

MONTANA STATE DEPARTMENT OF FISH AND GAME  
FEDERAL AID IN FISH RESTORATION SECTION  
HELENA, MONTANA

JOB COMPLETION REPORT  
INVESTIGATIONS PROJECTS

State of Montana

Project No. F-12-R-1

Job No. I

Title of Job: Cataloging the Waters of the Project Area:  
Bitterroot Drainage Electric Fish Census

Abstract:

Six streams, five closed and one open to fishing, were inventoried in the fall of 1952. Three of these streams were opened to fishing in 1953 and 1954, and the same sections of the same six streams were re-inventoried in the fall of 1954.

A general decline in fish taken was noted from 1952 to 1954 on all but the one stream which had been open to fishing prior to 1952. This general decline is attributed to the fact that the 1954 inventory was at a later date than the 1952. There was a somewhat greater decline in fish taken from the three opened streams than from the two which had remained closed, and this was more apparent by weights of fish than by numbers.

The T test for significance of the difference between two means was applied to the data and it was found that by numbers, differences as great or greater than those observed could be expected to occur over 50 percent of the time, while by weights this could be expected only 5 to 10 percent of the time.

Other factors than fishing pressure could have affected these differences; however even if it is assumed that the weight difference was due to fishing pressure, there is no basis for retaining the closed streams as a management measure. Cutthroat and Dolly Varden trout were present in all six streams at both inventories, and in the unfished streams they are adding nothing to the fishing of the area.

Because further information is desirable on both the populations in fished and unfished streams, and also on the general decline in fish noted with time of sampling, it is recommended that the two closed streams remain closed this next year; and that all six streams be re-inventoried in 1955 at the same time of year as the 1952 sampling and, if time permits, again in 1955 at the same time as the 1954 sampling.

It is further recommended that when time and funds permit, a project be experimentally designed to reduce the limitations of these data, and to show the true effect of fishing pressure on cutthroat populations in these or other streams.

### Objectives:

To catalog the waters of the project area from the standpoint of physical and chemical characteristics and from the standpoint of fish response to the environment. Specifically in this case, the original objective was to obtain population samples from several closed streams in order to help evaluate the worth of these closed streams in the fishery management of the Bitterroot drainage. The later objective in resampling was to try to determine the effect of fishing on the fish populations of three streams in this drainage.

### Techniques Used:

On September 26, 27, and 29, 1952, six streams were sampled in the upper Bitterroot drainage. Of these, five were closed to fishing and one was open. One 300-foot section was chosen on each stream for accessibility. Each section was blocked with nets, and fish were collected with a 220 volt AC shocking device. Fish collected were counted, weighed, and measured. Scale samples were taken from trout and sent to the Department's fishery laboratory for age and growth analysis. Three of the five closed streams were opened to fishing in 1953 and 1954 while two of them remained closed.

On October 13, 14, and 27, 1954, the same 300-foot sections of these six streams were again sampled by the same method. The project leader from the northwest district, who did the 1952 shocking, assisted in the 1954 shocking to insure locating the same sections as before. The fish collected from the four streams sampled on October 13 and 14 were treated in the same manner as those collected in 1952. The ones taken from the two streams sampled on October 27 were counted, measured, and scale sampled, but were not weighed.

### Findings:

Table No. 1 shows names and locations of streams sampled, and the 1952 and 1954 catches by numbers and species. Table No. 2 gives the 1952 and 1954 catches by weights for the streams on which weights were taken both years. It is readily apparent from an examination of this information that, with one exception, the total catch declined in both the opened and closed streams. The exception is Skalkaho Creek, which was open to fishing prior to 1952 and has remained open. The only explanation that can be offered for this general decline is that the streams were inventoried later in the season in 1954 than in 1952. During the 1954 sampling, water temperatures ranged from 41 to 32°F. with most of the streams around the lower figure. Some ice was forming on exposed boulders and along the edges of the streams. Unfortunately, temperatures were not taken during the 1952 inventory; but it is probable, from the fact that this sampling was done from two weeks to one month earlier, that they were considerably higher. It is possible that a general winter decline, as noted in brown and rainbow trout by Stefanich (1952) on Prickley Pear Creek, had already started on these streams at the time of the 1954 sampling.

