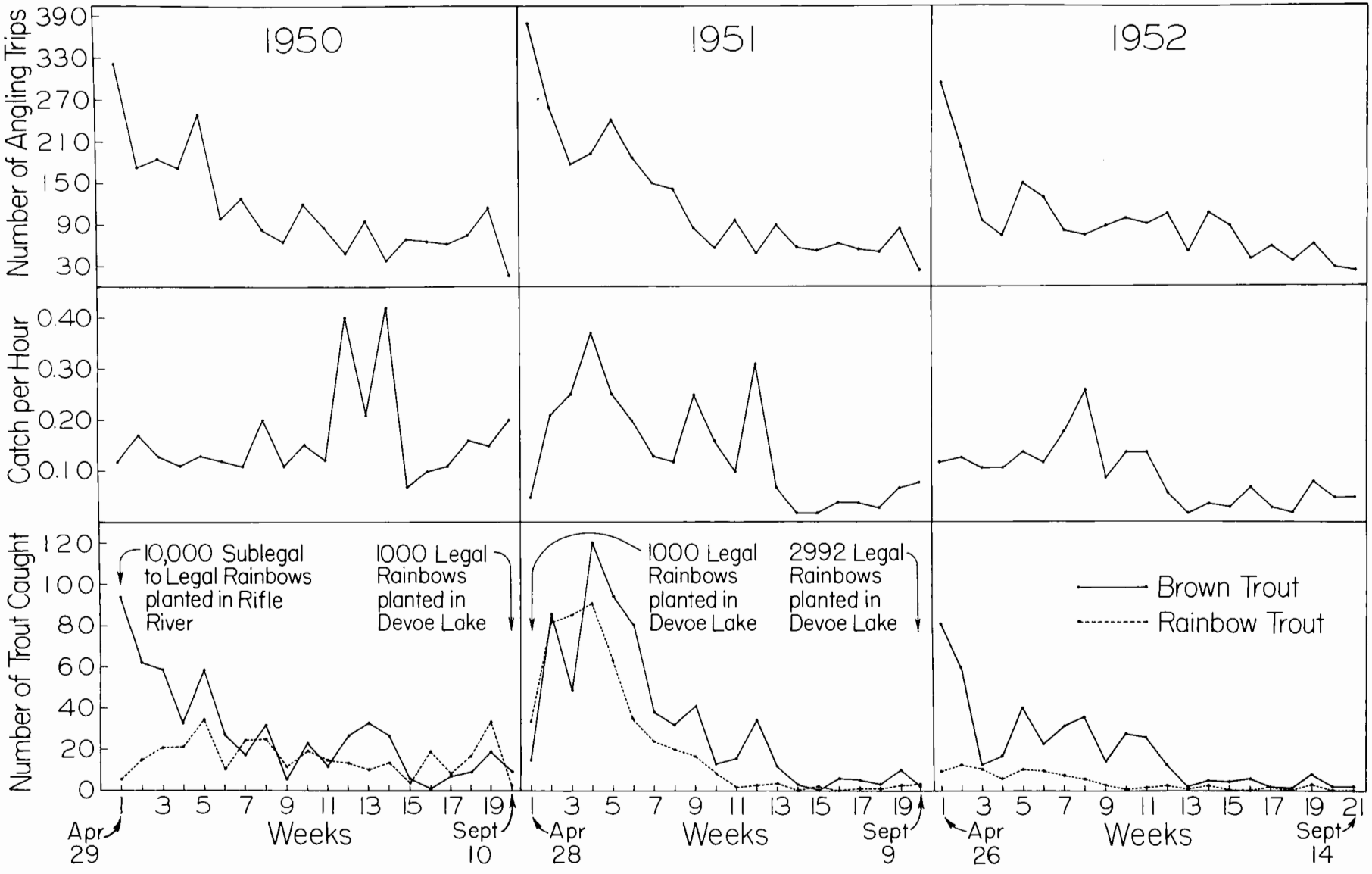
Since 1945, when the Department of Conservation purchased the Rifle River Area, there has been a general upward trend in its use by the public. Trout fishing pressure on the streams has usually followed this trend, as shown by the total angling days recorded from 1945 to 1952: 1,472; 1,427; 1,959; 2,162; 1,749; 2,612; 2,827; 2,218 (Shetter, 1952).

