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MONTANA FISH & GAME DEPARTMENT
FISHERIES DIVISION
HELENA, MONTANA

JOB COMPLETION REPORT
INVESTIGATIONS PROJECTS

State of Montana

Project No. F-27-R-7 Name Rock Creek Creel Census

Job No. I Title Summer Census

Period Covered July 1, 1965 - June 30, 1966

Abstract:

A creel census study to determine the contribution of catchable-size rainbow trout was continued for the eighth year on a 40-mile section of Rock Creek near Missoula, Montana. Fishing pressure and catch estimates were obtained by a regression analysis of complete car counter data and data from checking station contacts on randomly selected dates during the summer fishing season.

An estimated 9,961 anglers fished a total of 35,174 hours and caught 23,439 fish during the 1965 fishing season.

The average catch per man hour during the initial three years of the study (with fish stocking) was 0.92. The average catch per man hour during the next four years (without fish stocking) was 0.68. Rock Creek was stocked with 5,000 catchable rainbow trout during the 1965 fishing season and the average catch per man hour was 0.67.

The first year return of trout stocked during 1958, 1959 and 1960 ranged from 34.3 - 40.1 percent and averaged 37.9 percent. The return to the creel of hatchery trout stocked in 1965 was 35.5 percent.

Recommendations:

To fulfill the basic objectives of the study, the following is recommended:

1. The study be continued for at least one more year.

2. Stocking of hatchery fish be continued, and that 10,000 fish be stocked in 1966.

3. The practice of making note of the names and license numbers of as many of the same fishermen who fished Rock Creek since 1963 should be continued until completion of the study. At this time, information

relating to the catch rate and harvest of these fishermen should be retrieved from I.B.M. cards for all years in which it has been collected.

Objectives:

The long-range objective of the Rock Creek Study is to obtain the necessary harvest and pressure information for an evaluation of the stocking program of catchable-sized rainbow trout in Rock Creek. This report covers the eighth year of the study. The objective of the remaining years of study should be to continue the determination of the return of hatchery fish from Rock Creek at various stocking levels and the effect of these levels on the overall catch rate. The catch rate of anglers who have a known catch history on Rock Creek should also be determined for its effect on the overall catch rate.

Techniques Used:

Techniques used were the same as in previous years with the following exceptions: The fishing season began on May 23 and ended November 30 - a total of 192 days. The lower station was closed November 30, whereas the upper station closed September 6. Between opening day and their respective closing dates, 80 days were censused at the lower station and 54 days at the upper station. The days censused are shown in Appendix A.

After four years without fish stocking, 5,000 catchable hatchery rainbow trout were stocked in Section I of Rock Creek. No fish were stocked in Section II.

Traffic counters were inoperative from June 4-6 and June 17-19 inclusive. For each of these days an estimate was obtained by averaging the traffic counts for the same day of the previous and following week. No separate estimates of fishermen, hours and fish were obtained for these days. They are combined in the estimates obtained by regression analysis.

Findings:

Six species of game fish were taken by anglers in 1965. These were rainbow trout (Rb), Salmo gairdneri Richardson; cutthroat trout (Ct), Salmo clarkii Richardson; brown trout (LL), Salmo trutta Linnaeus; Dolly Varden (DV), Salvelinus malma (Walbaum); brook trout (Eb), Salvelinus fontinalis (Mitchill); mountain whitefish (Wf), Prosopium williamsoni, (Girard).

The species composition of the catch from 1958 through 1965 is given in Table 1. The most apparent change in species composition is the reduction of natural rainbows in the total catch during years of fish stocking. However, if the hatchery rainbows are deleted, there is less variation in catch composition of natural rainbow trout with and without stocking (Table 2). The catch of brook trout (Table 2) has decreased from 20 percent in 1958 to 11 percent and appears to be leveling off. The catch of brown trout also seems to be leveling off at about 7.0 percent after showing a steady increase from 1958 to 1963. Significant changes in catch composition of the other species are not apparent.

Table 1. Species composition of the anglers catch, in percent, from both sections of Rock Creek in the years 1958-1965.

Year	LL	DV	Ct	Wf	Eb	Hatchery Rb	Natural Rb
1958	1.2	5.0	7.3	7.0	15	26	38
1959	1.4	4.7	5.8	11.0	14	24	39
1960	1.9	5.2	8.0	13	13	25	34
1961	4.3	6.9	12.0	16	13	2.9	46
1962	4.9	5.5	8.6	15	12	1.3	53
1963	7.3	6.6	12.0	14	11	1.3	48
1964	7.2	4.8	10.0	14	11	tr.	53
1965	6.6	4.8	10.2	13.5	10.8	5.7	48.2

Table 2. Species composition of the anglers catch, in percent, exclusive of the hatchery rainbows, from both sections of Rock Creek during the years 1958-1965.

