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-3

Name Western Montana Fishery Study

Job No. II

Title Comparisons of Fish Populations of Six Clearwater Lakes

Period Covered October 1, 1956 to March 30, 1957

Abstract:

The six main Clearwater Lakes were netted simultaneously by six survey crews on June 17-22, 1956. Each crew followed the same daily schedule, and net sets were made at the same locations in each lake at which they were made in 1955. All fish captured were weighed, measured and recorded. Scale samples were taken only from species for which additions to the 1955 collections were necessary.

The average catch per net set was computed for each species in each lake. The 1955 and 1956 samples are compared by these average catches and their fiducial limits at the 95% confidence level. A significant increase in catch is indicated for both species of suckers, for yellow perch and for pumpkinseed sunfish on several lakes. A significant decrease in catch is indicated for Columbia River chub on two lakes. Two possible reasons are proposed for these changes. These are: an increase or decrease in fish numbers, or a change in fish activity with a later sampling date in 1956.

No significant changes between the two samples are indicated for cutthroat trout, and it is recommended that these two years' data be used as a basis for future evaluation of cutthroat management measures on these lakes. It is further recommended that this job be repeated in 1957 and in 1958, and that the evaluation of the management measures in 1958-59 be based on the comparison of the four years' data.

Objectives:

The object of this job was to obtain comparative netting data on the six main Clear-water lakes for a second year. The objectives of the first netting job were to obtain the best possible figures on the present fish populations of these lakes, ---as a basis for the evaluation in the future of management measures which vary from lake to lake, but which remain the same from year to year. The advantage of the two consecutive years' date lies in having a comparison of the change in catch between two seasons' samplings with a minimum of change in the fish populations. Or, stated in a different manner, two consecutive years' data were to be used to determine if this sampling technique would provide data which would be useable for the future evaluation of certain management measures.

Techniques Used:

Three standard experimental gill nets (one 250 feet and two 125 feet long) were set overnight in Placid Lake on June 13-14 and in Seeley Lake on June 14-15. In each lake

the 250 foot net was set deep (over 70 feet) and the two 125 foot nets were set shallow (less than 25 feet). All fish captured were recorded, weighed and measured. Chubs and squawfish were checked for gonad condition and scale sampled for use in the life history study of these species. The result of this preliminary netting is shown on Table 1. It is apparent that at the time of year these samples were taken, the shallow water sets captured more fish of the same species than did the deep water sets. Therefore, the crews on the regular netting were instructed to make shallow water sets only.

On June 17, six two-man crews assembled in the Seeley Lake area with netting equipment, and the first net sets were made before dark. Nets were lifted and re-set on June 18, 19, 20 and 21, and were lifted and removed on June 22. Pertinent data on each set was recorded on Montana's standard netting forms. Each crew was furnished with a map of its respective lake, upon which the locations of the 1955 net sets had been marked. In 1956, each individual net set was made at the location shown for that particular set in 1955. Exactly the same personnel who worked on the 1955 netting job could not be obtained for the 1956 sampling. However, in 1956 the crew for each Lake was composed of at least one of the individuals who had worked on that particular lake in 1955. All nets used were 125 foot nylon experimental gill nets, which consist of five equal sections of one and one-half, two, two and one-half, three and four inch stretch measure mesh. The following number of nets were used in each lake: Salmon - 4, Seeley - 5, Placid - 5, Inez - 4, Alva - 4, and Rainy - 2.

The following daily schedule was used by all crews: Nets were lifted, all fish were worked, nets were mended when necessary and nets were re-set. All fish captured were weighed, measured and recorded. Because approximately 50 scale samples had been collected for each species taken during the 1955 netting, no attempt was made to repeat the collections for all species in 1956. Scale samples were taken in 1956 from the following three categories of fish: (1) from most of the squawfish and Columbia River chubs, for use in the life history studies of these species; (2) from species whose 1955 scale samples totaled less than 50 individuals, up to a total of 50 samples for both years; (3) from size groups of various species, which were short or missing in the 1955 collections. Before this netting project started, the project leader reviewed the 1955 scale sample collections and compiled a list of the sizes and species of fish from which samples would be required in 1956. Each crew was furnished one of these lists for their respective lake before the start of the 1956 collections.