The heaviest fishing pressure on the streams in the Area is on the Rifle River. Of the total hours of stream angling, 89.9 percent were spent on the river in 1950, 90.5 percent in 1951, and 90.8 percent in 1952. Corresponding figures for 1945-1949 were comparable. Furthermore, the annual catch per hour of trout from the Rifle River deviates little, if any, from the catch per hour for all streams combined. Consequently, the annual crop of trout is harvested principally from the Rifle River, and this stream largely reflects the quality of trout angling on the Rifle River Area. Thus this stream might be used as a yardstick to measure angling quality in the Rifle River Area from year to year.

Angling Trends

The trout season covers a twenty- to twenty-one-week period. Fishing pressure, as measured by the number of angling trips, reaches a peak during the first week (Figure 1). This occurs annually, and is the result of the large number of fishermen who turn out for the opening two days of the season. In 1950, during the first week, 322 angling trips were made and 95 brown trout, 7 rainbow trout, and one brook trout were caught (Figure 1). The first week of the 1951 season accounted for 57 more fishing trips than 1950, but the

Figure 1. Weekly catch statistics covering the 1950, 1951, and 1952 trout seasons, Rifle River Area


1950
1951
1952
Number of Angling Trips
390
330
270
210
150
90
30
Catch per Hour
0.40
0.30
0.20
0.10
Number of Trout Caught
120
100
80
60
40
20
0
10,000 Sublegal to Legal Rainbows planted in Rifle River
1000 Legal Rainbows planted in Devoe Lake
1000 Legal Rainbows planted in Devoe Lake
2992 Legal Rainbows planted in Devoe Lake
Brown Trout
Rainbow Trout
1 3 5 7 9 11 13 15 17 19
Apr 29
Weeks
Sept 10
1 3 5 7 9 11 13 15 17 19
Apr 28
Weeks
Sept 9
1 3 5 7 9 11 13 15 17 19 21
Apr 26
Weeks
Sept 14

catch was only 15 brown trout, 34 rainbow trout, and 2 brook trout. The results of the first week of fishing in 1952 were comparable to 1950 when 294 angling trips produced 81 brown trout, 10 rainbow trout, and 3 brook trout. The catch per hour for the first week of each year (1950-1952) was 0.12, 0.05, and 0.12 respectively (Figure 1).

Fishing pressure is heaviest during the first half of the trout season. Except for a slight increase during the week including Decoration Day (5th week), the number of fishing trips tends to diminish after the opening week until about the first week of July, after which it levels off (Figure 1). During the first 10 weeks of the 1950 season, when the catch per hour fluctuated around 0.13, the downward trend in the catch of brown trout was compensated in part by the increased returns of rainbow trout (Figure 1). The entry of rainbow trout into the catch was due to a planting of 10,000 rainbow trout (left pelvic fin clipped) in the Rifle River on May 3 and 4, 1950. The size of these fish ranged between 2.7 and 8.9 inches. Shetter (1951) indicated that approximately 2 percent were larger than 8.0 inches in length and that 13.1 percent exceeded 7.0 inches.

In 1951, the bulk of the year's catch of brown and rainbow trout had been made by the first half of the 1951 season (Figure 1). This amounted to 86.1 percent of the year's total catch of 658 brown trout and 96.0 percent of the 479 rainbow trout. The large number of rainbow trout taken is ascribed mostly to the survivors of the planting of 10,000 rainbow trout previously mentioned, and to the release of 1,000 legal-length rainbows (right pelvic clipped) in Devoe Lake on April 13, 1951. During the first half of 1951, the catch per hour was 0.32; the highest weekly average occurred during the fourth week (May 19-25).

Fishing pressure in 1952 fell below the levels of 1951 and 1950, particularly during the first 10 weeks of the season. The catch per hour for the first half of the 1952 season was 0.13, similar to that of 1950. However, 1,407.5 more hours of angling were spent on the Rifle River during this period in 1950 than in 1952. Nevertheless the catch per hour remained the same for both years, as additional trout caught in 1950 were distributed over a larger number of fishing trips.