It can be noted from consideration of the weight data of Table No. 2, that although there was a decline in catch on all streams which had been opened to fishing than those on which had not. The same is true to a lesser degree in Table No. 1, although not so apparent from preliminary consideration of the data by numbers of fish. Tables No. 3 and 4 show this decline as percent drop from the 1952 figures, by numbers and weights respectively. The mean expressed here is the actual mean of the various percent drops (unweighed), and not the percent of total drop (weighed).

Table 1.  
Streams, Locations, and Catch by Numbers and Species,  
1952 and 1954 Shocking

(Hughes, Moose, and South Fork Skalkaho were closed through 1952 and opened in 1953 and 1954. Meadow, and West Fork Bitterroot have remained closed through 1954. Skalkaho Creek was opened before 1952 and remained open.)

Location	Species	Numbers of Fish Caught	
		1952	1954
Hughes Creek T3S, R21W, S2; Ravalli County	Cutthroat	61	17
	Dolly Varden	0	1
	Eastern Brook	1	1
	Whitefish	<u>27</u>	<u>13</u>
	Total	89	32
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Moose Creek T2N, R17W, S16; Ravalli County	Cutthroat	26	12
	Dolly Varden	<u>25</u>	<u>9</u>
	Total	51	21
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South Fork Skalkaho T5N, R18W, S29; Ravalli County	Cutthroat	31	17
	Dolly Varden	<u>9</u>	<u>10</u>
	Total	40	27
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Meadow Creek T2N, R18W, S35; Ravalli County	Cutthroat	72	50
	Dolly Varden	<u>48</u>	<u>47</u>
	Total	120	97
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West Fork Bitterroot T3S, R21W, S10; Ravalli County	Cutthroat	78	22
	Dolly Varden	17	4
	Eastern Brook	12	9
	Whitefish	12	9
	Suckers	<u>16</u>	<u>0</u>
	Total	135	44
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Skalkaho Creek T5N, R19W, S27; Ravalli County	Cutthroat	13	12
	Dolly Varden	6	9
	Rainbow	<u>2</u>	<u>1</u>
	Total	21	22

Table 2.  
Streams, Locations and Catch by/Weights, 1952 and 1954 Shocking.

(Hughes and Moose were closed through 1952 and opened in 1953 and 1954. Meadow and West Fork Bitterroot were closed prior to 1952 and have remained closed.)

Location	Species	Weights of Fish Caught	
		1952	1954
Hughes Creek T3S, R21W, S2; Ravalli County	Cutthroat	6.87	1.55
	Dolly Varden	0.00	0.06
	Eastern Brook	0.36	0.03
	Whitefish	<u>3.95</u>	<u>1.89</u>
	Total	11.18	3.53
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Moose Creek T2N, R17W, S16; Ravalli County	Cutthroat	3.39	1.32
	Dolly Varden	<u>0.89</u>	<u>0.29</u>
	Total	4.28	1.61
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Meadow Creek T2N, R18W, S35; Ravalli County	Cutthroat	8.90	6.14
	Dolly Varden	<u>1.88</u>	<u>1.27</u>
	Total	10.78	7.41
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West Fork Bitterroot T3S, R21W, S10; Ravalli County	Cutthroat	11.67	6.57
	Dolly Varden	2.24	0.92
	Eastern Brook	1.16	0.36
	Whitefish	0.35	1.62
	Suckers	<u>2.11</u>	<u>0.00</u>
	Total	17.51	9.47

Table 3.  
Percent Decline in Numbers of Fish Caught, 1952 to 1954

$$\text{Percent Decline} = \frac{1952 \text{ Catch} - 1954 \text{ Catch}}{1952 \text{ Catch}}$$