Findings:

Following is a list of abbreviations used on the tables in this report, common names and scientific names of the species of fish taken during the netting project:

Abbreviation	Common Name	Scientific Name
CT	Cutthroat trout	Salmo clarkii
EB	Eastern brook trout	Salvelinus fontinalis
RB	Rainbow trout	Salmo gardnerii
DV	Dolly Varden trout	Salvelinus malma
LL	Brown trout	Salmo trutta
KOK	Kokanee	Oncorhynchus nerka
WF	Mountain whitefish	Prosopium williamsoni
SQ	Squawfish	Ptychocheilus oregonensis
CRC	Columbia River chub	Mylocheilus caurinus
FSu	Fine-scaled sucker	Catostomus catostomus
CSu	Coarse-scaled sucker	Catostomus macrocheilus
YP	Yellow perch	Perca flavescens
PS	Pumpkinseed sunfish	Lepomis gibbosus
RSh	Red-sided shiner	Richardsonius balteatus
LMB	Largemouth bass	Micropterus salmoides

The age and rate of growth analysis has not been completed for scale samples taken n 1956. Therefore, no revisions in the previous age and growth data can be made. Because these data were presented in detail in the report on the 1955 netting job, they are not repeated here.

The total number of 125-foot overnight net sets made in each lake and the total catches by numbers of species are shown for each lake in Table 2. This same information is repeated from the report on the 1955 sampling in Table 3. Note from these two tables, that while the total effort (number of net sets) was increased by only 10% from 1955 to 1956, the total number of fish captured in 1956 was 50% greater than in 1955. Although this change in total catch appears quite large, the results of the statistical analysis of the individual net catches by species show that, at the 95% confidence level, these changes are indicative of an actual change in catch rates in only a very few cases.

Table 4 shows the average catch per net set, for both years' samples, of the 9 species which were most numerous in both collections. This figure was computed by dividing the total catch of one species in one lake by the total number of net sets made in that particular lake. No allowance was made for slight variations in the total hours' duration between sets. These differences were slight as all sets followed the same general daily schedule of lifting and re-setting. Therefore, it was only during the fairly unproductive mid-day hours that any of the nets were not fished. This average catch per net set has been referred to by various other workers, both as catch per net night and also as gill net ratio, although gill net ratio has also been used to describe a catch figure based on hours rather than days. In order to avoid excessive repetition of words, the average catch figures will hereafter be referred to in this report simply as ratio.

Table 4 also gives the fiducial intervals of these ratios at the 95% confidence level. These were computed by the procedure described on page 64, Snedecore, 1946. Table 5 shows a summarization of the significance of these changes in ratio from 1955 to 1956. The observed ratio for each year was compared to the fiducial interval of the other years's ratio. If neither of the observed ratios fell within the limits to which they were compared, then the change in ratio was regarded as significant and was recorded as either + for an increase or - for a decrease. If either or both of the two ratios fell within the limits to which they were compared, then the change was regarded as not significant and was recorded as o.

The significant increases in ratios from 1955 to 1956 are limited chiefly to the two species of suckers, the perch and the sunfish, while the significant decreases are limited primarily to the chubs. Note that except for dolly varden, although a significant change in ratio is not constant for any one species in all the lakes, any species that shows a significant change in one or more lakes shows no significant change in the opposite direction in any other lake.