During the last 10 weeks of the 1950 season, angling pressure generally declined. Angling quality picked up in the 12th week (July 15-21) when the catch of brown trout increased and fishing pressure fell off. In spite of a slight drop in the number of trout caught, the catch per hour increased to 0.42 in the 14th week (July 29-August 4) when fishing pressure diminished (Figure 1). The added number of rainbow trout taken during the period from the 15th week (August 5-11) to the 19th week (September 2-8) boosted the catch per hour.

From the 11th week (July 7-13) to the close of the 1951 season, fishing pressure leveled off to approximately 75 angling trips per week. Except for the 12th week (July 14-20), when the catch per hour reached 0.31, the number of trout killed during the remainder of the year steadily diminished, falling below that of 1950 (Figure 1).

Fishing pressure during the last half of 1952 was comparable to similar periods of the two previous years. The catch per hour of 0.06 compared more favorably with that of 1951 (0.08).

Figures on catch per hour, given previously in this report, were derived by dividing total catch by total angling hours. Such averages are not adaptable for statistical comparison. To facilitate a comparison of the quality of angling from year to year, the average catch per hour per angler was

determined for the Rifle River, by computing the catch per hour for each angling trip and then calculating the average for all angler trips.

For the year 1950, the catch/hr./angler of trout was 0.12. In 1951 and 1952, the respective indices of angling quality were 0.15 and 0.12. The "t" test (from data in Table 1) indicated that the quality of angling during 1951 was significantly better than that of 1952 and 1950.

Table 1.--Trout angling quality on the Rifle River for three years

Year	Number trout	Mean catch/hr./angler	Standard deviation	Standard error of mean
1950	900	0.12	0.326	0.006
1951	1,139	0.15	0.422	0.008
1952	516	0.12	0.386	0.008

These differences appeared to be the same when only wild trout were considered. By dividing the sum of the total number of angling hours into the catch of wild trout, the following simple catch-per-hour figures were obtained: 1950, 0.09; 1951, 0.12; 1952, 0.09. Even though these figures are not statistically comparable by the "t" test, their similarity to the averages (catch/hr./angler) for all trout are strongly suggestive of similar significant annual differences.

If the catch of all species of fish[1] are included in the catch/hr./angler, the indices of angling quality for 1950, 1951, and 1952 would be 0.13, 0.18, 0.20 respectively. Here there is a significant difference between 1950 and 1951, but not between the last two years (Table 2).

[1] All species of fish include smallmouth bass, northern pike, yellow perch, rock bass, bullheads, white suckers, and carp.

Table 2. Angling quality for all species of fish on the Rifle River

Year	Number fish	Mean catch/hr./angler	Standard deviation	Standard error of mean
1950	948	0.13	0.375	0.007
1951	1,369	0.18	0.497	0.009
1952	876	0.20	0.705	0.016

General angling trends might be summarized for 1950, 1951, and 1952 as follows: (1) Angling pressure is heaviest during the first half of the trout season. In 1950, this period produced 68 percent of the total trout catch; 90.5 percent in 1951; 83.5 percent in 1952. (2) In the first 10 weeks of the 1951 season, the catch of brown and rainbow trout was 1,027, compared to 611 taken during 1950, and 431 in 1952. Through this period fishing pressure in 1951 exceeded that of the other two years. (3) Comparing the last half of the trout season for the three years showed that fishing pressure during 1950 was greater than that of 1951, and approximately the same as 1952. This period produced a catch of 288 trout in 1950 in contrast to 110 in 1951, and 85 in 1952. (4) Although angling quality for the entire season of 1951 was better than either 1950 or 1952, it dropped below that of 1950 during the last 10 weeks of the season. (5) The catch of rainbow trout during 1950 helped to sustain angling quality throughout the season.

The fishermen's catch from the Rifle River is tabulated separately under the headings, upper Rifle River and lower Rifle River. Since these areas were not clearly defined, catch figures cannot be given with any degree of precision. Nevertheless, upper Rifle River included that portion of the stream from Devoe Lake dam to the point of entrance of Houghton Creek. Only 24 brown trout were listed as having been caught in upper Rifle River in 1950, 20 in 1951, and 13 during 1952. The catch per hour per angler of

trout from upper Rifle River in 1950 was 0.04, and in the following two years it remained at 0.05. When other species of fish are added to the catch of trout, the annual indices of fishing quality show significant differences. White suckers, rock bass, and yellow perch are the principal warm-water fish entering the yearly catch from this portion of the stream. Other species of fish caught include sunfish, bullheads, carp, bluegills, northern pike, and smallmouth bass. When all species of fish are combined, the trend of the catch per hour per angler steadily increased from 0.07 in 1950, to 0.14 in 1951, to 0.38 in 1952.

