JOB COMPLETION REPORT

INVESTIGATIONS PROJECTS

State of Montana

Project No. F-5-R-1 Work Plan No. II Job No. II-A

Title of Job: North Fork Smith River Reservoir Study.

Objectives:

In order to effect or sustain proper management of waters from a fishery standpoint it is desireable to have as much information regarding the limnological conditions as can be collected without exceeding practical and economic bounds. The North Fork Smith River reservoir is considered typical of several man-made lakes within the project area which have imposed the problem of progressively decreasing fishing results. If, through investigation, the causes of the fishing success decline can be determined it may be possible to initiate management practices advantageous to the fishery.

During the past year periodic measurements of the lake have been collected and recorded. The annual fluctuation of the lake from the low level near the end of the 1951 irrigation season to the filled condition during the spring of 1952 is recorded here. It is planned to continue investigational work on this reservoir throughout 1952.

Techniques Used:

On August 1, 1951 a bench mark was established in order to provide a datum level from which to measure the fluctuation of the lake. The point which was selected as a bench mark was the top of a concrete-filled pipe located at the base of the upstream side of the flow gate, control house.

Construction history, and data relating to capacities and areas were obtained from "Water Resources Survey" published by State Engineer's Office, Helena, Montana, July, 1950.

Findings:

The North Fork Smith River reservoir provides storage for water for the North Fork Smith River irrigation project and supplies water, most of which is used for supplemental irrigation to 11,000 acres of land. Approximately sixty-eight square miles of the high timbered Little Belt Mountains and foot hills provides the drainage area for the reservoir.

Construction of the dam was started May 4, 1936 and accepted as complete on November 19, 1936. The reservoir has contained water since 1937. Water from it was used for irrigation that year. Prior to the spring of 1950 the reservoir had a capacity of 10,750 acre-feet, at that time flash boards were added to the spillway crest which has increased the capacity to 11,550 acre-feet. The flooded area of the reservoir to the elevation of the spillway crest covers 322 acres.

Table 1. Measurements and calculated vertical distances from a datum level to the level of the North Fork Smith River Reservoir, Meagher County, Montana.

Date	Measured Distance along slope from datum level	Calculated Vertical distance to lake level from B.M.	Calculated Vertical distance from Spillway Crest.
Aug. 1, 1951	59'	27'	20'
Aug. 26, 1951	87'	39'	32'
Sept. 18, 1951	92'	41'	34'
Nov. 8, 1951	76'	34'	27'
Nov. 23, 1951	73'	33'	26'
Jan. 13, 1952	66'	30'	23'
Mar. 8, 1952	56'	25'	18'
Apr. 14, 1952	42'	19'	12'
May 18, 1952	15' 6"	7'	0

During the fall and winter of 1951 and the spring of 1952 periodic measurements were made of the fluctuation of the lake. The data collected is contained in Table 1. The lowest level from spillway crest recorded during 1951 was thirty-four feet. This level was recorded on September 18, 1951. From that date on through the remainder of the fall and winter less water was allowed to flow out of the reservoir than was flowing in. The reservoir level continued to rise until the last of April or the first part of May when the spillway crest had been reached.

Analysis and Recommendations:

With equipment now available, limnological data can be gathered and analyzed. It is recommended that the study of the North Fork Smith River Reservoir be continued.

Summary:

Periodic measurements of the level of the North Fork Smith River reservoir were made during the fall and winter of 1951 and the spring of 1952. The reservoir was at its lowest level during the later part of September. It was completely filled during the first part of May.

Data and Reports:

The original data is with the project leader at Belt, Montana.

Prepared by Nels A. Thoreson Approved by

Date June 30, 1952

JOB COMPLETION REPORT

INVESTIGATIONS PROJECTS

State of Montana

Project No. F-5-R-1 Work Plan No. III Job No. III-A

Title of Job: Sheep Creek Fish Population Study.

Objectives:

In order to effect or sustain proper management of waters from a fishery standpoint it is desireable to have information regarding the existing fish population. The objective of this study was to determine the size of the Sheep Creek fish population along with its length, weight, age and species composition.

Techniques Used:

Sampling was done with an electric shocking device and each 300 foot section was blocked off with 1/2-inch, square mesh nets. All fish were weighed and measured and scale samples were taken from a high percentage of each species.

Because of diversity of size and accessibility the stream was divided into Upper and Lower Sheep Creek. The two divisions were further subdivided into one tenth of mile units and by random selection of numbers twenty-two sections were chosen to be sampled. From 7.6 highway miles on Upper Sheep Creek fifteen sections were selected. Fish populations were determined in eleven of the fifteen. From 3.0 road miles on Lower Sheep Creek six sections were chosen and four of the six were actually worked with the electric shocker. This makes a total of twenty-one sections chosen and fifteen actually worked out of 10.6 miles of road paralleling the stream.

Findings:

Sheep Creek, a tributary of Smith River, is approximately 35 miles long, originating above 7,000 feet of elevation on the south slope of Kings Hill in the Lewis and Clark National Forest of the Little Belt Mountains. Approximately thirteen miles of the upper end is paralleled by U.S. Highway 89. A portion of lower Sheep Creek is accessible by a single track forest road.

Considerable cutting of Lodgepole pine is in progress at the present time on the upper end of Sheep Creek. Greater removal is anticipated and the area of logging will probably be increased to include tributaries entering Lower Sheep Creek.

The average width of the sampling sections on Upper Sheep Creek was approximately 12 feet, the depth over this width in riffle areas ranging from 3 to 8 inches. Velocity was crudely calculated to be two feet per second. Stream widths on the Lower Sheep Creek sampling sections were from 25 to 40 feet with depths in riffle areas from 8 inches to one and one-half feet. Several holes were deeper than eight feet.

In the fifteen sections sampled four thousand five hundred feet of the stream were intensively covered with the electric shocking machine. No reliance can be placed on the numbers of fish smaller than three inches because of considerable loss through the barrier nets.

Seven hundred and sixty-six fish were found in the fifteen sections. Of these 350 were of legal size (7 inches and longer, total length). The number of each species of legal fish, the average length, weight and condition ($C = \frac{100,000W}{L3}$) for each section is shown in table 1.

Similar data is listed for the sublegal fish in table 2. There are 415 sublegal fish included, one sublegal brown trout was found but not included in the table.

Fifty-five per cent of the legal fish in the sampled sections were whitefish (figure 1). Two modes can be seen on the length frequency graph (figure 6), one in the 5.0-5.9 inch and the other in the 9.0-9.9 and 10.0-10.9 inch groups. They show the predominance of two distinct age groups in the whitefish population. The average condition of all whitefish was 34.2.

Eastern brook trout make up thirty-two per cent of the total game fish in the sublegal class as shown in figure 2. They make up twenty-two per cent of all species of game fish regardless of size (figure 3) but contribute only 10 per cent to the legal-sized population. The preponderance of small fish of this species can be seen in the length frequency chart (figure 4). The greatest number were in the 5.0-5.9 inch group. Each of the groups in the sublegal class contain more fish than any of the legal sized groups. Few brook trout were found over eight inches long. The average condition of all eastern brook trout was 39.5.

Little can be said regarding the resident rainbow trout population because of hatchery plants made just prior to the population survey. Section 15 (tables 1 and 2) contained mostly rainbow trout although no natural cover could be found here. It was later learned that this section is a common planting location because of accessibility and convenience due to a highway bridge. The average condition factor of all rainbow trout was 39.5.

The numbers of legal-sized fish were uniformly distributed throughout the areas which were sampled. Distribution of brook trout, rainbow trout and whitefish in the sampled sections are shown in figure 7. Sections one through three show practically no legal fish which is attributable to the fact that in these sections the water remains extremely cold much of the year and the volume is much reduced.

The peaks of the whitefish population (figure 7) in sections 7, 10, and 17 are due to large, deep holes in which this species were congregated. The high points in the rainbow population in sections 7, 12, 15, 16 and 21 are believed to be attributable to hatchery planting.

Table 1. Mean total lengths in inches, weights in pounds and calculated condition factor (C) of legal-sized (7 inches and longer) game fish in sampled sections of Sheep Creek, Meagher county, Montana, 1951.

Each Section 300 feet	Eastern Brook Trout				Rainbow Trout				Whitefish				Cutthroat				Hybrid (Rb.xCt.)			
	No.	Wt.	Lgth.	C	No.	Wt.	Lgth.	C	No.	Wt.	Lgth.	C	No.	Wt.	Lgth.	C	No.	Wt.	Lgth.	C
Section 1	1	.16	7.3	41.1	0	.00	0.00	00	0	0.0	0.0	0.0	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 2	1	.19	7.3	48.8	0	.00	0.0	00	0	0.0	0.0	0.0	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 3	0	.00	0.0	00.0	1	.27	8.5	43.9	2	.34	9.8	36.1	1	.15	7.9	30.4	0	.00	0.0	00.0
Section 5	5	.24	8.2	40.0	6	.22	7.9	43.4	4	.32	9.5	36.5	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 7	2	.30	8.4	44.0	11	.24	8.4	39.7	40	.41	10.4	34.9	0	.00	0.0	00.0	1	.15	7.4	37.0
Section 9	5	.20	7.8	40.7	6	.22	8.4	37.8	17	.27	9.1	35.5	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 10	1	.24	7.6	54.5	5	.21	8.3	35.3	26	.30	9.5	33.0	0	.00	0.0	00.0	1	.10	7.0	29.2
Section 12	9	.23	8.2	39.7	9	.43	9.5	39.3	18	.23	8.5	36.2	0	.00	0.0	00.0	2	.16	7.3	41.0
Section 13	3	.22	7.9	43.4	2	.26	8.6	38.8	10	.24	8.7	34.3	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 14	3	.33	9.1	40.1	11	.27	8.4	41.7	14	.37	10.0	36.2	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 15	1	.20	7.9	40.4	12	.28	8.7	39.5	6	.26	9.0	36.5	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 16	0	.00	0.0	00.0	24	.22	8.0	39.5	9	.55	11.2	37.9	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 17	4	.48	9.7	42.1	9	.24	8.4	38.0	25	.47	10.8	34.9	1	.18	8.0	35.0	0	.00	0.0	00.0
Section 19	0	.00	0.0	00.0	6	.19	7.8	38.4	6	.49	10.8	37.2	2	.14	7.5	32.6	1	.19	8.1	35.7
Section 21	0	.00	0.0	00.0	11	.19	7.9	37.5	16	.50	10.6	37.9	0	.00	0.0	00.0	0	.00	0.0	00.0
Total Number	35				113				193				4				5			
Mean (Wt.Lg.C)		.26	8.3	41.5		.25	8.3	39.3		.37	9.9	35.4		.15	7.7	32.6		.15	7.4	36.8

Table 2. Mean total lengths in inches, weights in pounds and calculated condition factor (C) of sub-legal sized (less than 7 inches) game fish in sampled sections of Sheep Creek, Meagher county, Montana, 1951.