Gill nets are passive fishing gear, which depend for their catch, both upon numbers of fish present and upon the movement of those fish. Therefore, two possible reasons must be considered for the significant increases in the catch ratios of the suckers, perch and sunfish. First, they could be due to an actual increase in numbers of these species in their respective lakes, (i.e. strong year classes of fish just becoming available to our sampling gear). Second, they could be due to warmer temperatures during the 1956 netting period causing greater activity among these fish than occurred during the 1955 sampling period. The 1955 sampling took place from June 5-10, and the 1956 sampling from June 17-21. These same two reasons (change in fish numbers or change in fish activity) may also be considered for the significant decrease in the Columbia River chub ratios in Seeley and Placid Lakes. These changes could be due to an actual decrease in number of chubs available to our sampling gear in these two lakes. They could also be due to a decrease in activity of chubs in the lakes. Although a decrease in activity with a later spring sampling date may sound odd at first, there is a possibility that it occurred in this case. Of 37 adult female chubs examined from the 1956 catch on Placid Lake, 26 were

spent and 1 was ripe. Records of the famale chub gonad condition were not taken from the 1955 catch. However, with the 1955 sampling occurring one week earlier than the 1956 sampling, it is quite possible that the first year chub samples were taken during the main spawning period of these fish. This could account for their higher catch ratios in 1955 than in 1956 on Placid and Seeley lakes.

If increased or decreased activity of the fish, due to time of sampling, is the correct reason for the significant changes in catch ratio, then the question arises of why the same significant changes did not occur for any one species on all the lakes. No definite reason can be given for this, however, it is well to remember that by showing no significant change in ratios, the statistical analysis used here does not mean difinitely that no change has taken place. What the analysis does mean in these cases, is that any changes that have occurred cannot be reliably shown by our sampling technique. With this in mind, note that the gill net ratio rose (significantly in eight case and not significantly in the other seven) for coarse-scaled suckers, yellow perch and pumpkinseed sunfish in all the lakes where these species were taken.

On the other hand, the Columbia River chub ratio did not fall on all lakes. As mentioned above, the only significant change was the ratio's drop on Seeley and Placid lakes. It also dropped on Salmon Lake, but it rose on Inez, Alva and Rainy lakes. Although these latter changes are not significant and therefore need no justification, the following explanation can be considered. The three lakes in which the chub catch rose are uppermost in the drainage. Chub spawning appears to be a short duration. It is possible that during the 1955 netting the chubs were spawning on the lower threelakes and not on the upper three; and that during the 1956 netting they had completed spawning on the lower lakes and were engaged in spawning on the upper ones.

No explanations can be given for the dolly varden's significant changes in ratio on Placid and Inez, nor for the significant change in whitefish ratios from Alva. It must be remembered that at the 95% confidence level at which these ratios are compared, there will be approximately 5 times out of 100 that variations greater than these may occur through chance. With 106 individual samples represented on Table 2, it is to be expected a few of the differences shown to be significant, may actually be due to sampling error.

As the main purpose of this job was to obtain population indices, which will be used to evaluate various types of cutthroat trout management on these lakes, it is well to note that no significant changes in ratio were shown for this species.

Recommendations:

The catch ratios which have been obtained by this job and its last year's counterpart have shown no significant changes for cutthroat trout between two consecutive years' samples. Therefore, it is recommended that these ratios be used as a basis for the future evaluation of the cutthroat trout management measures which are now in use on some of the Clearwater lakes.

In some cases, these catch ratios have shown significant variation between the two consecutive years' samples for certain species of fish other than cutthroat. However, most of these changes may be plausibly justified by our knowledge of fish activity related to time of sampling. In order to gain more information concerning these significant changes in ratios and the validity of our proposed reasons for their occurrance, it is recommended that this netting job be repeated yearly until the success or failure of the various present cutthroat trout management practices are indicated.

A total of four years from the inception of the present management practices should be a sufficient length of time for any particular type of management to affect the cutthroat trout catch ratio, provided that any of the measures which are now in use are effective. As the present management program (the one of varied degrees and types of effort on different lakes) was started partially in 1954 and completely in 1955, it is recommended that this job be repeated in the 1957 and 1958 seasons. It is also recommended that, in 1958-59, the entire four years' data be given statistical treatment similar to that given the two previous years' data in this report.