The contribution of the tributary streams (i.e., excluding the main river) to the total catch of trout in the Rifle River Area has varied from 14.1 percent in 1950, to 10.3 percent in 1951, to 15.5 percent in 1952. The quality of angling on these streams is briefly summarized in Table 3.

Table 3.--Angling quality on four streams in the Rifle River Area

Stream	Number of fishing trips			Total hours of fishing			Catch/hr./angler		
	1950	1951	1952	1950	1951	1952	1950	1951	1952
Houghton Creek	105	78	106	266.0	173.5	239.5	0.32	0.34	0.18
Gamble Creek									
Upper	77	50	29	146.0	81.0	35.0	0.12	0.24	0.20
Lower	91	80	49	185.0	176.5	72.5	0.07	0.04	0.10
Fontinalis Creek	26	21	49	49.0	33.0	91.5	0.22	0.13	0.48
Brown Trout Creek	24	66	15	22.0	121.0	23.0	0.08	0.01	0.09

Although the quality of angling on Houghton Creek dropped off during 1952, it has been consistently better than any other stream in the Area for the three

year period. Fishing pressure on Gamble Creek generally exceeds that of Houghton Creek, but during the last three years the number of fishing trips to Gamble Creek has diminished, falling below that of Houghton Creek in 1952. Upper Gamble Creek, i.e., that portion of the stream from the north boundary of the Rifle River Area downstream to the Ridge Road bridge, supports a better quality of fishing than lower Gamble Creek (downstream to Devoe Lake).

Fontinalis Creek, a small tributary of Gamble Creek, receives light fishing pressure. The number of trout caught in this stream is relatively small and subject to fluctuations from year to year. The catch per hour per angler of trout from this stream in 1952 was 0.48, the highest of any stream in the Rifle River Area that year. The number of angling trips in 1952 was approximately double that of either of the two preceding years. The quality of angling involved 49 fishing trips and 62 trout, and was more reflective of the skill of the anglers than of the angling quality. Three fishermen, who had not fished this stream the previous year (1951), accounted for 79 percent of the total catch but only 24.5 percent of the total angling trips.

Brown Trout Creek is a small brushy tributary of Gamble Creek. Although it supported approximately as much fishing effort as Fontinalis Creek during the last three years, catch records for the two streams differed markedly. Only seven trout were caught in this stream during the three years.

Analysis of the catch

With few exceptions, brown trout caught in the streams of the Rifle River Area during this three year period have been wild fish. In 1950, 567 native brown trout and one brook trout were harvested from the Rifle River (Table 4). One brown trout (jaw-tagged) was of hatchery origin. This stream in 1951 produced 658 wild brown trout and two native brook trout. Gamble

Table 4.--Distribution of the anglers' catch of trout from the streams [1] of the Rifle River Area for the years 1950, 1951, and 1952

Trout	Rifle River			Houghton Creek			Gamble Creek			Fontinalis Creek			Brown Trout Creek		
	1950	1951	1952	1950	1951	1952	1950	1951	1952	1950	1951	1952	1950	1951	1952
Native brown trout	565	658	401	28	42	26	27	18	11	11	2	44	1	1	3
Hatchery brown trout	2	...	14	...	...	...	...	5	1	...	...	...	...	...	...
Brook trout	1	2	8	...	...	...	5	3	3	1	3	17	...	...	...
Rainbow trout															
Left pelvic	290	201	...	67	10	...	...	1	...	...	1	...	...	...	...
Right pelvic	...	161	1	...	13	...	...	7	...	...	...	...	...	2	...
Left pectoral	...	69	14	...	15	1	...	...	...	...	...	...	...	...	...
Right pectoral	4	3	7	...	...	...	2	...	...	2	...	...	...	...	...
Left pectoral adipose	...	...	18	...	...	2	...	...	...	...	...	1	...	...	...
Right pectoral adipose	...	...	24	...	...	2	...	...	...	...	...	...	...	...	...
Jaw tagged	12	3	1	...	...	...	...	...	...	...	...	...	...	...	...
Dorsal	1	...	22	...	...	7	...	...	...	...	...	...	...	...	...
Unmarked	25	42	[2] 6	...	8	[3] 1	3	...	1	...	...	...	...	...	...
Total	900	1,139	516	95	88	13	37	34	16	14	7	62	1	3	3