300' Sections	Eastern Brook Trout				Rainbow				Whitefish				Cutthroat				Hybrid (RbxCt)			
	No.	Wt.	Lgth.	C	No.	Wt.	Lgth	C	No.	Wt.	Lgth	C	No.	Wt.	Lgth.	C	No.	Wt.	Lgth	C
Section 1	1	.03	3.8	54.4	0	.00	0.0	00.0	0	.00	0.0	00.0	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 2	12	.04	4.3	45.7	0	.00	0.0	00.0	0	.00	0.0	00.0	2	.07	5.6	37.1	0	.00	0.0	00.0
Section 3	6	.09	5.9	38.2	9	.02	3.6	32.3	0	.00	0.0	00.0	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 5	16	.06	5.2	39.1	5	.08	5.9	38.8	4	.05	4.8	38.7	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 7	24	.06	5.2	38.2	4	.08	5.8	42.8	6	.06	5.8	27.8	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 9	13	.06	5.4	35.6	11	.06	5.2	37.4	4	.05	5.2	36.6	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 10	18	.04	4.8	37.9	14	.06	5.4	36.2	20	.05	5.3	28.4	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 12	21	.06	5.2	39.3	21	.08	5.6	41.0	16	.06	5.8	31.2	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 13	1	.03	4.3	37.8	9	.10	6.3	42.0	24	.06	5.8	31.5	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 14	7	.07	5.7	36.4	16	.08	5.6	42.8	2	.08	6.1	32.9	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 15	2	.08	4.9	42.5	23	.06	4.8	42.9	4	.07	5.8	35.2	0	.00	0.0	00.0	0	.00	0.0	00.0
Section 16	6	.06	5.4	36.9	19	.08	5.7	38.9	2	.06	5.6	36.9	1	.06	5.6	34.1	2	.06	5.5	35.8
Section 17	4	.05	4.9	41.5	17	.07	5.4	39.6	9	.04	5.0	33.4	2	.08	6.0	37.0	0	.00	0.0	00.0
Section 19	1	.05	5.0	40.0	10	.06	5.4	36.6	1	.05	5.2	35.6	2	.06	5.4	34.7	6	.07	5.7	36.8
Section 21	1	.03	4.4	35.2	11	.09	6.1	38.9	3	.05	5.4	34.4	1	.09	6.1	39.5	2	.06	5.1	41.2
Total Number	133				169				95				8				10			
Mean (Wt.Lg.C)	.06		5.1	39.0	.07		5.4	39.6	.06		5.5	31.7	.07		5.7	36.4	.07		5.5	37.5

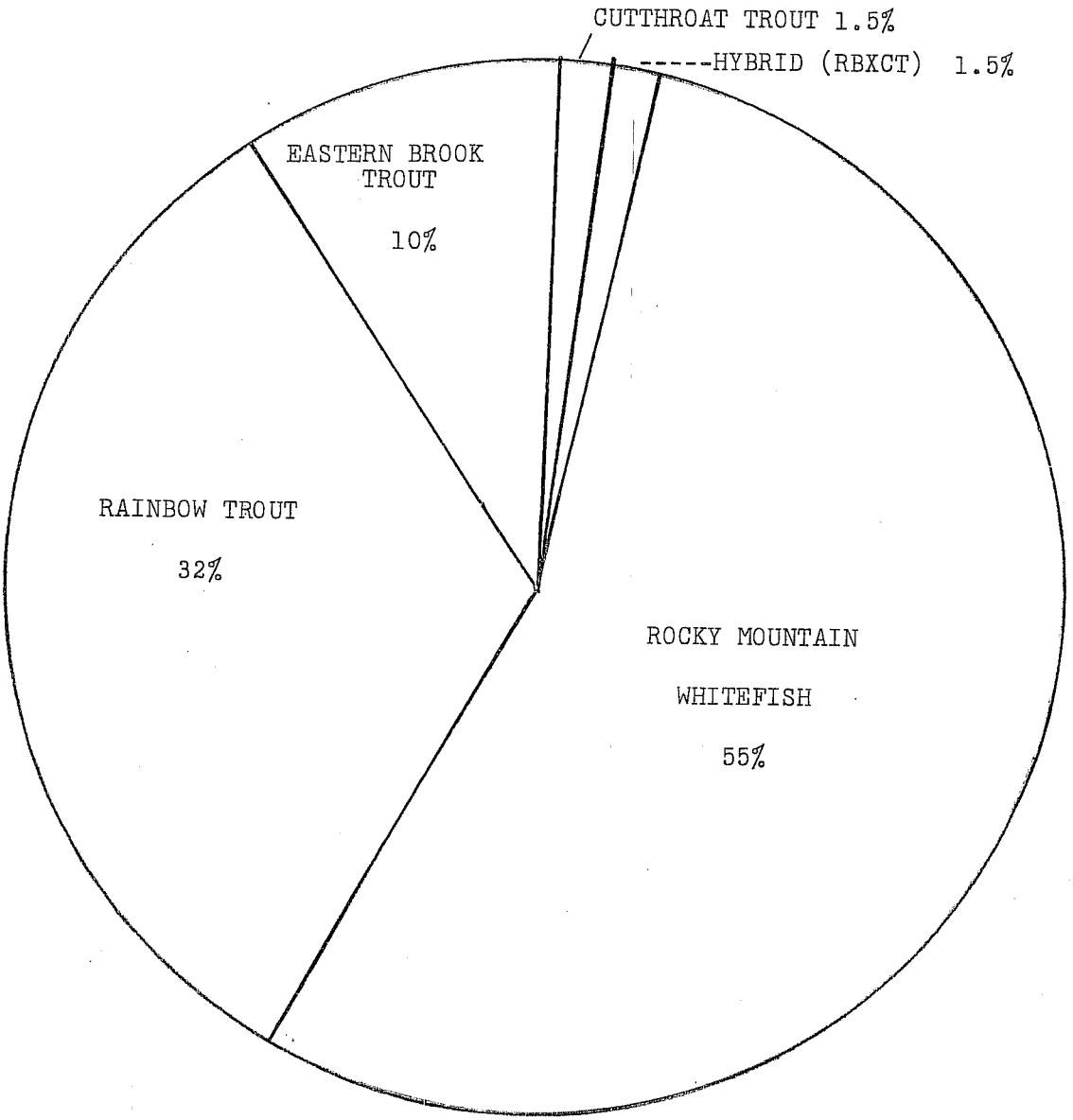


Figure 1. Percent of each species of all legal-sized (7" and longer) game fish found in randomly selected sections of Sheep Creek, Meagher county, Montana, 1951.

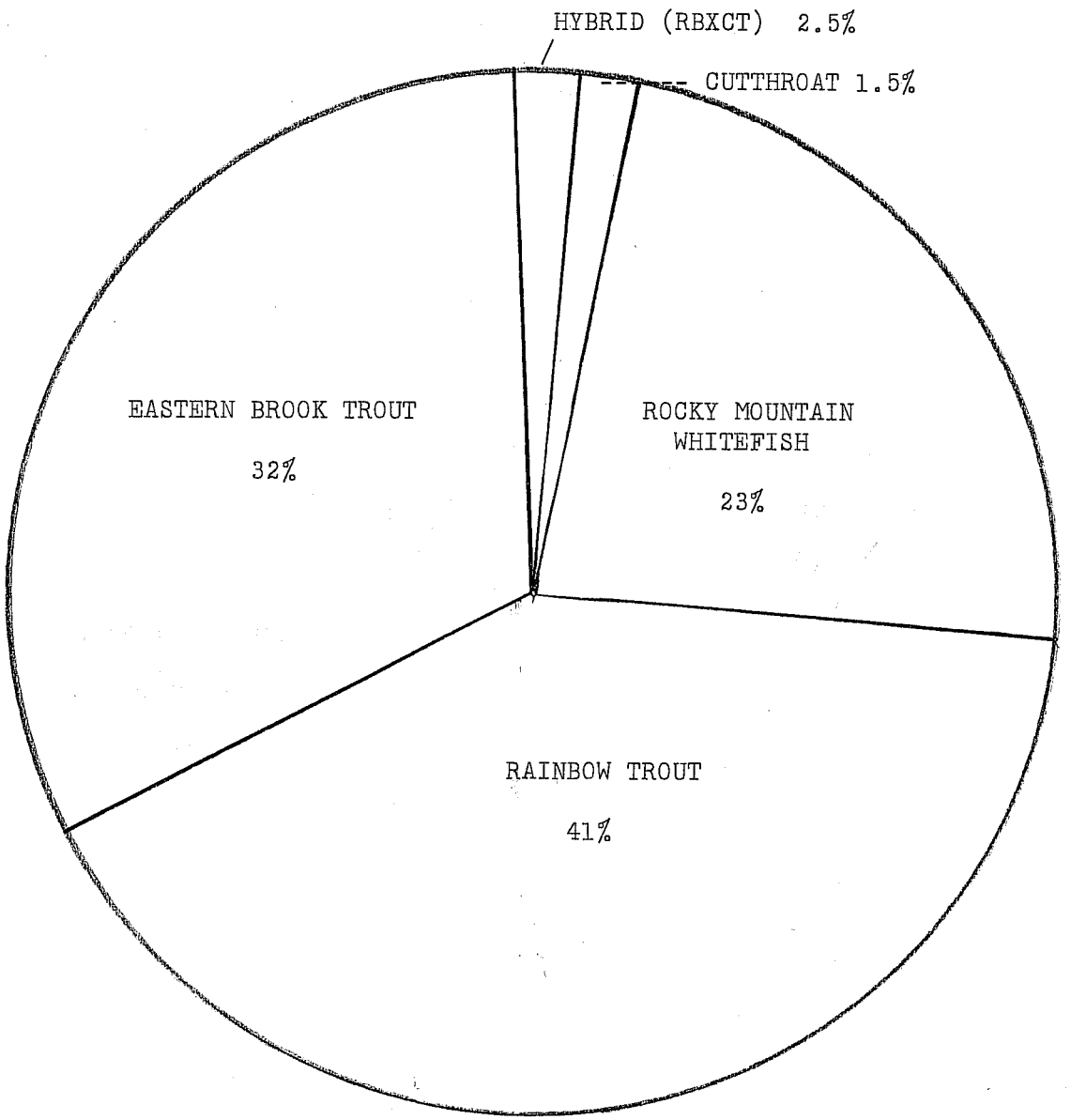


Figure 2. Percent of each species of sub-legal sized (Less than 7") game fish found in randomly selected sections of Sheep Creek, Meagher county, Montana, 1951.

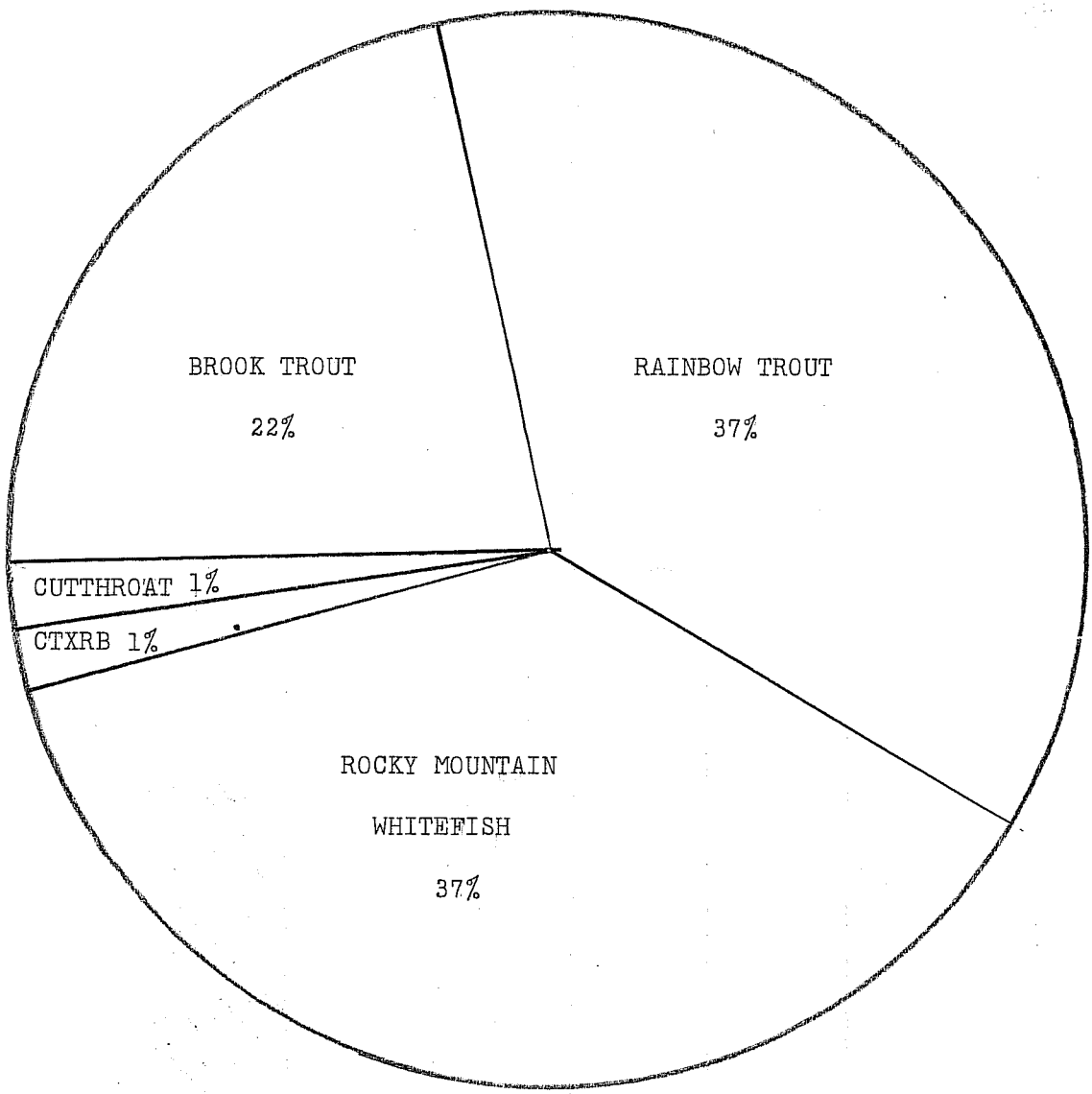


Figure 3. Percent of each species of all game fish recovered from randomly selected sections of Sheep Creek, Meagher County, Montana, 1951.