Stream	All Fish	CT and DV	CT Only
<u>Fished Streams</u>			
Hughes	64.0	70.4	72.1
Moose	58.8	58.8	53.8
S. Fk. Skalkaho	32.5	32.5	45.2
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Mean	51.8	53.9	57.0
Weighed Mean	55.6	56.6	61.0
<u>Unfished Streams</u>			
Meadow	19.2	19.2	30.6
W. Fk. Bitterroot	67.4	72.6	71.8
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Mean	43.3	45.9	51.2
Weighed Mean	44.7	42.8	52.0

Table 4.  
Percent Decline in Weights of Fish Caught, 1952 to 1954

$$\text{Percent Decline} = \frac{1952 \text{ Catch} - 1954 \text{ Catch}}{1952 \text{ Catch}}$$

Stream	All Fish	CT and DV	CT Only
<u>Fished Streams</u>			
Hughes	68.4	76.6	77.4
Moose	62.4	62.4	61.0
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Mean	65.4	69.5	69.2
Weighed Mean	66.8	71.1	72.0
<u>Unfished Streams</u>			
Meadow	31.3	31.3	31.0
W. Fk. Bitterroot	45.9	46.2	43.7
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Mean	38.6	38.8	37.4
Weighed Mean	40.3	39.7	38.2

While it is not customary to average percentages, in this case the T test for significance of the difference between two means was applied, which uses the differences of each variant from the group mean; and it was felt that the unweighed mean would give a better application to this formula than would the weighed one. The percent difference of the total decline (weighed mean) is also given on these tables for comparison. This T test<sup>1/</sup> was applied to the following groupings of the data: All fish, numbers and weight; cutthroat and Dolly Varden, numbers and weight; and cutthroat only, numbers and weight. The values of T with their approximate probability levels are given on Table 5.

#### Recommendations:

From consideration of the probability levels on Table 5, it can be seen that by numbers, the actual difference in means could be expected to be exceeded over 50 percent of the time due to sampling error. Therefore, the somewhat greater percent drop in numbers of fish in the streams which were opened to fishing, over that on the streams which remained closed, is not indicative of any greater drop in population in the opened streams than in the closed ones. However, there is a high probability (90-95 percent) that the greater drop in weight on the opened streams than on the closed ones is indicative of a difference in population drop on these streams. It cannot be said that this is due solely to fishing pressure however, because the original sampling was not set up with statistical analysis in mind, and there are other differences than fishing pressure that may have had an effect on the populations sampled in the various streams. For example: Sections were not randomly selected; only one section was chosen on each stream; some of the streams appear to have different populations than others; the two streams with the highest original populations were retained as closed streams; and the two inventories were not made at the same time of year. However, these limitations of the data do not invalidate them for the purpose of the original inventory, which was merely to obtain population samples from closed and opened streams in order to demonstrate the relative value of retaining closed waters in this area. Consideration of these data certainly shows that the game fish populations were not completely removed in the opened streams; and even if we assume that the greater weight reduction on the two opened streams than on the two closed ones was due to fishing pressure, we still have no basis for keeping them closed. The feeder stream idea is not generally considered a valid management measure. Although fishing may have reduced the total weight of the population somewhat, the slightly higher weight populations in the closed streams are adding nothing to the fishing of the area, while the populations in the opened streams are. Therefore, from a management standpoint it should be recommended that the remaining closed waters be opened to fishing.

$$\frac{1}{\sqrt{\frac{\sum (X_1 - \bar{X}_1)^2 + \sum (X_2 - \bar{X}_2)^2}{n_1 + n_2}}} \times \frac{(\bar{X}_1 - \bar{X}_2)}{\sqrt{\frac{n_1 + n_2 + 2}{(n_1 + 1)(n_2 + 1)}}}$$

$X_1$  = Variants in first sample

$X_2$  = Variants in second sample

$\bar{X}_1$  = Mean of first sample

$\bar{X}_2$  = Mean of second sample

$n_1$  = degrees of freedom for sample 1

$n_2$  = degrees of freedom for sample 2

Table 5.  
T Values and Approximate Probability Levels for Differences  
in Mean Percent Decline in Catch, 1952 to 1954, of Fished and Unfished Streams