[1] Skunk Creek, and Gamble Creek Diversion are not listed, as only one rainbow trout was taken from each of these waters.
[2] One fin-clipped rainbow trout was not completely identified as to markings.
[3] As above (2).

Creek contributed the only hatchery brown trout (five fish) caught in 1951. Of the five hatchery brown trout, four represented the only trout creeled thus far from a marked planting of 1,000 brown trout fingerlings in Gamble Creek on November 21, 1949. The fifth brown trout was planted at about 7 inches in Houghton Creek in 1951.

The 1952 catch of native brown trout from the Rifle River dropped to 401. In addition to these fish, 8 native brook trout and 14 hatchery brown trout were taken. Eleven of the hatchery brown trout were from legal-length plantings of that year and two were carry-overs from similar plantings made in 1951. One hatchery brown trout originated from a fingerling planting of 1,000 fish (adipose-clipped) in Gamble Creek on October 31, 1950; this is the first known recovery to reach the creel from this stocking. One other hatchery brown trout taken in 1951 in Gamble Creek is the only return thus far from the planting of 1,000 fingerling trout in Gamble Creek on October 21, 1948.

The Rifle River contributes a major portion of the catch of rainbow trout from the streams of the Area. The yield of rainbow trout from this stream in 1950 amounted to 332 fish, of which only 25, or 7.5 percent, were of native origin. The total catch from all streams was 407, with 6.9 percent representing wild rainbow trout.

In 1951, the Rifle River produced 479 rainbow trout, of which 8.7 percent were wild fish. When the catches of all streams are combined, the number of trout caught totaled 536, with 9.3 percent of these fish being native rainbow trout.

The returns of rainbow trout from the Rifle River during 1952 were comparatively small. Five of the 94 rainbow trout caught were native fish. The remaining streams in the Area contributed 14 additional hatchery rainbow trout plus one native rainbow trout.

Left pelvic-clipped rainbow trout represented a large share of the total catch of this species in 1950 (Table 4). As cited earlier, on May 3 and 4, 1950, 10,000 of these fish were planted in the Rifle River as "fingerlings", ranging in length from 2.7 to 8.9 inches. From this planting, 357 were taken during the 1950 season, representing a known recovery of 3.5 percent. A carry-over of this planting into 1951 resulted in the capture of an additional 213 trout. The carry-over into the second year amounted to 2.1 percent. These fish failed to show up in the 1952 catch. Combining the catch for the first two years yielded a return to the angler of 570 trout, or a recovery of 5.7 percent. The total catch of 67 rainbow trout in Houghton Creek in 1950 came from this marked planting.

A release of 1,000 legal-length rainbow trout (right pectoral clipped) in Devoe Lake on November 28, 1949, gave an exceptionally poor return to the fishermen. Only nine were caught in 1950, one from Devoe Lake, and eight from the streams of the Area (Table 4). Three trout from this planting were taken in the Rifle River during 1951. None appeared in the 1952 catch. Total recovery from this planting was 1.2 percent. Two other stockings of rainbow trout contributed to the catch of 1951. On November 3, 1950, rainbow trout (left pectoral clipped), numbering 1,000, were released in Devoe Lake. The following year five were recaptured in Devoe Lake, 69 in the Rifle River, and 15 in Houghton Creek. This is equivalent to a return of 8.9 percent. Three carried over into the 1952 catch; one from Houghton Creek, one from Devoe Lake, and the third from Gamble Creek Diversion. The other planting was made on April 13, 1951, when 1,000 right pelvic-clipped rainbow trout were liberated in Devoe Lake. These trout averaged 7.2 inches in length. The Devoe Lake catch of this planting amounted to 18 fish, while 161 were caught in the Rifle River, and 13 in

Houghton Creek. In addition, 7 had migrated into Gamble Creek where they were captured, and 2 were taken from Brown Trout Creek. This particular planting produced a total catch of 201 trout the first season, or a recapture of 20.1 percent. Only one carried over into the catch of the 1952 season.