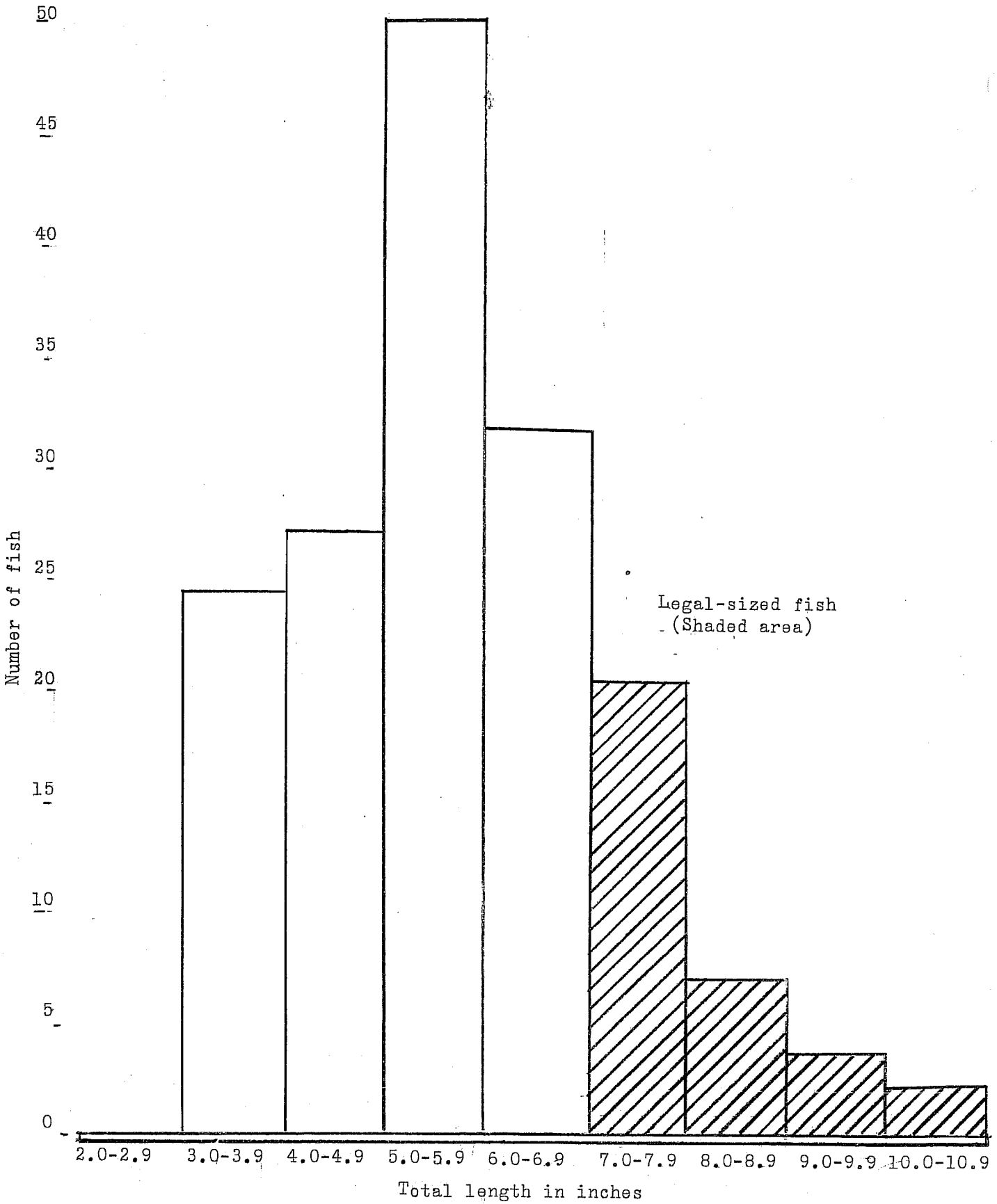


Figure 4. Length frequencies of eastern brook trout from sampled sections of Sheep Creek, Meagher county, Montana, 1951.

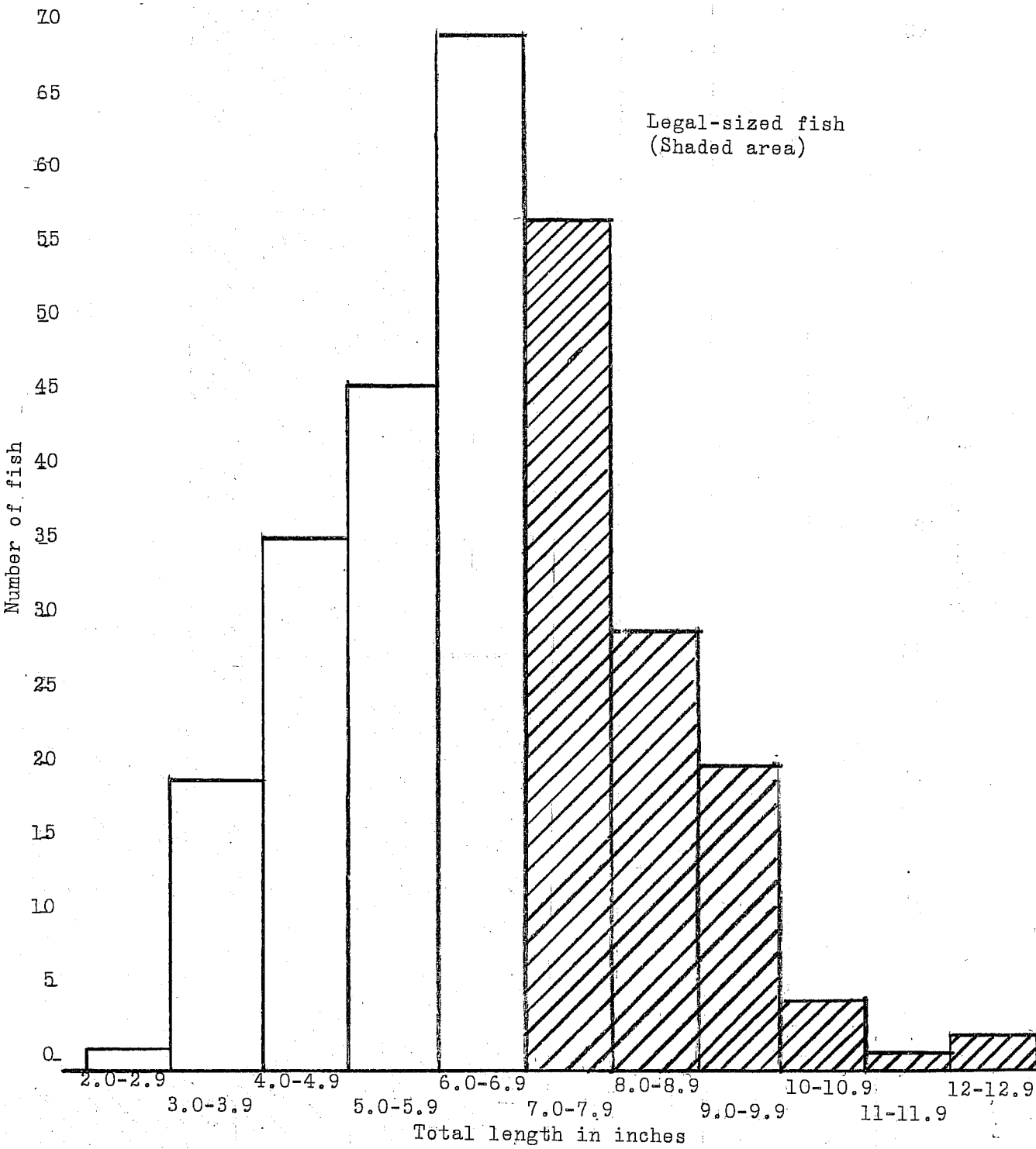


Figure 5. Length frequencies of rainbow trout from sampled sections of Sheep Creek, Meagher county, Montana 1951.

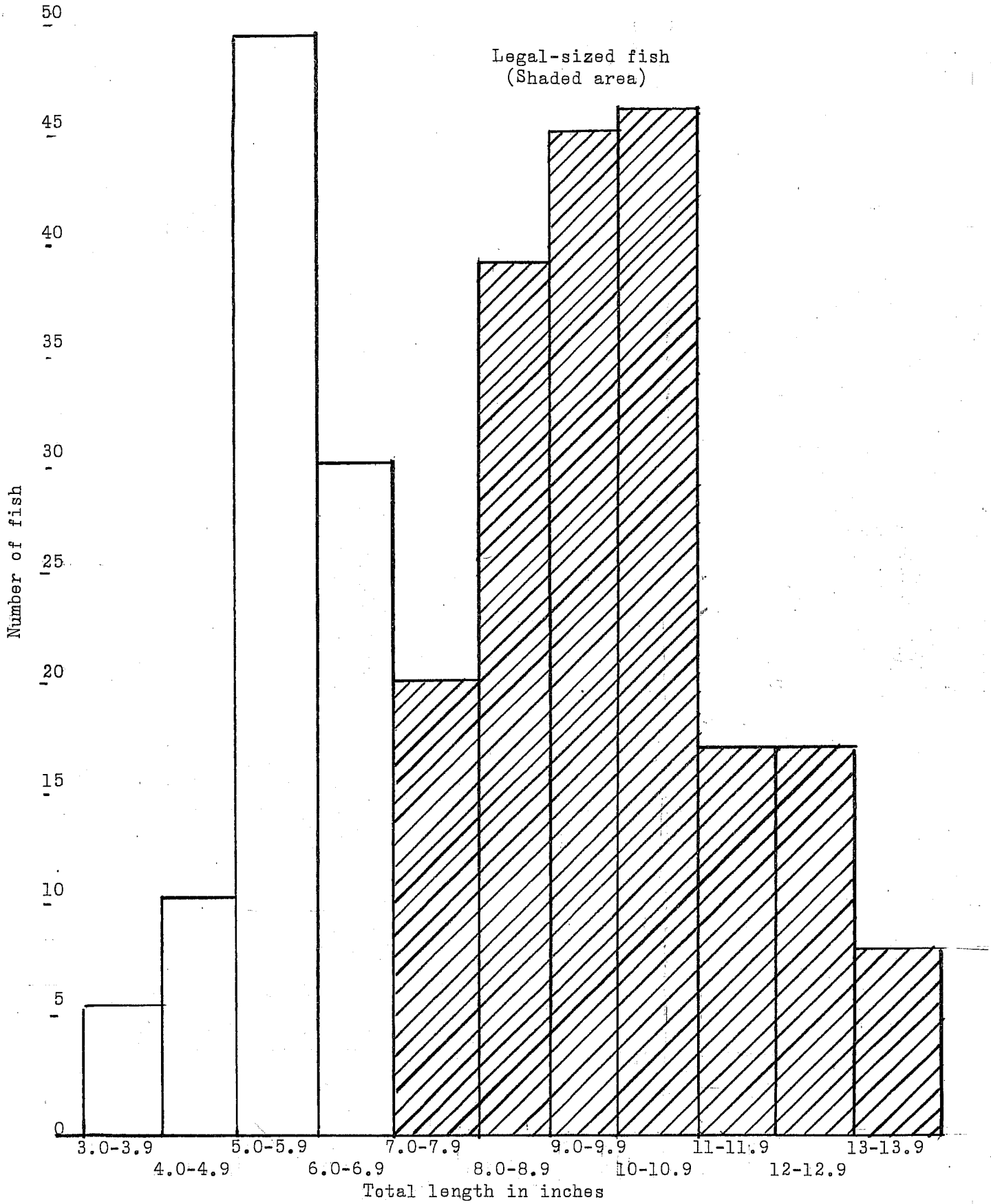


Figure 6. Length frequencies of whitefish from sampled sections of Sheep Creek, Meagher county, Montana, 1951.