Year	Species Rb	Ct	Eb	DV	LL	Wf
1958	52	10	20	6.8	0.2	9.5
1959	52	7.6	18	6.2	0.2	14
1960	45	11	17	7.0	0.2	17
1961	46	12	13	6.9	4.3	16
1962	53	8.6	12	5.5	4.9	15
1963	48	12	11	6.6	7.3	14
1964	53	10	11	4.8	7.2	14
1965	51.1	10.9	11.4	5.1	7.1	14.4

Based on a known return of 706 hatchery fish, it is estimated that 1,777 or 35.5 percent of the stocked fish were returned to the creel. This percent compares closely with the first-year return of hatchery rainbows planted in 1958, 1959 and 1960 (Table 3). No hatchery fish were checked through the upper station in 1965. Table 3 also summarizes the estimated number of fishermen, hours fished, fish harvested and number of hatchery fish stocked since 1958.

Table 3. Estimated number of fishermen, hours fished, and fish harvested, number of hatchery fish planted and their percent return from Rock Creek, 1958-1965. 1/

Year	Fishermen	Hours	Fish	No. hatch. fish stocked Sec. 1	Sec. 2	% return (1st year) of hatchery fish
1958	14,800	55,300	50,300	21,795	16,400	34.3
1959	14,920	48,894	45,809	14,330	12,435	39.3
1960	14,563	49,104	45,537	19,917	8,955	40.1
1961	11,278	33,367	25,144	none	none	-
1962	12,399	36,450	25,457	none	none	-
1963	10,110	32,178	20,665	none	none	-
1964	9,258	34,887	21,637	none	none	-
1965	9,961	35,174	23,439	5,000	none	35.5

1/1960-1962 figures are revised data and differ from those found in completion reports for those years. See explanation in F-27-R-4 completion report (pg. 7) covering period July 1, 1962 - June 30, 1963.

The estimates of harvest in numbers of fish, pressure in man-hours and man-days are found in Appendix B. Confidence limits at the 95 percent level have been applied to these estimates. Because fishing pressure at the Upper Station was extremely low after September 6, no estimate of pressure, hours, and harvest was made after that date, as it would not significantly affect the overall results.

Correlation coefficients (r) showing the relationship between cars counted by traffic counter and each of the other variables (fishermen, hours, fish) are also shown in Appendix B for each station.

Trends in catch per hour, catch per angler and average length of trip since 1958 are shown in Table 4.

Table 4. Average catch per hour and per trip, and the average length of trip for both stations of Rock Creek, 1958-1965.

Year	Catch per angler	Catch per hour	Average length of trip (hours)
1958	3.39	0.91	3.7
1959	3.07	0.94	3.5
1960	3.13	0.93	3.3
1961	2.23	0.75	2.9
1962	2.05	0.70	3.0
1963	2.04	0.64	3.2
1964	2.34	0.62	3.8
1965	2.35	0.67	3.5

The overall catch per man hour of 0.67 in 1965 was slightly higher than the CPMH of 0.62 in 1964. There was a decrease in average length of trip from 3.8 in 1964 to 3.5 in 1965. The increase in catch of fish per angler from 2.34 in 1964 to 2.35 in 1965 is probably not statistically significant.

The rate of catch of natural and hatchery rainbows, and other game fish from 1958 through 1965 is shown in Figure 1. The total catch per hour was increased by fish stocking. In fact, the total catch per hour in 1965 was increased over that of 1964 by an amount nearly equal to the increase in catch per hour of hatchery fish. In 1965 the catch per hour of natural rainbows was nearly equal to that of the other game fish combined. Very little change has occurred in this catch rate since 1958.

Age-growth analyses were made on Rock Creek fish collected by electro-fishing in 1960 and 1963. These data were collected to determine the age structure and growth rates of the base fish population in Rock Creek. All six species of game fish previously listed were taken in both years. The information on fish collected by electrofishing will be compared with data on fish in the anglers' catch. From this a comparison will be made between the age groups found most frequently in the creel and those most abundant in the stream population. Age-growth analyses of the fish taken by electro-fishing are given in Appendix C.