On October 31, 1951, Devoe Lake was stocked with 1,492 slow-growing rainbow trout (left pectoral and adipose clipped) and 1,500 fast-growing rainbow trout (right pectoral and adipose clipped). The average total length (based on measurements of every tenth fish) of the slow-growing group amounted to 8.6 inches. Similar measurements of the fast-growing group averaged smaller in length, 7.8 inches. Of the latter group, 26 were recaptured during the 1952 season: 24 from the Rifle River, and 2 from Houghton Creek. The average length of these recaptures were 9.0 inches, giving them an average increment in growth of 1.2 inches. The 1952 returns from the slow-growing rainbow trout totaled 21. Eighteen of these fish were caught in the Rifle River, two in Houghton Creek, and one in Fontinalis Creek. They averaged 9.3 inches in length. The average increment in length was 0.7 inches, or 0.4 of an inch smaller than that of the fast-growing group.

The largest returns from legal-length plantings of rainbow trout in Devoe Lake were harvested from the streams of the Area, particularly the Rifle River. The returns from hatchery plantings during the last three years are summarized as follows in Table 5.

Table 5.--Returns from hatchery trout planted in the Rifle River Area, based on both stream fishing and lake fishing (Most returns from streams)

Trout	Planted	Number	Size	Time	Returns (%)
Rainbow	Devoe L.	1,000	legal	fall (1949)	1.2
Rainbow	Devoe L.	1,000	legal	fall (1950)	9.1
Rainbow	Devoe L.	1,000	legal	spring (1951)	20.2
Rainbow	Devoe L.	1,492	legal	fall (1951)	1.4
Rainbow	Devoe L.	1,500	legal	fall (1951)	1.7
Rainbow	Rifle R.	10,000	"fingerling" (2.7-8.9)	spring (1950)	5.7
Brown	Gamble Cr.	1,000	fingerling (4")	fall (1948)	0.1
Brown	Gamble Cr.	1,000	fingerling (3")	fall (1949)	0.4
Brown	Gamble Cr.	1,000	fingerling	fall (1950)	0.1

Age composition and growth of brown trout

The minimum size limit for trout during the three years was 8 inches for the Rifle River and 7 inches for the remaining streams in the Area. By the close of the 1951 season, 658 native brown trout had been caught, of which 580 (88.1 percent) were scale sampled and aged. A larger portion of the 1952 catch of brown trout were scale sampled; of the total catch of 401 trout, 383 (95.5 percent) were aged. Scale samples from the 1950 catch were few in number and are not discussed here.

For growth histories of brown trout in the anglers' catch, calculated lengths were based upon the body-scale relationship $y = ax^b = 16.81x^{0.80816}$ computed from a sample of brown trout taken in the Rifle River in the fall with an A. C. shocker.

The body-scale relationship rests upon a comparatively small sample of brown trout. Growth will be reviewed at a later date as additional data are assembled. For comparative purposes here, the above cited body-scale relationship was used.

The age composition and growth of brown trout in the Rifle River during the years 1951 and 1952 were similar in some respects but a few changes were also noted (Table 6). Age groups II and III, which were most numerous in the anglers' catch, showed the greatest yearly differences in lengths. The average lengths of age group IV and V were similar during the two years. The entry of trout of age group VI into the catch was small both years.

A comparison by Chi-square [1] of the 1951 and 1952 ratio of observed and expected numbers of age groups II, III, IV to the total combined catch indicated: (1) there was a significant decrease in the numerical abundance of age group II from 1951 to 1952, (2) age group III was of comparable abundance both years, (3) age group IV increased significantly from 41 to 57 trout; as summarized in the following:

Age group	Number of fish 1951	1952	Chi-square
II	308	139	14.55
III	214	158	1.66
IV	41	57	25.53

Thus with a drop in the numerical abundance of age group II in 1952, there was an accompanying increase of 0.8 of an inch in the average length of these three-year-old fish. Age group III also showed an increase in average length (0.8) in 1952, although there was no appreciable difference in the abundance between these age groups for the two

[1] Values of Chi-square were determined as outlined by Snedecor (1946).