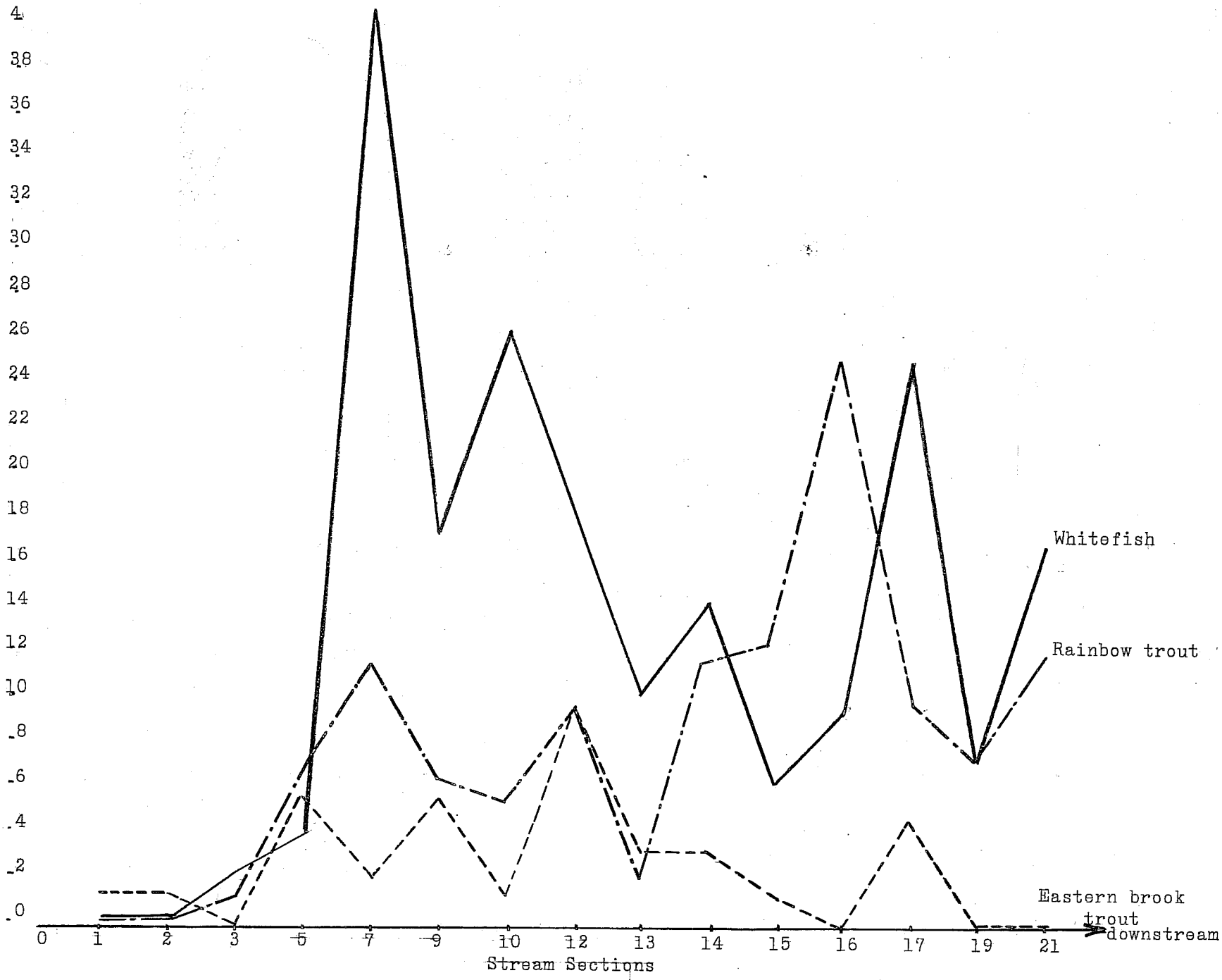


Figure 7. Distribution of legal-sized brook trout, rainbow trout and whitefish in sampled sections of Sheep Creek, Meagher county, Montana, 1951.

It is felt that the number of sections sampled in the two areas is adequate and because there is uniformity of numbers it is not considered hazardous to convert them into fish per mile. Numbers of legal game fish per mile is calculated to be four-hundred and sixty. By species the legal number per mile are as follows: Whitefish, 260; Rainbow trout, 150; Eastern Brook trout, 44; Cutthroat and Hybrid (RbxCt), 6.

The five year plan of fish distribution and management call for a planting of 10,000 yearling rainbow trout each year.

Analysis and Recommendations:

Whitefish definitely predominate in the legal-sized population of the stream. Their contribution to the creel will be studied.

Less than one-fifth of the Eastern Brook trout in the stream are of legal length. The greatest number being from 5 to 6 inches in total length. It is recommended that the minimum size limit on Eastern Brook trout be removed on Sheep Creek.

Summary:

By stratified random selection of sections (300 feet long) and sampling with an electric shocker, a population study was conducted on Sheep Creek. Fifteen sections (4,500') were worked and seven hundred and sixty fish were weighed and measured.

Approximately one-fifth of the brook trout were of legal size. Whitefish comprised fifty-five per cent of the legal-sized population. Very few fish of legal length were found in the three sections farthest up the stream. The calculated number of legal game fish per mile was four hundred and sixty.

Data and Reports:

The original data is with the fisheries biologist at Belt, Montana.

Prepared by Nels A. Thoreson Approved by R. H. Lambert

Date: February 28, 1952

JOB COMPIETION REPORT

INVESTIGATIONS PROJECTS

State of Montana

Project No. F-5-R-1 Work Plan No. III Job No. III-B

Title of Job: The Contribution of Hatchery Trout to the Catch of Fish from Sheep Creek.

Objectives:

The purpose in conducting this study is to determine the effectiveness of hatchery plants made in Sheep Creek, Meagher County, as measured by their contribution to the creel.

Techniques Used:

On May 7, 1952 the right pelvic (ventral) fin was clipped from 2,000 "yearling" rainbow trout to be planted in Sheep Creek, Meagher County. Four lots of these fish were weighed during the time they were marked and while they were still anesthetized by the use of urethane. The numbers and weights are recorded in Table 1.

Table 1. A sample of rainbow trout "yearlings" weighed at the Great Falls Hatchery during the time they were marked (right pelvic fin clipped), May 7, 1952.

Number of fish	Weight (ounces)
10	41.5
10	38.5
10	44.0
25	117.0
Total 55	241.0
Average weight 4.38 ounces	

The marked fish were planted in Sheep Creek on May 13, 1952. The numbers and locations of the plants that were made are listed in Table 2.

Table 2. Number and location of plantings of marked (fin clipped) rainbow trout in Sheep Creek, Meagher County, Montana, May 13, 1952.

No. of Fish	Buckets	Pounds	Location*
146	3	40	Approx. 100 yds. below Section 1.
146	3	40	Bridge on Sheep Cr. at Dead Mans Creek road.
195	4	53	Bridge on Sheep Cr. at Lamb Creek road.
292	6	80	Logging road bridge. Section 10.
292	6	80	Jumping Creek Forest Camp.
243	5	67	Approx. 100 yds. downstream from Section 13.
146	3	40	Adams Bridge. U.S. 89.
365	8	100	Forest Green Resort.
1825	38	500	TOTAL

*Sections are the same as those used in The Sheep Creek Population Study completed and submitted April 7, 1952.

The average weight of the sample of marked fish weighed was 4.38 ounces. At the time of planting the stream was high but clear enough to view the bottom of holes from six to eight feet deep. The fish showed but very little sign of shock when planted.

After the trout were marked they were held in the circular hatchery pond for six days before planting. No unusual loss occurred and nothing unusual concerning these fish was observed during this time.

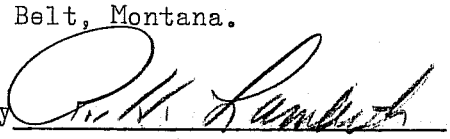
Creel census is being conducted on Sheep Creek at the present time. Evaluation of the catch and the contribution of marked fish will be submitted at the end of the 1952 fishing season.

Summary:

Marked rainbow trout were planted in Sheep Creek, Meagher County, Montana on May 13, 1952 in order to determine the contribution of hatchery reared trout to the catch on that stream. The fish were marked by clipping the right pelvic fin and held for six days at the hatchery. No unusual loss occurred during this time. Fifty-five were weighed and the average weight of this sample was 4.38 ounces per fish. The number planted was 1,825.

Data and Reports:

The original data is with the project leader at Belt, Montana.

Prepared by Nels A. Thoreson Approved by 

Date June 30, 1952

JOB COMPLETION REPORT

INVESTIGATIONS PROJECTS

State of Montana

Project No. F-5-R-1 Work Plan No. IV Job No. IV-A

Title of Job: Abundance, Fluctuation in Abundance, and Migration of the Fishes of Prickley Pear Creek.

Objectives:

To learn the size of the Prickley Pear Creek trout population along with it's length, weight, age, and species composition.

To establish the size sample needed to measure the abundance of trout, and the fluctuations of abundance in a medium sized stream.

To measure the movement or dispersion of trout and suckers.

To find and study the portions of the stream where trout are most numerous.

Techniques Used and Findings:

A manuscript entitled "Sampling Fish Populations in Prickley Pear Creek, Montana" has been presented for publication. This is submitted to fulfill objective 2 and part of objective 1. Two more papers, one by William Alvord on known-age fish and one by Clinton Bishop on age, growth, and condition will be completed during the winter of 1952-53 as part of objective 1. Movement data for objective 3 is presented in the completion report of Job IV-B of this project.

Time, equipment and personnel available did not allow for complete consideration of objective 4, although some mention is made of this in the above named manuscript.

Analysis and Recommendations:

It was found that Prickley Pear Creek, although considered to be a "fished-out" stream by most anglers, had a goodly population of trout. Except for 1951 when the population increased from 118 pounds to 161 pounds of trout per mile, the population remained relatively steady from the first to the last shocking in spite of fish removal by anglers. There was a fall in population size from the first to the third study year. The average pounds of trout per mile for 1949 was 228 pounds and for 1950 was 157 pounds. While the 1951 population began at a low point, it built back through the season to a higher point than reached in 1950.

It appears from the data that a large population of suckers enters the stream from the Missouri River in the spring but largely returns to the river by mid-summer after spawning. The resident sucker population is not large.

It is recommended that the little time required to do so be taken to make one electric census of the regular study section each year. This should be done about the middle of September to coincide with the census of the three previous years. It will be a valuable contribution to knowledge for fishery management to follow the natural fluctuations of the fish population of this stream.

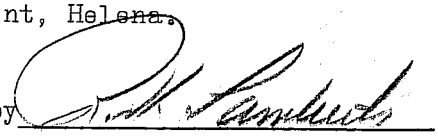
It has been of fundamental inportance to Montana fishery managers to learn that a "fished out" stream such as this one, contains such a fine resident fish population. Unfortunately it was impractical to census the stream both before the opening and after the closing of the fishing season. It is, however, recommended that this be done, perhaps in Prickley Pear Creek, but most particularly in other problem streams, to learn the effects of fishing on the standing trout populations and to measure the magnitude of winter mortalities.