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Date March 1, 1967

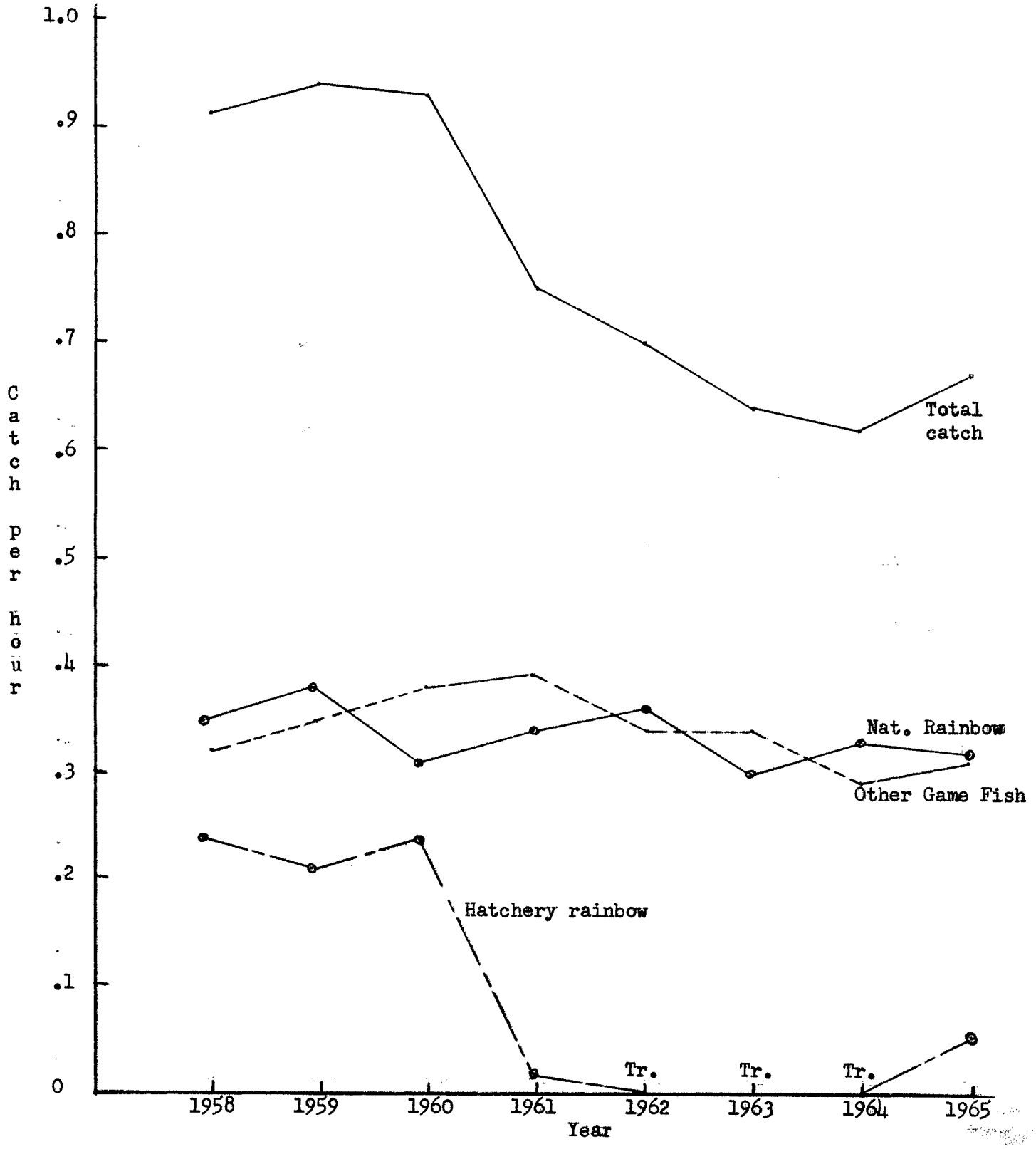

Figure 1. - Rate of catch in numbers of fish per man-hour for both sections of Rock Creek during the years 1958 through 1965.

Appendix A

Rock Creek creel census schedule - 1965
(Dates shown are census days)

Lower Station

May

- - - - - - - - - - -- -- -- -- -- -- -- -- -- -- -- -- -- -- 23 -- 25 -- 27 -- 29 -- 31

June

- 2 - 4 - 6 - 8 - 10 -- 12 -- 14 -- 16 17 -- -- 20 -- 22 -- -- 25 26 -- 28 -- --

July

1 - - 4 - 6 7 - 9 10 -- 12 13 -- -- 16 -- 18 -- -- 21 22 -- 24 -- 26 27 -- -- 30 --

August

1 2 - 4 5 6 7 - - 10 -- 12 -- -- 15 -- -- -- -- 20 21 -- 23 -- 25 -- -- -- 29 -- 31

September

1 2 3 4 - 6 - 8 9 -- -- 12 13 14 -- -- 17 18 -- -- 21 -- 23 -- -- 26 27 -- 29 --

October

- 2 - - - - - 8 - 10 -- -- 13 -- -- 16 -- -- 19 -- -- -- -- 24 -- -- -- -- -- 30 --

November

- - - - - 6 7 - - -- 11 -- -- -- -- -- -- -- -- 20 21 -- -- -- -- -- -- -- -- --

Appendix A (continued)

Rock Creek creel census schedule - 1965
(Dates shown are census days)