This analysis will then indicate the presence or absence of a true change in catch rate of cutthroat trout on each of the six lakes during the four years of sample. The continuation of any of the special management practices should then depend upon the relationship of this change on each of the lakes receiving special effort to the change on the lake receiving no special effort.

The following recommendations are made for the 1957 sampling:

1. The sampling should be scheduled for roughly the same time of year that the two previous years' samples were made.

2. Preliminary netting, to determine if deep water sets should be used in the regular sampling program, need not be repeated this year.

3. Individual net sets should be made at the same locations at which they were made in 1955 and 1956.

4. Maximum-minimum thermometer stations should be established in several of the lake outlets by mid-May. Readings should be recorded from these every two days until the netting job is completed.

5. Scale samples need be taken only from those species upon which a special life history study is being made, or from those species for which additional samples are required for better growth rate analysis of present collections.

Summary:

1. A comparison of deep to shallow water sets made in two of the Clearwater lakes just prior to the regular netting schedule showed that shallow water sets captured more fish of the same kinds than did deep water sets. Therefore, shallow sets only were used in the regular netting schedule. From June 17-22, six two-man crews made five overnight sets in the six main Clearwater lakes. The following number of 125 foot nylon experimental gill nets were used in each lake: Salmon - 4, Seeley - 5, Placid - 5, Inez - 4, Alva - 4, and Rainy - 2. Maps showing the locations of the 1955 net sets were furnished to each crew and each individual net set was made at the location shown for that set in 1955. The crew on each lake was composed of at least one individual who had worked on that particular lake in 1955.

2. All fish captured were weighed, measured and recorded. Scale samples were taken in general only from the squawfish and Columbia River chub and from other species only where additional samples were required to fill out the 1955 collections. Scale analysis has not been completed for this year, consequently, the revision of the 1955 age and growth data is not included in this report.

3. The total catch of all species by lakes and the total number of net sets made in each lake are shown in Table 2. For comparison, these data are also included from the 1955 sampling in Table 3. The average catch of fish per net set (catch ratio) for both years'

samples, by species and by lakes is given in Table 4 for the 9 species of fish which were most numerous in both years' catches. The fiducial intervals at the 95% confidence level of these catch ratios are also included in this table. The significance of the changes in ratio, which are shown on Table 4, are summarized on Table 5. They are shown here as a significant increase, a significant decrease, or no significant change.

4. Significant increases in ratio are shown chiefly for both species of suckers, for the yellow perch and for the pumpkinseed sunfish. These changes are believed to be due either to an increase in fish numbers, or to an increase in fish activity with a later sampling date in 1956. Significant decreases in ratio are limited primarily to the Columbia River chub on two lakes. It is believed that these could be due to the spawning period of these fish as related to the time of sampling.

5. Because no significant changes between the two years' sample were indicated for the cutthroat catch ratios, it is recommended that these data be used as a basis for future evaluation of different management practices in use on the various lakes.

6. In order to gain more information concerning the significant changes in catch ratio of some of the other species and the validity of our proposed reasons for their occurrance, it is recommended that this netting job be repeated yearly until the data required for the cutthroat trout management evaluation are obtained.

7. The cutthroat trout management practices mentioned above were initiated in 1954 and 1955. Four years' time should be sufficient to allow any effective management practice to affect the catch ratio of the cutthroat trout. Therefore, it is recommended that this job be repeated in 1957 and 1958.

8. It is also recommended that in 1958-59, the four years' data be given statistical treatment similar to that used on the data in this report. The evaluation of the management practice in use on any particular lake will then depend upon the relationship of the change in cutthroat trout catch ratio on that lake to the change in ratio on the lake receiving no special management effort.

9. The following recommendations are made for 1957 sampling:

   a. The netting should be scheduled for the first part of June.
   b. The preliminary netting should not be repeated this year.
   c. Net sets should be made at the same locations at which they were made in 1955 and 1956.
   d. Maximum-minimum thermometer stations should be established in several of the lake outlets by mid-May.
   e. Scale samples should be taken only from those fish for which additional data is required for good age and growth analysis of present samples.