Summary:

Fish populations were sampled at intervals for three years in 15.5 miles of Prickley Pear Creek, Montana, by electric shocking. Through evaluation of confidence limits at the 0.80 level for the sampling distribution of $\bar{t}$, the chances were one in five that twenty to twenty-four 150-foot randomly selected samples would obtain an estimate of the trout population outside 20 to 30 percent of the mean weight and of all fish combined outside 26 to 38 percent of the mean. With the data rearranged in strata by pools and riffles, the chances were one in five that the trout and fish estimates would lie outside 15 to 38 percent and 18 to 36 percent of the mean, respectively. By rearranging random sampling data either by pool and riffle strata or by strata of equal stream lengths, better estimates of the mean were obtained. It was recommended that standing stream fish population estimates by electric shocking be made from sampled sections selected in two manners: (1) That if streams have been pool graded in connection with other work, different categories be established and a random sample be drawn from each stratum; and (2) that random samples be drawn from measured lengths of stream which sections are established from physical differences in the stream or simply from short portions of stream of equal length. Standing populations were expressed in pounds per mile rather than pounds per acre since, because of fluctuations in water level, an acre of stream is an undefined variable, while a mile is a constant. Population trends were measured with fewer variations than population size.

Data and Reports:

The data are filed in the Fish and Game Department, ~~Helena.~~

Prepared by Charles K. Phenicie Approved by 

Date June 30, 1952

JOB COMPLETION REPORT

INVESTIGATIONS PROJECTS

State of Montana

Project No. F-5-R-1 Work Plan No. IV Job No. IV-B

Title of Job Fishing Pressure and the Relation of the Angler Catch to the Actual Stream Fish Population, Prickley Pear Creek.

Objectives:

1. To study the angler's catch as it relates to the estimated size and composition of the trout population.

2. To measure the fishing pressure on the lower 13 miles of Prickley Pear Creek.

3. To measure fishing success by type of lure and to make such other incidental observations about the fishery and fishermen as time will allow.

4. To evaluate the catch of marked hatchery fish liberated in the stream during the past two years.

Techniques Used and Findings:

Manuscript presented for publication.

Analysis and Recommendations:

In comparing Prickley Pear Creek with other streams in the State, for which data are available, it appears that in most respects this stream is an average Montana trout stream. One would expect this stream to have a heavier-than-average fishing pressure, however, because the entire study section is readily accessible to fishermen, is paralleled by a main highway, and is located relatively close to two large population centers, Great Falls and Helena.

The brown trout is the predominant game fish in numbers and weight but does not contribute its proportionate share to the creel when compared to the lesser rainbow population. The creel census data indicate that this low harvest of the dominant population can possibly be attributed to the methods employed by the fisherman, some of the most important ones being as follows: (1) The major portion of the fishermen utilize the less productive period of day from 9:00 a.m. to 4:00 p.m. with the major pressure falling on Sundays and holidays. (2) The catch per man-hour on flies, or some form thereof, is almost twice as high as the bait fishermen's catch per hour, but only 35 percent of the fishermen use the more productive form of fishing. (3) Population inventories indicate that the Prickley Pear fishermen utilize the water adjacent to parking areas quite extensively with little effort expended to fish water within easy walking distance.

In Montana the most important form of fish management is the use of hatchery raised trout in the maintenance of stream and lake fishing. Throughout the world, during the past twenty years, hundreds of thousands of dollars have been expended and large volumes of data have been accumulated on the use of hatchery-raised trout. True, Prickley Pear Creek is only one of several thousand streams in Montana, but it should be borne in mind that the findings concerning hatchery-reared fish planted in Prickley Pear Creek are similar to those obtained elsewhere by other investigators. Since Prickley Pear Creek is an average trout stream, it is more than likely that further investigation in Montana would show no more than that its waters also will react in the same manner to management through the use of hatchery-reared fish, as has been found true throughout the world.

Further studies are now underway in Montana to evaluate the use of hatchery reared trout, and these studies will be continued and others begun. On the basis of the best information available, recommendation is made that Montana revise its fish-planting policy. This will most surely result in a higher return of planted fish to the creel. Further work then, can be directed toward refining these policies to insure a still higher return rather than being directed toward duplication of twenty some years of work done in a wide variety of conditions merely to show that Montana's waters conform to biological principles discovered elsewhere.

There is no need here to give a complete review of the literature on trout planting, for many comprehensive reviews are available. It should suffice to quote the following from one of these reviews by Holloway 1/:

> "Recoveries from experimental plants in streams of brook, rainbow and cutthroat trouts have indicated an average recovery from fall-planted fingerlings of less than one percent; for fall-planted, legal length trout, 6 to 10 percent; for spring and summer plantings of legal-length, 45 to 60 percent, with some recoveries being as high as 70 to 90 percent when the number planted was correlated closely with fishing pressure. In many trout lakes, the planting of fry and fingerlings has given very good results. Brown trout experiments are inconclusive but indicate that planting fingerlings in the fall may be as satisfactory as stocking legal-length trout in the spring. In considering cost, fall planted, brown trout fingerlings would appear advantageous for use in many waters."

Two experiments in Montana that have been completed conform to the general statement above. On Prickley Pear Creek for 1951, 38 percent of the legal spring plant of rainbow trout was caught and 2 percent of the fingerling fall plant. The 1950 portion of the study did not cover the opening month of the fishing season but may have had a somewhat higher percent return of legal rainbows. In 1948 a marking experiment was conducted on rainbow trout planted in the Madison River from the Ennis Hatchery of the U.S. Fish and Wildlife Service. From this study it was learned that trout "spot planted" at points of access gave 2.3 times higher return than fish liberated uniformly along the river from a boat. This can be explained in

1/ Holloway, Ancil D.
1945. Summary of trout stocking experiments.
U.S. Fish and Wildlife Service Fishery Leaflet 137, 15 pages.

that fishing pressure was heavier in locations where the spot plants were made.

Still another point should be made. In his review of the problem, Miller 2/ states that spring-planted legal trout in Michigan were caught in the first two weeks of open season and that those not caught then were never caught. In Wisconsin investigators found no survival to the second season, while in Pennsylvania negligible numbers of planted fish were caught after the first six weeks, the bulk of the catch being in the first week. Most of the trout were caught in the first three to four weeks of the season in Minnesota streams, with only two percent recovered the following season.

In Montana where the fishing pressures are lighter than in the states mentioned above, it appears that hatchery fish will be caught by the angler for a little longer period. In Prickley Pear Creek 31 percent of the legal planted fish caught, were caught during the first month, with 88 percent of them having been caught within the first eight weeks of the season. Fifty-eight percent of the wild fish caught during the season were taken during the first eight weeks. In the Madison River, 52 percent of the hatchery fish caught were taken in the first four weeks, while 75 percent had been caught in the first eight weeks. Sixty-three percent of the wild fish taken had been caught within the first eight weeks.

Discussions of this sort, unfortunately, have erected barriers of opposition to establishing new and constructive policies. Fish managers and sportsmen alike, expect an affirmative answer to be given to the natural question which follows: Is the hatchery an ineffective tool in Fisheries Management?

The answer is that the hatchery is effective in fishery management, but, from the standpoints of both economy and the need for adding more fish to the anglers' creel, the hatchery should be used in a manner consistent with up-to-date findings.

From the studies made in this program a fishery management plan will be formulated and submitted to the Fish and Game Commission.

Summary:

A two-year creel census in conjunction with a population and survival of hatchery fish study was conducted on Prickley Pear Creek, Montana. An inventory of the resident game fish population was made through the use of the electrical census method. The population of legal-sized fish present, in order of abundance were: brown trout, rainbow trout, mountain whitefish, and eastern brook trout. The rainbow contributed 27 percent more in numbers to the creel than the predominant brown trout population.

2/ Miller, Richard B.
1949. The status of the hatchery.
The Canadian Fish Culturist, Vol. 4, No. 5, pp. 19-24.

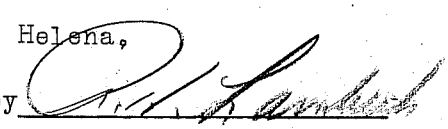
The catch per man-hour for the entire study in 1951 was 0.71 fish per man-hour. Thirty-five percent of the fishermen used some form of flies to catch an average of 0.96 fish per hour; the remaining 65 percent used some form of bait to catch an average of 0.46 fish per hour. July was the poorest fishing month, with a catch per man-hour of 0.43. May was the month of heaviest fishing pressure, with an average of 23 fishermen's cars per day. There were 3,377 fishermen in the study section in 1950, as compared with 2,072 in 1951.

The total yield for the entire season in 1951 was 2,335 pounds, or 44.3 pounds per acre. The average weight of the electrically inventoried fish was 2,516 pounds, or 46.6 pounds per acre. There was an average of 334 legal fish per mile present during the study.

Plantings of hatchery-reared rainbow trout, marked by fin clips, were made to determine their effectiveness. Creel checks for the entire season of 1951 accounted for 38 percent of the legal plant, as compared with 2 percent for the fingerling plant. The contribution to the total creel by the plants made was 7 percent. There was no indication that the plants made in 1949 and 1950 contributed materially to the catch in 1951. Figuring the contribution of hatchery fish on a monetary basis, the fingerlings cost the fishermen $1.43 per fish, as compared with $0.35, the cost of the legal fish returned to the creel.

Data and Reports:

The data is filed in the Fish and Game Department, Helena.

Prepared by Boyd R. Opheim Approved by 

Date June 30, 1952

JOB COMPLETION REPORT

INVESTIGATIONS PROJECTS

State of Montana

Project No. F-5-R-1 Work Plan No. V Job No. V-A

Title of Job: Ranch Reservoir Study.

Objectives:

To determine in so far as possible the species of fish which are best adapted to Montana's ponds as regards survival, growth and catchability. In this project most attention is given the colder water ponds.

Techniques Used and Findings:

Because most members of the trout family cannot reproduce without running water, new plantings of these fish must be made from time to time to maintain an adequate fish population. Planting of fry in waters already containing large fish is not considered sound management. Because the kokanee is not known to live beyond the period of its first reproduction and because it is not a notorious cannibal, successive plants of fry of this species would not be threatened by the older fish. Fry plants of this species have been made but insufficient time has elapsed to evaluate the results.

Problems of winter or summer mortalities of fish populations often arise in Montana reservoirs. Determining the causes of such mortalities often has to be based on certain assumptions because the investigator usually does not know of the catastrophe until after it has happened. In the meantime conditions may have changed. One farm pond was closely observed during the summer of 1951 and as a result certain chemical and physical factors were measured while the mortality was still in progress.

On June 27, 1951 a maximum-minimum thermometer was placed in a pond so that the bulb was located two feet below the surface. The reservoir contained two age classes of rainbow trout. The older age group were in their fifth season of growth and the younger group were in their second season. From June 27 to August 1, the thermometer was read at two week intervals. Temperature readings recorded on the thermometer are listed in Table 1.

Table 1. Temperature readings taken from a maximum-minimum thermometer located in a spring-fed Montana farm pond. Thermometer bulb was two feet below the surface.

Date	Temperature	
	Maximum	Minimum
June 27, 1951	Thermometer installed	
June 27 - 30	64 F.	46 F.
July 1 - 14	69 F.	56 F.
July 15 - 31	73 F.	64 F.
Aug. 1 - 3	70 F.	65 F.
Aug. 4 - 31	70 F.	65 F.
September	68 F.	60 F.

During the later part of July the lesser duckweed (Lemna minor) became so abundant that the pond was completely covered with the plants. In previous years an abundance of this plant has been observed on other ponds in this vicinity especially during the hottest days of summer. Considerable quantity of decomposing duckweed was found on the bottom.

On August 2, 1951 the trout began to die and by morning of August 3rd it is believed that all the trout in the pond had succumbed. Tests for dissolved oxygen were made at various locations in the reservoir and readings as low as 0.25 ppm were found. Results of the temperature and dissolved oxygen readings are presented in Table 2. During the period when the fish were dying, the maximum temperature two feet below the surface did not exceed 70 F. Several days previous to the mortality the maximum temperature at this same location had been 73 F. The lowest oxygen reading was found near the inlet where water entering the reservoir was flowing over sunken, decomposing duckweed nearly a foot thick.

Table 2. Temperature and dissolved oxygen readings taken during and immediately following a complete rainbow trout mortality in a spring-fed Montana reservoir.