Table 6.--Age composition and growth [1] of Rifle River brown trout in the anglers' catch of 1951 and 1952

Age years	Calculated lengths: calculated total length 1951	1952	calculated increment 1951	1952	Age group	Empirical averages: number of fish 1951	1952	average total length 1951	1952
1	3.3	3.2	3.3	3.2	0				
2	7.1	7.2	3.9	4.0	I		9		8.4
3	9.6	10.4	2.5	3.2	II	308	139	9.7	9.7
4	11.6	12.4	2.1	2.0	III	214	158	11.3	12.2
5	14.4	14.4	2.8	2.0	IV	41	57	13.1	13.8
6	16.1	16.2	1.7	1.8	V	12	14	15.8	15.8
7	17.5	18.0	1.4	1.8	VI	4	4	17.5	17.2
					VII	1	2	19.0	18.7

[1] Calculated lengths are based upon the body-scale relationship $y = ax^b = 16.81x^{0.80816}$ and are the average total length at the end of each year of life. Lengths for age groups are determined by empirical averages.

years. A slightly larger number of five-year-old fish entered the 1952 catch but the average length of this age group remained the same as 1951.

The differences in relative abundance of age groups, indicated in the above tabulation, would be decreased somewhat if allowance could be made for trout which were not aged (not scale sampled, or scales regenerated and not ageable). Of the 1951 catch of wild brown trout, 13.4 percent were not aged. These non-aged fish averaged 11.2 inches in length (0.4 of an inch larger than aged trout) and ranged in size from 8.0 to 20.6 inches. The non-aged trout in the 1952 collection represented 4.5 percent of the total catch. These fish varied in length from 8.2 to 14.6 inches and averaged 11.2 inches in length (0.4 inch smaller than aged trout). In view of the high Chi-square values obtained for aged trout, it appears certain that omission of the non-aged fish has not significantly influenced the conclusions.

Evidence of a shift in the size composition was indicated when the length distribution of the catch was tabulated for 1950, 1951, and 1952. The total collections of native legal-length brown trout caught by angling for the three years were 561*, 658, and 400** respectively. The length-frequency distribution of these fish is given in Table 7.

---

*For comparative purposes, 4 fish in the 7-inch group were excluded.
**One sublegal 7-inch fish was omitted.

Table 7.--Percentage capture of brown trout by one-inch groups from the Rifle River

Inch groups	Percentage		
	1950	1951	1952
8.0 - 8.9	30.3	14.5	9.5
9.0 - 9.9	28.5	22.8	18.5
10.0 - 10.9	13.3	24.0	17.0
11.0 - 11.9	8.9	16.5	12.2
12.0 - 12.9	6.4	9.5	13.7
13.0 - 13.9	5.3	6.2	11.5
14.0 - 14.9	3.2	2.5	8.0
15.0 - 15.9	2.1	0.7	5.5
16.0 - 16.9	0.7	0.7	2.2
17.0 - 17.9	0.5	0.9	0.7
18.0 - 18.9	0.5	0.6	0.5
19.0 - 19.9	0.2	0.4	...
20.0 - 20.9	...	0.1	0.5

During the three-year period the trend of the catch has been toward fish of an increasingly greater average length. In 1950, the predominant part of the catch consisted of the 8- and 9-inch groups. The shift in numbers in 1951 was to the 9- and 10-inch groups, with the percentage of 11-inch fish almost double that of 1950. The 8- to 10-inch fish, which comprise most of age group II, dropped off in 1952. However, the length distribution shifted to the larger fish in 1952, from the 12- to 16-inch groups. When the average total length of each year's catch of legal-length brown trout was determined, the following results were obtained: 1950 (561 fish), 10.3 inches; 1951 (658 fish), 10.8 inches; 1952 (400 fish), 11.6 inches.

The cause and effect of changes that have occurred in the age composition and growth of brown trout in the Rifle River during 1951 and 1952 are not known and are open to speculation.