Upper Station

May

- - - - - - - - - - -- -- -- -- -- -- -- -- -- -- -- -- -- -- 23 -- 25 -- 27 -- 29 -- 31

June

- 2 - 4 - 6 7 - - 10 -- 12 -- -- 15 -- 17 -- -- 20 -- -- 23 -- 25 26 -- 28 29 --

July

- 2 3 4 5 6 - - 9 10 -- 12 -- 14 15 -- -- 18 -- -- 21 -- 23 24 -- 26 27 -- 29 -- --

August

1 2 - 4 - - - - - - 10 -- 12 13 14 15 -- -- 18 -- 20 21 -- -- 24 -- 26 -- -- 29 30 --

September

- - - 4 5 6 - - - -- -- -- -- -- -- -- -- -- -- --

Appendix B

Estimates of harvest, hours fished and angler trips with confidence intervals at the 95 percent level, for Rock Creek, Lower Station, 1965.[1/]

	Lower limit	Point estimate	Upper limit
Harvest:			
Regression estimate	7169	9277	11385
Known	10692	10692	10692
T o t a l	17861	19969	22077
Hours:			
Regression estimate	11182	14467	17752
Known	16423	16423	16423
T o t a l	27605	30890	34175
Anglers (man-days):			
Regression estimate	3259	4216	6130
Known	4728	4728	4728
T o t a l	7987	8944	10858

1/Formula for calculation of confidence intervals:

1. $S_{\hat{y}} = \sqrt{s^2 + \frac{s^2}{n} + \frac{(\text{estimated total} - \bar{x})^2}{n}}$

2. Upper and lower limits = $N \pm t_{.05} \times S_{\hat{y}}$

Where

$S_{\hat{y}}$ = predicted standard error

s^2 = variance for each variable (fishermen, hours, or fish) obtained from multiple regression analysis

n = number of days with known data (census days, exclusive of opening day.

(continued)

estimated total = total fishermen, hours, or fish estimated by car count for non-census days (obtained from regression analysis)

$\bar{x}$ = total mean daily number of fishermen, hours, or fish (obtained from regression analysis)

$\hat{N}$ = point estimate of each variable (obtained from sum of known and estimated data)

* * * * *

Correlation coefficient (r) showing the relationship between cars counted and each of the three other variables (fishermen, hours, fish) Rock Creek, Lower Station, 1965

	Cars
	r
Fishermen	.8745
Hours	.8242
Fish	.7990

Appendix B (continued)

Estimates of harvest, hours fished and angler trips with confidence intervals at the 95 per cent level for Rock Creek, Upper Station, for the period May 23 through September 6, 1965.[1]

	Lower limit	Point estimate	Upper limit
Harvest:			
Regression estimate	1289	1898	2507
Known	1572	1572	1572
T o t a l	2861	3470	4079
Hours:			
Regression estimate	1645	2421	3197
Known	1863	1863	1863
T o t a l	3508	4284	5060
Anglers (man-days):			
Regression estimate	391	575	759
Known	442	442	442
T o t a l	833	1017	1201

[1] Formulas for confidence interval calculation are same as for Lower Station.

* * * * *

Correlation coefficients (r) showing relationship between cars counted and each of the three other variables (fishermen, hours, fish) Rock Creek, Upper Station, May 23 through September 6, 1965.

	Cars
	r
Fishermen	.6889
Hours	.6008
Fish	.5930

Appendix C

Age-growth analyses of Rock Creek fish taken by electro-fishing, both sections combined, 1960 and 1963.

Species & Year	I	II	III	IV	V	VI	VII	VIII	IX
Rainbow									
1960	2.9(118)*	6.4(40)	10.2(17)	12.1(5)	14.8(3)				
1963	2.7(79)	5.8(31)	9.9(15)	13.8(6)	15.0(1)				
Cutthroat									
1960	2.9(29)	5.1(9)	10.6(1)						
1963	3.0(12)	5.0(8)	7.6(2)						
Dolly Varden									
1960	3.1(23)	6.2(23)	9.0(16)						
1963	4.2(11)	6.4(11)	8.6(1)	14.1(1)					
Brown trout									
1960	5.1(1)	8.6(1)	14.1(1)						
1963	3.1(4)	5.9(3)	9.3(2)	12.0(2)	14.8(1)				
E. Brook									
1960	3.6(10)	6.1(6)							
1963	3.4(9)	6.6(1)							
Whitefish									
1960	2.8(377)	6.2(209)	8.8(168)	10.6(94)	12.4(49)	13.5(28)	13.9(16)	16.7(3)	17.4(1)
1963	2.6(93)	5.8(72)	8.3(45)	10.2(42)	11.8(32)	13.0(21)	15.3(10)	15.8(8)	17.1(2)

*Figures in parentheses are the sample size