Date and Location	Dissolved oxygen		Temperature	
	Surface	Bottom	Surface	Bottom
August 3, 1951				
Near center of pond	1.6 ppm	0.9 ppm	72 F.	67 F.
Outlet pipe.		1.8 ppm		65 F.
Shallow water near the inlet	1.0 ppm	0.25 ppm	73 F.	72 F.
Late afternoon				
Near center of pond	1.5 ppm	3.0 ppm	72 F.	67 F.
August 4, 1951				
Near center of pond.	1.35 ppm	1.25 ppm	68 F.	68 F.
August 8, 1951				
Near center of pond.	3.00 ppm	1.75 ppm	67 F.	65 F.

Analysis and Recommendations:

The problem presented here is not considered to be a common one in Montana reservoirs. It is believed that most fish mortalities in Montana ponds occur during the winter months.

Greater depth of the inlet channel in the pond considered in this paper possibly would have prevented the loss. With greater depth the temperature would probably have been lower and decomposition of the duckweed might have gone on at a sufficiently slow rate to prevent the almost complete depletion of oxygen.

In general, Montana ranch fish ponds lack sufficient depth to sustain continuous crops of fish. Depths of fifteen to twenty feet are desireable and should be encouraged wherever new construction is contemplated. Drain pipes and fenced enclosures also are advantageous to good farm pond management and should be widely recommended.

JOB COMPLETION REPORT

INVESTIGATIONS PROJECTS

State of Montana

Project No. F-5-R-1 Work Plan No. VI Job No. VI-A

Title of Job: Fish Losses in the Pishkun Irrigation Canal and Development of Census Techniques.[1]

Objectives:

To determine the number of trout stranded in the Pishkun Supply Canal, Sun River Project of the U. S. Bureau of Reclamation, at the close of the 1951 irrigation season.

Techniques Used:

The work was accomplished under a cooperative agreement between the Missouri River Basin Studies of the U. S. Fish and Wildlife Service and the Montana State Fish and Game Department.

The Pishkun Supply Canal originates within the Diversion Dam on the North Fork Sun River about 25 miles northwest of Augusta, Montana and runs in an easterly direction approximately 12 miles terminating at Pishkun Reservoir. The seasonal flows of this canal are dependent upon the operation of Gibson Storage Reservoir located about 3 miles upstream from the Diversion Dam. Water is diverted as required by the Sun River Project lands in the vicinity of Fairfield, Montana. During peak demands of the normal irrigation season, April through September the canal carries between 1,000 and 1,300 second-feet of water. Pishkun Canal has been in operation at its present capacity since 1935. There are no devices at the headgates to prevent or reduce the number of fish entering the canal.

Time becomes a vital element in canal loss observations as soon as water levels begin to drop. Several factors come into play which rapidly reduce the opportunity to count the total number of fish stranded. Natural predation, movement of fish to cover, and removal of legal-sized fish by people, obliterates the evidence of the magnitude of the fish kill in a relatively few days. Weather conditions at the time of closure frequently complicate the job still further. With these factors in mind and realizing that a detailed count of 12 miles of canal was not possible, a random sampling method was adopted for the 1951 observations.

The canal has 10 natural divisions or sections composed of five open sections, three tunnels, and two siphons (see attached map). The siphon through Arnold Coulee, located about one-third the distance between Tunnel No. 3 and Pishkun Reservoir, was not considered as a division point; therefore, only eight sections are considered in this report. The location

1/Adapted from "Fish Stranded by the Closure of the Pishkun Supply Canal", A cooperative report by M.R.B.S., Fish & Wildlife Service, & the Montana Fish and Game Department, March 1952.

and length of each section is shown on the accompanying map. The river siphon and tunnels 1, 2, and 3 were censused in their entirety. Sections 2, 4, 6 and 8 were divided into 1/10-mile plots prior to the canal closure date and a random sample method of censusing applied to each section except in Section 2 where approximately 80 percent of the area was censused. About 38 percent of Section 4, 35 percent of Section 6 and 18 percent of Section 8 was censused. A major portion of the censusing was accomplished by using electric fish shockers. Each plot was repeatedly gone over with an electric shocker to recover as large a percentage of fish as possible. In some of the deeper and more inaccessible plots where it was impossible to obtain reliable results with either an AC or DC shocker, powdered cube root was utilized after all other means of censusing and recovering had been tried. The data obtained were recorded by the crew leader after the study plot was censused and at the same time an estimate was made as to the percentage of fish not recovered from the plot.

No attempt was made to determine or estimate the number of trout consumed by predacious birds and mammals during the time when the flows were low or after the water had been shut off tight. Unquestionably, a large number of trout were lost to predators and scavengers since several flocks of mergansers and scores of magpies were observed along the canal.

Findings:

In early May 1951, 1,000 marked, legal-sized rainbow trout, from the Great Falls hatchery were liberated in the North Fork of the Sun River between Gibson and Diversion dams to determine what percent of the legal sized hatchery fish were lost into the diversion and also to determine how far the fish would drift through the canal. Fifty-six of the marked fish were recovered in the canal of which 49 were recovered within the first mile below the headgates (see Table 2.). Only one marked fish was recovered in the lower 5 miles of canal.

Section No. 1 (Tunnel No. 1, 1,200 feet). Within an hour after the gates were closed, a mobile electric shocking unit was taken into the canal and the count was started immediately below the headgates. After all fish had been removed from the tunnel, powdered cube root was used in the tunnel drain located about 400 feet from the headgates so that all fish trapped therein could be recovered. A total of 153 legal and 100 fingerling-size trout were removed from the tunnel and drain (see Table 2.). Of the 253 total, 183 or 72 percent were salvaged and released in the North Fork Sun River below the Diversion Dam. It is believed that 100 percent recovery was made in this section.

Section No. 2 (Open canal, 2,635 feet). An exceptionally large number of fish were stranded in this section of the canal. A very thorough and detailed census was made on approximately 80 percent of this section. One hundred and seventy-two legal-size and 2,907 fingerling and fry-size trout were recovered from this part of the canal and released in the main river below the Diversion dam. Considering the 20 percent of the section not censused and the estimated number of fish that escaped observation in the censused area, approximately 4,600 fish were stranded in this section of canal.

Table 1. Data on trout stranded in the Pishkun Supply Canal, Sun River Project, Bureau of Reclamation, following closure, autumn of 1951.

(1) Sections (And Total Lengths)	(2) Section Actually sampled, in percent	1951 No. of Trout Stranded (3) In sampled areas		(4) In unsampled areas		(5) Additional, in Section		(6) Totals		1950 (7) Total No. Stranded	
		Legal	Fing.	Legal	Fing.	Legal	Fing.	Legal	Fing.	Legal	Fing.
1. Tunnel No. 1 (1200')	100	153	100	0	0	0	0	153	100	5	20
2. Outlet of Tunnel No. 1 to mouth of river siphon (2635')	80	172	2,907	43	726	19	725	234	4,358	710	2,840
3. River siphon (1,397').	100	922	251	0	0	240	1,900	1,162	2,151	500	1,500
4. Outlet of river siphon to mouth of Tunnel No. 2 (13,736').	38	48	1,740	78	2,838	158	3,287	384	7,865	4,300	9,970
5. Tunnel No. 2 (1,147').	100	42	77	0	0	2	35	44	112	125	275
6. Outlet of Tunnel No. 2 to mouth of Tunnel No. 3 (11,927')	34.8	119	1,289	223	2,415	63	7,574	405	11,278	1,650	4,300
7. Tunnel No. 3 (2,380').	100	8	0	0	0	2	40	10	40	100	300
8. Outlet of Tunnel No. 3 to Pishkun Reservoir (29,175)	17.8	82	38	378	175	2,399	5,922	2,859	6,135	2,100	6,000
TOTALS		1,546	6,402	722	6,154	2,883	19,483	5,251	32,039	9,490	25,205
								37,290		34,695	

*Based upon technician's estimates of recovery success in seining, shocking or poisoning efforts. (The recovery success varied throughout the entire canal depending upon the uncontrollable physical factors such as dense aquatic vegetation, deep water, spring-fed areas and porous rocky sections.)

Section No. 3 (River siphon, 1,397 feet). The water in the river siphon was drained down to the outlet level by removing a part of the drain valve mechanism. Once the cap and debris were removed from the 8-inch pipe the water gushed up through the opening with terrific force. It was impossible to recover or even observe all the fish that were forced out through this opening. Many of the fish were mangled almost beyond recognition. Only 60 legal and 38 fingerling trout were actually recovered at the time the siphon was drained. It was estimated that for every legal-size trout recovered, four others escaped and for every fingerling-size recovered, 50 escaped observation. A 2-inch pump was used in pumping the water from the siphon below the drain level. This operation required 2 days and nights to reduce the water level low enough to permit working and successful seining of trapped fish. An additional 862 legal and 213 fingerling-size trout were removed from the siphon and released into the Sun River below the Diversion Dam.

Section No. 4 (Open canal, 13,736 feet). This section extends from the outlet of the river siphon to the inlet of Tunnel No. 2, a little more than 2½ miles of open canal. Ten plots, or 38 percent of the entire section, were censused. Forty-eight legal and 1,740 fingerling-size trout were recovered within the sampled areas. Estimates on the number of fish not observed within the censused plots at the time of censusing were 98 legal and 1,248 fingerling-size fish. From figures based on the random sample and estimates of the fish not recovered within these plots, approximately 384 legal and 7,865 fingerling-size fish were stranded in this section.

Section No. 5 (Tunnel No. 2, 1,147 feet). There was a constant flow of water through this tunnel, consequently it was a difficult task to accurately census this section by the use of artificial light and a stationary electric shocker. The shocker was set up near the inlet and the first 500 feet of tunnel were censused, then the equipment was moved to the outlet and the lower 500 feet censused. With the equipment at hand, approximately 1,000 feet were censused, however, 147 feet in the center of the tunnel were not shocked. Only 42 legal and 77 fingerling-size trout were recovered. However, the counts were not as complete as on Tunnel No. 1 because of the above-mentioned difficulties. It is believed that at least 2 legal and 35 fingerling-size trout were not observed, thus making a total of approximately 44 legal and 112 fingerling-size fish in this section.

Section No. 6 (Open canal, 11,927 feet). Of the 2½-mile section of canal between the outlet of Tunnel No. 2 and the inlet of Tunnel No. 3, eight 1/10-mile plots were censused. One hundred and nineteen legal and 1,289 fingerling-size trout were recovered from these areas. Applying the figures obtained from the random samples and the estimates of fish not observed within the censused areas, there were approximately 405 legal and 11,278 fingerling-size trout stranded in this section of canal.

Table 2. Species composition and summary of trout actually counted in the Pishkun Supply Canal, Sun River Project of the Bureau of Reclamation, autumn of 1951.