Data and Reports:

The original data and reports are with the project leader in Missoula. All field scale data, scale mounts and copies of the age and growth data are at the Department's fishery laboratory at Bozeman, Montana

Literature cited:

Snedecore, George W., 1946
Statistical methods. Iowa State College Press, Ames, Iowa. xvi, 485 pp.

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TABLE I

Comparison of Deep to Shallow Sets in Seeley and Placid Lakes
Preliminary Netting 1956

Lake	No. & Size of Nets	Depth of Set	CT	DV	KOK	EB	WF	SQ	CRC	FSu	CSu	YP	PS	TOTAL
PLACID	1 - 250'	70' - 70'	0	0	0	0	0	0	0	1	0	0	0	1
	2 - 125'	8' - 25' 6' - 12'	5	0	0	2	20	9	29	27	4	0	44	140
SEELEY	1 - 250'	100' - 100'	0	0	0	0	0	0	0	0	0	0	0	0
	2 - 125'	10' - 22' 10' - 20'	0	3	1	0	30	8	1	4	0	12	0	57

TABLE II

125-FOOT OVERNIGHT NET SETS
CLEARWATER LAKES, JUNE 17-22, 1956

TOTAL CATCHES BY NUMBERS OF SPECIES

Lake	No. of Sets	CT	EB	RB	DV	LL	KOK	WF	SQ	CRC	SQ X CRC	FSu	CSu	YP	PS	RSH	LMB	TOTAL
Salmon	20	4	0	1	3	2	2	81	164	71	0	96	86	760	15	0	1	1286
Seeley	25	19	0	0	30	0	1	148	174	71	0	92	101	415	59	0	2	1112
Placid	25	19	5	0	9	0	4	181	34	151	0	69	24	0	237	0	0	733
Inez	20	0	0	0	13	0	3	146	83	28	0	23	49	190	2	0	0	537
Alva	20	2	0	0	17	0	0	100	197	28	0	91	51	31	0	0	0	517
Rainy	10	5	0	0	12	0	0	106	52	49	1	45	27	56	0	1	0	354
TOTAL	120	49	5	1	84	2	10	762	704	398	1	416	338	1452	313	1	3	4539

TABLE III

125-FOOT OVERNIGHT NET SETS
CLEARWATER LAKES, JUNE 5-10, 1955

TOTAL CATCHES BY NUMBERS OF SPECIES

Lake	No. of Sets	CT	EB	RB	CT x RB	DV	KOK	WF	SQ	CRC	FSu	CSu	YP	PS	RSh	LMB	Total
Salmon	20	1	0	0	0	7	0	52	170	110	56	49	323	5	2	0	775
Seeley	25	23	0	2	0	35	21	111	185	276	56	37	85	35	1	0	867
Placid	25	5	14	0	0	23	6	178	49	298	37	9	0	34	0	1	654
Inez	15	2	0	0	1	4	3	104	90	14	43	6	25	0	0	0	292
Alva	16	7	0	0	0	9	0	45	83	12	35	8	4	0	0	0	203
Rainy	9	5	0	0	0	8	1	84	49	23	33	21	8	0	0	0	232
Total	110	43	14	2	1	86	31	574	626	733	260	130	445	74	3	1	3023