Available evidence indicates that the recruitment of brown trout into the Rifle River is an important factor influencing the composition and density of the population of this species in the river. The Rifle River is not an isolated stream within the Rifle River Area but is actually an extension of Gamble Creek and Devoe Lake, with Houghton Creek being a major tributary. Except when the outlet dam at Devoe Lake is closed off, these waters are open avenues to trout movement. With the completion of Gamble Creek Diversion in 1951, Gamble Creek is now more directly connected to the Rifle River. Observations in the fall of 1950 and 1952 indicated that spawning by brown trout in the Rifle River was limited. Sampling at seven stations in the Rifle River with an A. C. shocker for a total of seven hours, and covering a minimum distance of 1.8 miles of stream, resulted in the capture of only two young-of-the-year brown trout. Similar sampling in the fall of 1952 gave comparable results.

To learn something of migration and recruitment of brown trout from Houghton Creek into the Rifle River, a marking experiment was conducted in the spring and summer of 1952. With a D. C. shocker, brown trout were collected, marked, and released at one station in the Rifle River and at three widely separated stations in Houghton Creek. These trout were marked (fin-clipped) differently at each station.

Weirs installed in the Diversion and in the lower reaches of Gamble Creek will be of assistance in determining the movement of brown trout between Gamble Creek and the Rifle River and also the role which Devoe Lake plays as a connecting link.

An evaluation of brown trout growth is complicated by the presence of a relatively large and heterogeneous population of non-trout species in the Rifle River. Changes that have occurred in the growth of brown

trout could be merely a fluctuation about some norm, or possibly the initiation of a trend. If the latter is true, the factors responsible are not yet known.

Like the Rifle River, the majority of trout caught in the other streams in the Area are in their 3rd and 4th years of life (Table 8). The relatively small number of trout caught in these streams leaves little upon which to base a comparison of growth. Regarding Fontinalis Creek, an inference might be drawn from the data. Trout in this stream appear to be growing comparatively slowly. The average empirical lengths of 3- and 4-year-old trout in this stream compare unfavorably with fish of a comparable age in either the Rifle River or Houghton Creek.

Additional summary information regarding stream angling in the Rifle River Area during the years 1945 through 1952 is given in Institute Report No. 1375, by Lawrence Bush (1953).

Table 8.--Growth of brown and brook trout taken by anglers from the tributary streams of the Rifle River during 1951 and 1952

Stream	Age group	Number of fish 1951	Number of fish 1952	Average total length 1951	Average total length 1952
Brown trout					
Houghton Creek	I	4	1	8.0	8.5
	II	22	9	9.4	9.3
	III	10	9	11.4	11.2
	IV	2	5	11.2	14.2
	V	...	1	...	17.2
Gamble Creek	I	1	...	7.5	...
	II	8	4	8.6	9.8
	III	2	7	10.6	10.5
Fontinalis Creek	II	1	12	7.9	8.0
	III	...	25	...	9.4
	IV	...	3	...	11.7
	V	...	1	...	10.8
Brown Trout Creek	II	...	1	...	8.4
	III	1	1	9.3	9.1
Brook trout					
Gamble Creek	II	2	2	8.2	8.8
	III	...	1	...	10.8
Fontinalis Creek	II	2	16	8.6	8.0
	III	1	1	10.2	7.8

Acknowledgments

Lawrence H. Bush, Charlie J. Kohn, Arthur W. DeClaire, and Basil V. Hughes, members of the staff at the Rifle River Area during the period of this report, collected the creel census data. Lawrence H. Bush compiled much of the 1952 catch statistics. Certain phases of the report were discussed with David S. Shetter, in charge of Hunt Creek Fisheries Experiment Station.

Literature Cited

Bush, Lawrence H.

1953. The 1952 Rifle River Area report. Unpublished. I. F. R. Report No. 1375, pp. 1-30.

Shetter, David S.

1951. The recreational use of the Rifle River Area, Ogemaw County, in 1949. Unpublished. I. F. R. Report No. 1301, pp. 1-16.

1952. The recreational use of the Rifle River Area, Ogemaw County, during the calendar year 1951. Unpublished. I. F. R. Report No. 1345, pp. 1-18.

Snedecor, G. W.

1946. Statistical methods. The Iowa State College Press, Ames, Iowa, pp. 1-485.

INSTITUTE FOR FISHERIES RESEARCH

Howard Gowing

Approved by: A. S. Hazzard

Typed by: P.R. Darling