Section	Rainbow			Eastern Brook		Cutthroat		Totals	
	Legal	Marked Legal	Fing.	Legal	Fing.	Legal	Fing.	Legal	Fing.
1. Tunnel No. 1 (1,200')	132	4	56	14	44	3		153	100
2. Outlet of Tunnel No. 1 to mouth of river siphon (2,635')	126	22	2,264	24	643	0		172	2,907
3. River Siphon (1,397')	775	24	150	43	101	80	Non Identified	922	251
4. Outlet of River Siphon to mouth of Tunnel No. 2 (13,736')	38	1	1,617	9	123	0		48	1,740
5. Tunnel No. 2 (1,147')	30	2	65	9	12	1		42	77
6. Outlet of Tunnel No. 2 to mouth of Tunnel No. 3 (11,927')	96	2	1,060	21	229	0		119	1,289
7. Tunnel No. 3 (2,380')	7	0	0	1	0	0		8	0
8. Outlet of Tunnel No. 3 to Pishkun Reservoir (29,175')	77	1	36	2	2	2		82	38
TOTALS	1,281	56	5,248	123	1,154	86		1,546	6,402
								7,948	

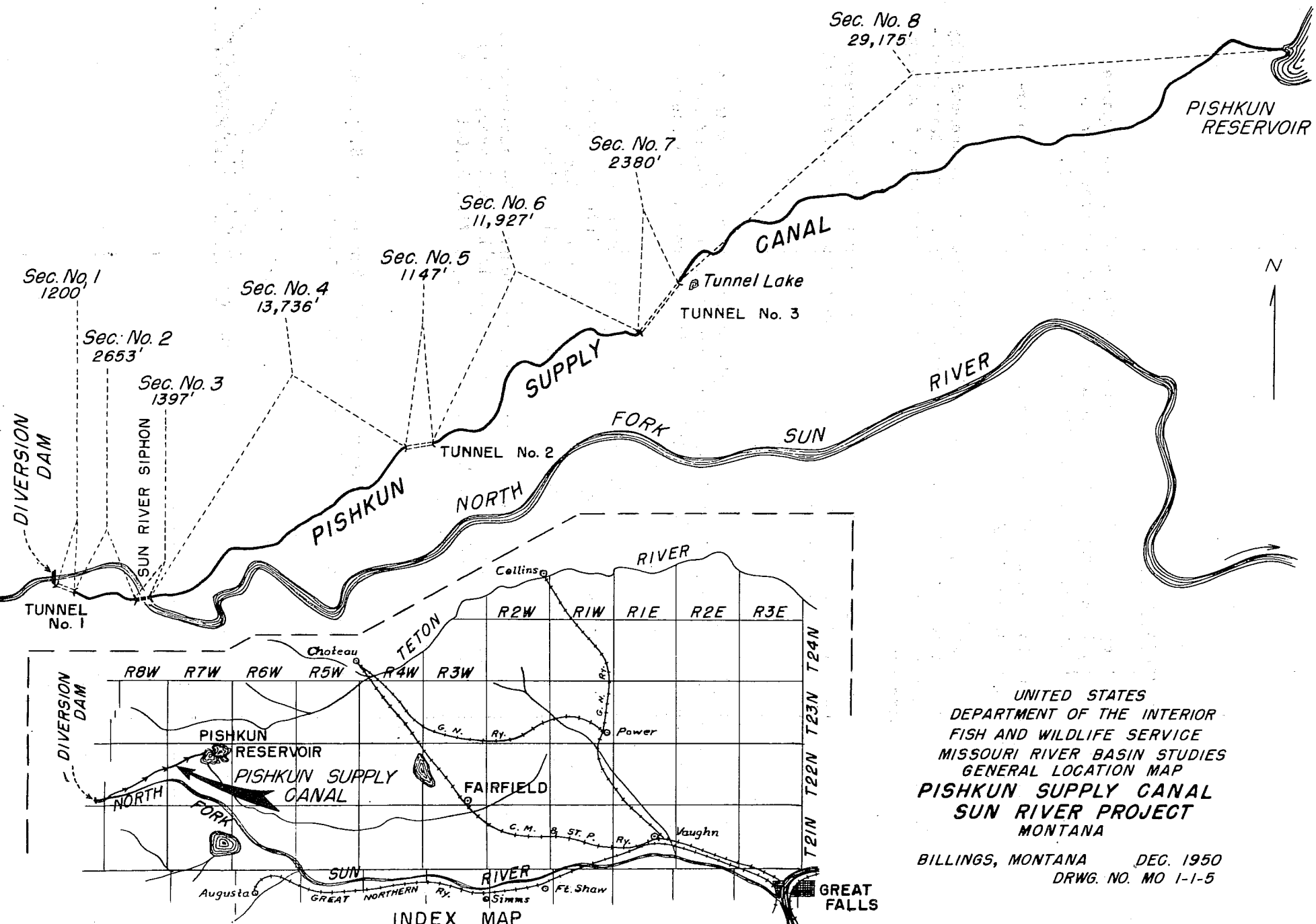
Section No. 7 (Tunnel No. 3, 2,380 feet). Very few fish were observed in this tunnel. Observations were made under extremely poor lighting conditions and no attempt was made to recover the few fish observed. Only 8 legal-sized fish were seen and it was estimated that an additional 2 legal and 40 fingerling-sized fish were unobserved. It is believed that the estimated total of 10 legal and 40 fingerling-size trout is a conservative estimate of the number of fish stranded in this section.

Section No. 8 (Open canal, 29,175 feet). The last 5½ miles of canal between the outlet of Tunnel No. 3 to Pishkun Reservoir was considered as one unit even though there is a siphon through Arnold Coulee located about midway through the section. Ten 1/10-mile plots or 17.8 percent of the entire section were censused. Eighty-two legal and 38 fingerling-size trout were recovered from the sampled plots in this section. It was estimated that at least 427 legal and 1,054 fingerling and fry-size trout were unobserved within the sampled areas. Using the actual count and the estimated figures obtained from the sample plots as a basis, it is believed that approximately 2,399 legal and 5,922 fingerling trout were stranded in this section.

A summary of species composition and numbers of trout actually recovered from the Pishkun Canal is found in Table 3. Weight and length data were obtained on a representative sample of all species of trout recovered from the canal during the study. A sample of 205 legal-size rainbow trout averaged 10.93 inches in length and .509 pounds each. Only six cutthroat trout were sampled and averaged 10.68 inches in length and .46 pounds. A sample of eight eastern brook trout averaged 8.78 inches in length and .29 pounds each. Two 1-pound samples of fingerling-size trout were counted that averaged 213 per pound. The estimated total weights of all size groups are shown in Table 3.

Table 3. Estimated Numbers and Weights of Fish Stranded in Pishkun Supply Canal, 1951

Species	Average Length	Estimated Number Fish Stranded	Average Weights	Estimated Total Weights
Cutthroat	10.68	292	.29	85
Rainbow	10.93	4,541	.51	2,706
Rainbow	Fingerling	26,265	213/pound	123
Eastern Brook	8.78	417	.46	192
Eastern Brook	Fingerling	5,774	213/pound	27
				3,133



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
MISSOURI RIVER BASIN STUDIES
GENERAL LOCATION MAP

PISHKUN SUPPLY CANAL
SUN RIVER PROJECT
MONTANA

BILLINGS, MONTANA DEC. 1950
DRWG. NO. MO 1-1-5

Analysis and Recommendations:

Inasmuch as the operation of the Pishkun Canal during 1951 was reported to be normal, it is assumed that the number of trout stranded can be considered as a typical annual loss for this particular canal.

Annual attempts to prevent the loss through rescue operations are impracticable and economically unsound.

The problem of minimizing or preventing the annual loss on an economically sound basis requires an appraisal of the trout lost from a monetary standpoint and reasonable estimates of the costs of installing and maintaining special contrivances.

Because of insufficient information as regards the engineering problems involved the course which should be followed, to prevent the substantial loss of fish, cannot be stated here.

Summary:

Following the closure of the Pishkun Supply Canal a study was made in order to determine the number of fish left stranded. A system of stratified random sampling by use of electric shocking devices and poison was used to determine the fish population.

One-thousand marked fish were planted above the diversion in order to determine the number and movement of the planted fish into and through the canal. Fifty-six of the marked fish were recovered in the canal. Forty-nine were found within the first mile below the diversion.

The number of fish left stranded in the canal was found to be substantial. The calculated total number of legal-sized fish (7 inches and over, total length) was 5,251, sublegal length (less than 7" T.L.) fish 32,039. The total loss of trout was 37,290.

Data and Reports:

The original data is with the Missouri River Basin Studies, U.S.Fish and Wildlife Service, Billings Field Office, Billings, Montana.

Prepared by Nels A. Thoreson Approved by R. N. Lantz

Date March 17, 1952

JOB COMPLETION REPORT

INVESTIGATIONS PROJECTS

State of Montana

Project No. F-5-R-1 Work Plan No. VII Job No. VII-A

Title of Job: Population Surveys of Streams Within the Project Area.

Objectives:

In order to effect or sustain proper management of waters from a fishery standpoint it is desirable to have information regarding the existing fish populations. The objective of this study was to gather data from several streams in the area in an effort to obtain information needed in management.

Techniques Used:

Sampling was done with an electric shocking device and each 300 foot section was blocked off with 1/2-inch, square mesh nets. All fish were weighed and measured and scale samples were taken from a high percentage of each species.

In order to expedite the job and work as many streams as possible the sampling sections were chosen by merely driving to the streams at the lower, middle and upper ends and shocking a section in each of these locations.

Findings:

Big Elk Creek.
The origin of Big Elk creek is in the Crazy Mountains. It flows east and north approximately 25 miles and empties into the Musselshell river near the town of Two Dot. The late August stream temperatures varied from 43°F in the canyon to 50°F. at the Bill Fox ranch. From a fishery viewpoint the stream varies from near barren water in the canyon to one supporting a sizeable population of fish farther downstream.

Hatchery plants of Eastern Brook trout have established a population of this species below the canyon. Farther downstream the population of game fish grades into one of predominantly Brown trout. Apparently this species moved in from the Musselshell river and finding suitable habitat have established themselves, reproduced and can now be found in considerable numbers. At the Bill Fox ranch the Brown trout make up nearly the entire population of game fish (see Table 1). Farther upstream in the vicinity of the Campbell ranch the game fish population grades from a predominance of Browns to Eastern Brook trout. Several miles farther up in the vicinity of the Jack Arthur ranch the game fish were found to be exclusively Eastern Brook trout with the greatest portion of the population being of less than legal size. The difference in populations is shown in Figure 1.

Table 1. Trout Populations found in Big Elk Creek, Wheatland County, Montana on Aug. 27 & 28, 1951.

Section*	Brown trout			Eastern Brook trout			Rainbow Trout		
	In Section		Approx.legals	In Section		Approx.legals	In Section		Approx.legals
	Sublegal	Legals	per mile	Sublegal	Legals	per mile	Sublegal	Legals	per mile
Fox Ranch Lower Big Elk	57	49	980	4	1	20	0	1	20
Campbell Ranch Middle Big Elk	22	20	400	32	23	460	5	4	80
Arthur Ranch Middle Big Elk	0	0	0	40	4	80	0	0	0
Canyon Crossing Upper Big Elk	0	0	0	5	0	0	0	0	0
	Also one sublegal cutthroat in this section.								
Forks in Canyon Upper Big Elk	Two sublegal cutthroats in two sections. Practically no fish.								

* Sections sampled were three hundred feet in length.

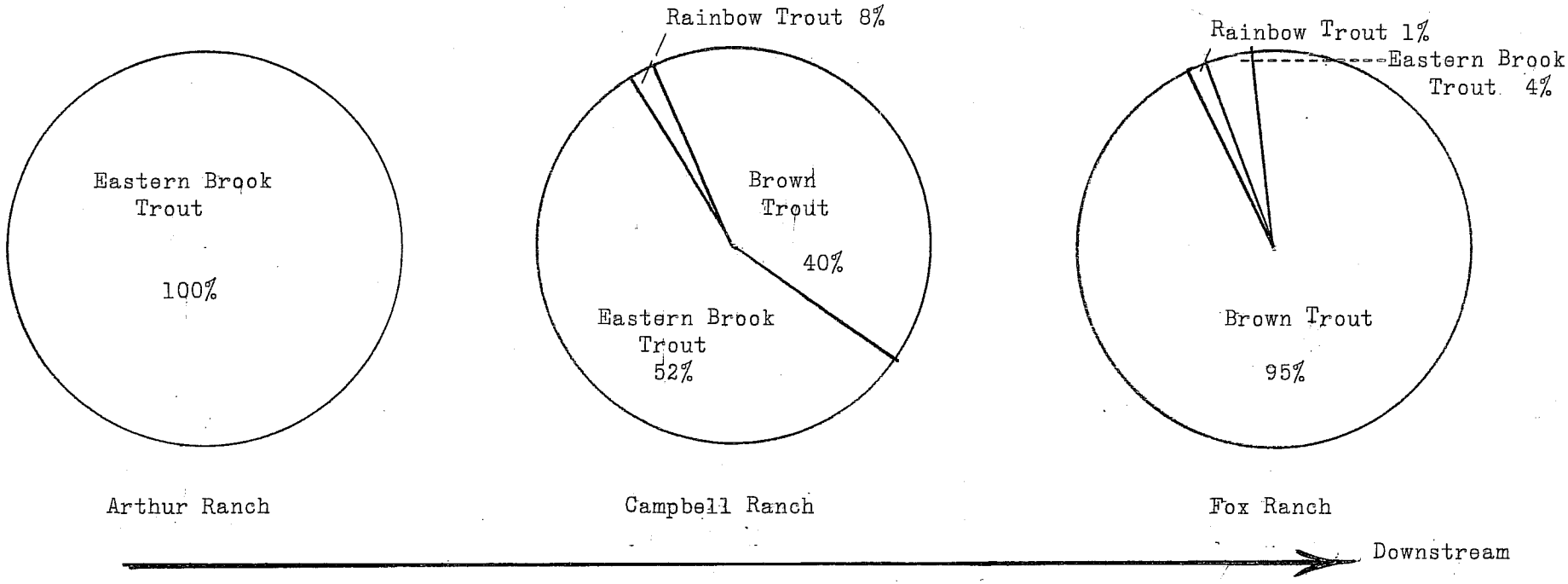


Figure 1. Percent of each species of all game fish recovered from sampled sections of Big Elk Creek, Wheatland County, Montana, Autumn of 1951.