TABLE IV

Average Catch Per Net Set and Fiducial Intervals at the 95% Confidence Level

LAKE	YEAR	CT	DV	WF	SQ	CRC	FSu	CSu	YP	PS
SALMON	1955	0.1 (0.0-0.2)	0.4 (0.1-0.7)	2.6 (1.0-4.2)	8.5 (4.7-12.3)	5.5 (2.1-8.9)	2.8 (1.4-4.4)	2.5 (0.5-4.5)	16.2 (8.0-24.4)	0.3 (0.2-0.5)
	1956	0.2 (0.0-0.4)	0.2 (0.0-0.4)	4.1 (1.8-6.4)	8.2 (2.6-13.8)	3.6 (1.6-5.6)	4.8 (2.0-7.6)	4.3 (2.1-6.5)	38.0 (16.8-59.2)	0.8 (0.0-1.6)
SEELEY	1955	0.9 (0.5-1.3)	1.4 (0.7-2.1)	4.4 (2.8-6.0)	7.4 (5.6-9.2)	11.0 (8.2-13.8)	2.2 (1.3-3.1)	1.5 (0.9-2.1)	3.4 (1.7-5.1)	1.4 (0.5-2.3)
	1956	0.8 (0.2-1.4)	1.2 (0.6-1.8)	5.9 (3.4-8.4)	7.0 (6.1-7.9)	2.8 (1.4-4.2)	3.7 (2.7-4.7)	4.0 (3.3-4.7)	16.6 (8.8-24.4)	2.4 (1.8-3.0)
PLACID	1955	0.2 (0.0-0.4)	0.9 (0.6-2.2)	7.1 (5.0-9.4)	2.0 (1.3-2.7)	11.9 (7.2-16.6)	1.5 (0.6-2.4)	0.4 (0.9-2.1)	NONE	1.4 (0.4-2.4)
	1956	0.8 (0.2-1.4)	0.4 (0.2-0.6)	7.2 (5.2-9.2)	1.4 (0.4-2.4)	6.0 (2.5-9.5)	2.8 (0.5-5.1)	1.0 (0.4-1.6)	NONE	9.5 (2.9-16.1)
IMEZ	1955	0.1 (0.0-0.3)	0.3 (0.0-0.6)	6.9 (3.9-9.9)	6.0 (3.2-8.6)	0.9 (0.2-1.6)	2.9 (0.4-5.4)	0.4 (0.0-0.8)	1.7 (0.2-3.2)	NONE
	1956	NONE	0.7 (0.4-1.0)	7.3 (4.0-10.6)	4.2 (1.9-6.5)	1.4 (0.4-2.4)	1.2 (0.2-2.2)	2.5 (0.6-4.4)	9.5 (3.2-15.8)	0.1 (0.0-0.3)
ALVA	1955	0.4 (0.0-0.9)	0.6 (0.2-1.0)	2.8 (1.0-4.6)	5.2 (3.0-7.4)	0.8 (0.1-1.5)	2.2 (1.1-3.3)	0.5 (0.1-0.9)	0.3 (0.0-0.7)	NONE
	1956	0.1 (0.0-0.3)	0.9 (0.5-1.3)	5.0 (3.3-6.7)	9.9 (4.7-15.1)	1.4 (0.4-2.4)	4.6 (2.7-6.5)	2.6 (0.3-4.9)	1.6 (0.8-2.4)	NONE
RAINY	1955	0.6 (0.0-1.3)	0.9 (0.0-1.8)	9.3 (5.2-13.4)	5.4 (2.4-8.4)	2.6 (0.4-4.8)	3.7 (1.3-6.1)	2.3 (0.4-4.2)	0.9 (0.2-1.6)	NONE
	1956	0.5 (0.0-1.0)	1.2 (0.1-2.3)	10.6 (8.1-13.1)	5.2 (1.6-8.8)	4.9 (0.0-10.1)	4.5 (1.6-7.4)	2.7 (0.7-4.7)	5.6 (0.0-15.6)	NONE

TABLE NO. V

Direction of Significant Change in Average Catch per Net from 1955 to 1956 at the 95% Confidence Level. (+) = significant increase, (−) = significant decrease, (o) = no significant change, (*) = no fish taken in either year's sample.

LAKE	SPECIES								
	CT	DV	WF	SQ	CRC	FSu	CSu	YP	PS
SALMON	o	o	o	o	o	o	o	+	o
SEELEY	o	o	o	o	−	+	+	+	+
PLACID	o	−	o	o	−	o	o	*	+
INEZ	o	+	o	o	o	o	+	+	o
ALVA	o	o	+	o	o	+	o	+	*
RAINY	o	o	o	o	o	o	o	o	*