By Numbers of Fish (Three Fished and Two Unfished Streams)		
Species	T	Probability (Three Degrees of Freedom)
All Fish	0.3875	Greater than 50%
CT and DV	0.3250	Greater than 50%
CT Only	0.0811	Much Greater than 50%

By Weights of Fish (Two Fished and Two Unfished Streams)		
Species	T	Probability (Two Degrees of Freedom)
All Fish	3.3821	Between 5 and 10%
CT and DV	2.9847	Slightly more than 10%
CT Only	3.0671	Between 5 and 10%

The only limitation in these data which can be most easily eliminated is that of time of sampling. While the amount of effort that can be expended on this problem at present will not permit removal of all the present limitations in the data, it is felt that further comparison figures on these streams made at the same time of year would be desirable. This would be true both from the point of view of comparing fished and unfished streams, and also from the standpoint of gathering more data on the general drop in catch noted on both groups of streams with a later sampling date. Therefore, it is recommended that the two streams remain closed this next year, and that at the minimum, the same sections be sampled in 1955 at the same time of year as the 1952 inventories. Then, if time permits, that they be sampled again in 1955 at the same time as the 1954 inventory.

Because it is suspected that the cutthroat trout is a more gullible fish than other trout and therefore, fishing pressure may have a greater effect on this species, it would be well to design a series of inventories to show this effect. It is therefore recommended that, when time and funds permit, statistical counsel be obtained for experimental design of a project on these, or other streams to show the effect of fishing pressure on cutthroat populations.

#### Summary:

1. One section each on six streams tributary to the upper Bitterroot River (One open and five closed to fishing) was inventoried by the electric shock method in September, 1952. Three of the closed streams were opened to fishing in 1953 and 1954 and the same sections of these six streams were re-inventoried by the same method in October, 1954.

2. A general decline in fish taken was noted from 1952 to 1954 on all but the one stream which had been open to fishing before 1952. This general decline was tentatively attributed to the later sampling date in 1954. There was a somewhat greater decline in fish taken from the three opened streams than from the two which had remained closed, and this was more apparent by weights of fish than by numbers.

3. This decline is expressed as percent drop and calculated by dividing the 1952 catch by the difference between it and the 1954 catch. This was computed by weights and numbers for the following data groupings: all fish, cutthroat and Dolly Varden, and cutthroat only. There was overlap in range between the percent declines in the opened streams and closed streams by numbers, but not by weight.

4. The T test for significance of the difference between two means was applied to the average percent declines of the opened as compared to the closed streams. It was found that by numbers, differences as great or greater than those observed could be expected to occur over 50 percent of the time due to errors of sampling. On the other hand, by weights this could be expected only 5 to 10 percent of the time.

5. It cannot be said that this high probability for differences in weights is due solely to fishing pressure because of the facts that sections were not randomly selected; only one section was chosen on each stream; some of the streams appear to have different species in their populations; the streams with the highest original populations were retained as closed streams; and the surveys were not made at exactly the same time of year.

6. Even if it is assumed that there is a weight difference due to fishing pressure in the populations of these streams, there is no basis for retaining the closed streams as a management measure. Cutthroat and Dolly Varden were present in all six streams at both inventories, and in the unfished streams they are adding nothing to the fishing of the area.

7. Because further information is desirable both on the populations in fished and unfished streams, and also on the general decline in fish noted with time of sampling, it is recommended that the two closed streams remain closed this next year, and that all six streams be re-inventoried in 1955 at the same time of year as the 1952 sampling, and if time permits again in 1955 at the same time as the 1954 sampling.

8. It is further recommended that when time and funds permit, a project be experimentally designed to reduce the limitations of these data and to show better the true effect of fishing pressure on cutthroat populations in these or other streams.

#### Data and Reports:

The original data and reports are with the project leader at Missoula. Duplicate file cards of the survey information taken will be filed in the Helena office.

#### Literature Cited:

Stefanich, Frank A.

1952. The population and movement of fish in Prickley Pear Creek, Montana. Trans. Am. Fish. Soc., Vol. 81 (1951), pp. 260-274.

Prepared by A. N. Whitney Approved by \_\_\_\_\_

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