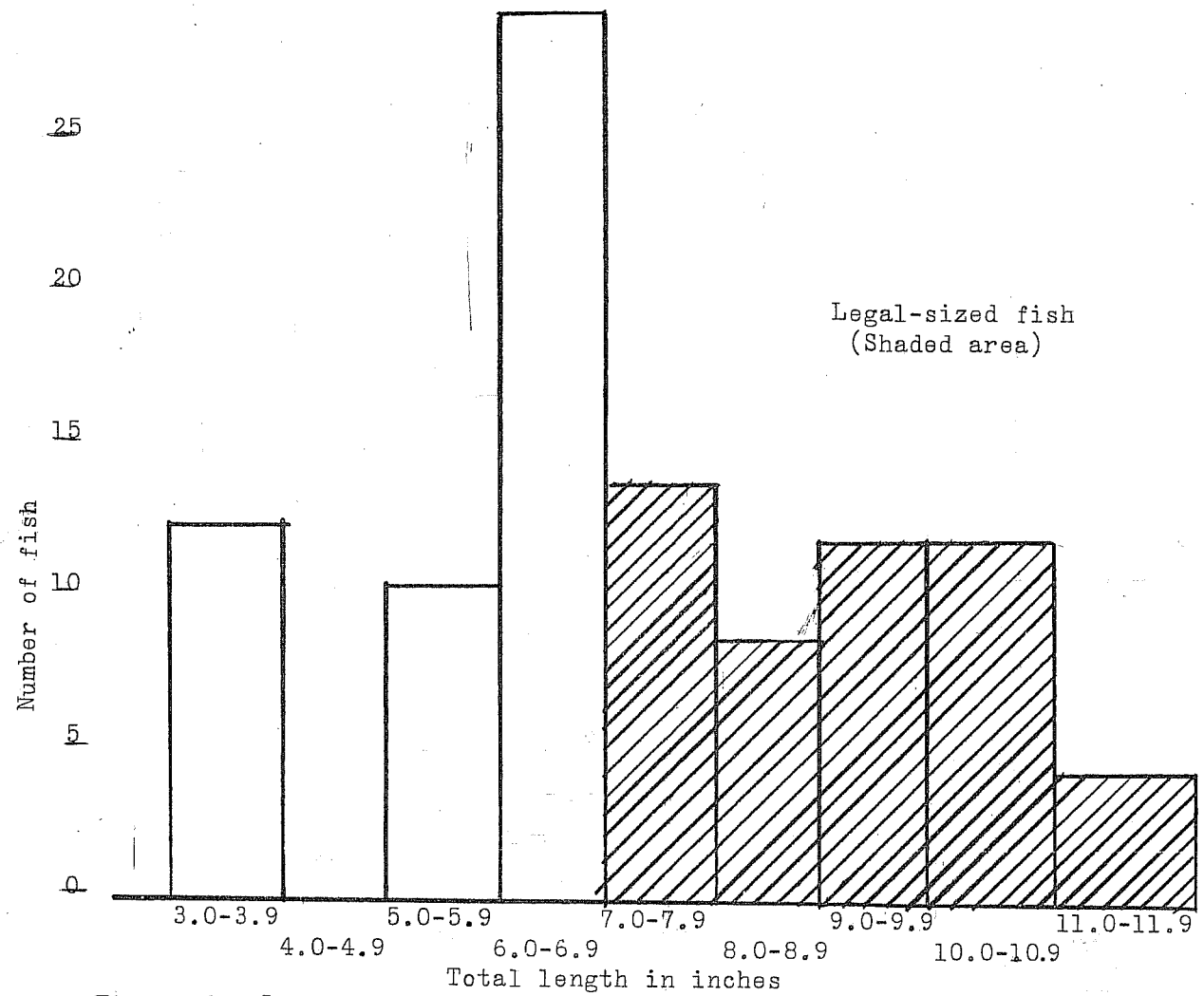


Figure 2. Length frequencies of Brown trout at Fox ranch on Big Elk Creek, Wheatland County, Montana, 1951.

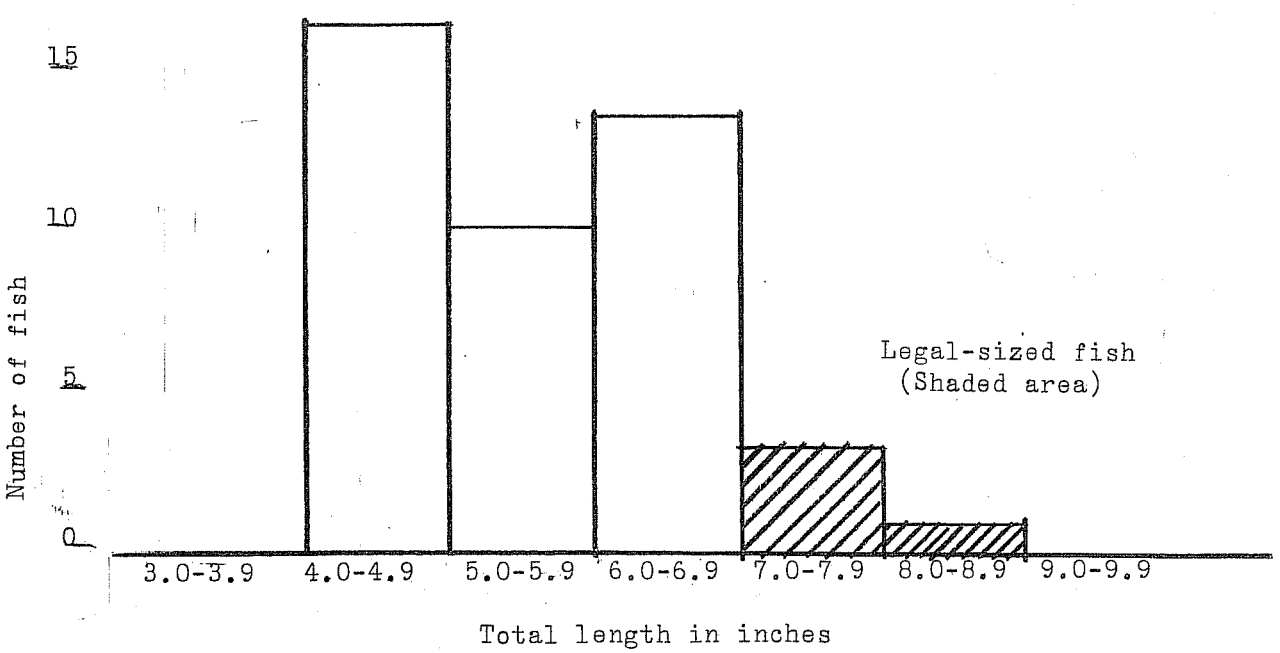


Figure 3. Length frequencies of Eastern Brook trout at Arthur ranch on Big Elk creek, Wheatland County, Montana, 1951.

In this vicinity the calculated number of fish per mile was 880 with less than one-tenth of legal size. There were eighty calculated legals per mile. At the Fox ranch there were 980 calculated legal brown trout, 20 legal brooks and 20 legal rainbow trout making a total of 1,020 legal-sized fish per mile of stream.

The five year plan of fish distribution and management has called for plantings of 5,000 three-inch Eastern Brook trout per year.

Analysis and Recommendations:

Adequate populations of trout were found in all sections of Big Elk Creek below the canyon. It is therefore recommended that hatchery plants be discontinued until such a time as it is shown to be necessary.

Eastern Brook trout from 4 to 7 inches in total length make up an overwhelming portion of the population in those areas where brook trout are abundant. It is recommended that the minimum size limit be removed on Eastern Brook trout in Big Elk creek.

Summary:

Several sections of Big Elk Creek were sampled with an electric shocker in order to determine the fish populations present.

It was found that lower Big Elk Creek contains substantial numbers of both legal-sized and sublegal Brown trout. The population grades into Eastern Brook trout progressively upstream and in the upper portion below the canyon this species is found almost exclusively. Above the crossing in the canyon the stream was found to be nearly barren of fish.

Data and Reports:

The original data is with the fisheries biologist at Belt, Montana.

Prepared by Nels A. Thoreson Approved by P. W. Lambert

Date March 18, 1952

JOB COMPLETION REPORT

INVESTIGATIONS PROJECTS

State of Montana

Project No. F-5-R-1 Work Plan No. VII Job No. VII-B

Title of Job: Population Surveys of Streams Within the Project Area.

Objectives:

In order to effect or sustain proper management of waters from a fishery standpoint it is desirable to have information regarding the existing fish populations. The objective of this study was to gather data from several streams in the project area in an effort to obtain information needed in management.

Techniques Used:

Sampling was done with an electric shocking device and each 300 foot section was blocked off with 1/2-inch, square mesh nets. All fish were weighed and measured and scale samples were taken from a high percentage of each species.

In order to expedite the job and work as many streams as possible the sampling sections were chosen by merely driving to the streams at the lower, middle and upper ends and shocking a section in each of these locations.

Findings:

Judith River.
The origin of the Judith River is in the Little Belt Mountains. From the junction of the South Fork and the Middle Fork the river flows north and east approximately eighty-five miles and empties into the Missouri river in northern Fergus county. The mouth of the Judith is not far distant from Fort Peck reservoir. The influence of the reservoir on the fishery of the Judith river has not yet been studied.

The five-year plan of fish distribution and management calls for 25,000 yearling Rainbow trout to be planted above Utica and 15,000 three-inch Brown trout to be planted below the Hobson bridge each year. Other plants are listed for tributary streams.

Three sections were sampled in the Judith river during the latter part of August 1951. The findings are listed in table 1.

Table 1. Fish populations found in sampled sections of the Judith River, Judith Basin county, Montana, Autumn of 1951.*

Sections	Rainbow trout			Cutthroat trout			Whitefish			Suckers
	Sublegal	Legal	Total	Sublegal	Legal	Total	Sublegal	Legal	Total	Total
Near Utica	21	17	38	0	0	0	20	5	25	175
Calculated number per mile	420	340	760	0	0	0	400	100	500	3,500
Flanigan's Park	9	7	16	0	0	0	0	0	0	0
Calculated number per mile	180	140	320	0	0	0	0	0	0	0
South Fork	0	9	9	1	0	1	2	0	2	0
Calculated number per mile	0	180	180	20	0	20	40	0	40	0

* In addition to the above fish numerous Sculpins were found in all three sections and in the section at Utica a minnow was found in abundance.

The section sampled near the town of Utica contained a large population of fish, however non-game fish predominated and the game fish of legal size were fewer than in other similar sized streams studied. The non-game fish population contained two species of suckers, sculpins and at least one species of minnow. The sculpin population was high in all three sections that were sampled. There may be suckers and whitefish in the area adjacent to the Flanigan Park section even though none were found in the sampled section. The portion of stream shocked was almost entirely a riffle area and contained no deep holes where both whitefish and suckers would be expected.

Analysis and Recommendations:

Further study of the Judith River is recommended before a sound management plan can be presented.

Summary:

Three sections of the Judith river were sampled with an electric shocker in order to determine the fish populations present.

It was found that the Judith river in the vicinity of Utica contains a large population of non-game fish. In the sections studied rainbow trout, cutthroat trout and whitefish were the only game fish present and none of these were found in average numbers as compared with other similar sized streams within the project area.

Further study is recommended.

Data and Reports:

The original data is with the fisheries biologist at Belt, Montana.

Preapred by Nels A. Thoreson Approved by

Date March 19, 1952