TROUT MIGRATION AND SPAWNING STUDIES ON THE

NORTH FORK DRAINAGE OF THE FLATHEAD RIVER

BY

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INTRODUCTION

Although various fisheries problems have been studied on Flathead Lake, little has been done on the Flathead River which flows into the lake. The South Fork of the Flathead is effectively blocked to spawning runs by Hungry Horse Dam, and a diversion is planned for the Middle Fork. This will leave only the North Fork, on which this study was made, in its natural condition. However, it too may be shut off in time by the proposed Glacier View Dam. In beginning a study in an area for which little information is available, any knowledge of its background is of help in the evaluation and understanding of existing conditions. The survival of an established population in a changing invironment is determined by the degree to which that environment is changed and the ability of the population to adapt itself to those changes. Geological origin influences nutrients which govern productivity; cover controls run-off and temperatures; roads bring accessibility and exploitation; a growing human population bring industry.

During the Proterozoic Era sedimentary deposits were formed in a large, shallow sea covering what is now the Rocky Mountain Region. Compaction of these deposits formed rock layers known as the Belt series. Uplift occurred toward the end of Cretaceous time. Pressure caused a folding of the rock layers and eventually a break along a low-angle fault. The western layer of the fold was driven upward and eastward, about 15 miles in the Glacier Park area, to form the Lewis overthrust. Then the western part of the block broke along a vertical fault and sank several thousand feet. It is on this downfaulted block, covered for a short time by Lake Missoula, that the present valley of the North Fork of the Flathead River lies (Dyson, 1953).

Located in northwestern Montana, the North Fork arises 40 miles north of the Canadian border in southeastern British Columbia, enters Montana at the western boundary of Glacier National Park, and flows south to its confluence with the Middle and South Forks of the Flathead River which empties into the north end of Flathead Lake 100 miles below the Canadian Border. Many tributaries enter the North Fork from the Livingston Range on the east and the Whitefish Mountains on the west.

With an annual precipitation of 20 inches a year (U.S. Department of Agriculture, Yearbook of Agriculture, 1941), the valley of the North Fork is forested by what is primarily a transition forest between the coast and montane climaxes (Weaver and Clements, 1938). Dominant climax species are larch (Larix occidentalis), Douglas Fir (Pseudotsuga taxifolia), Englemann spruce (Picea engelmanni), and yellow pine (Pinus ponderosa). Subclimax stands of lodgepole pine (Pinus contorta) cover extensive burned areas. In 1910 major forest fires working down from Canada burned large areas in the northern part of the valley. Other important fires occurred in 1917, 1919, 1929, and 1936 and burned much of the lower half of the valley and portions of most of the drainages west of the river.

The first homesteaders began settling in the North Fork about 1910 before a road had been built to the upper end of the valley. Those still living in the area recall that large runs of fish came up the river yearly. Cutthroat were abundant in the river and its tributaries, and good fishing was reported from the time the water began to clear in early July until late in the summer at which time most of the fish disappeared. Called "flats" locally, the mature cutthroat, which ranged from 13 to 18 inches long, were caught from early spring until late in the fall. In contrast, the immature "bluebacks", which varied in length from 6 to 10 inches, appeared in large numbers in July and began to disappear in late August.

Dolly Varden were taken through late spring, summer, and fall. Weights ranged up to 34 pounds and 20 to 25-pound fish were common. Although available in numbers, they were not preferred as a food fish, but some were utilized as feed for sled dogs. Winter fishing on the river was unproductive; however, ice fishing on lakes such as Bowman and Kintla apparently produced both cutthroat and Dolly Varden in quantity.

Prospectors explored the valley, but found no minerals present in commercial quantities. Large coal deposits occur above the Canadian border, and small quantities were produced from a Montana mine near Coal Creek, prior to 1942. However, none has been mined since that time. Wildcat drilling for oil began near Kishenehn Creek in 1901, and the Kintla Well was started a few years later. Canadian operations were begun during the same period and continued sporadically at various sites. The most recent drilling was halted in 1953.

A wagon trail from West Glacier to Starvation Creek served as the first road into the region, and in 1911 and 1912 a road was built on the west side of the river from Columbia Falls to Coal Creek. Development of lumbering during the twenties saw the river used for spring log drives. However, these were not always successful, and it was not until a better road was built in the lower part of the valley that logging became important as an industry. Extensive logging operations were not begun until recently, when the entire west road was improved and new roads constructed as a means of harvesting infested spruce trees in the Flathead National Forest.

AIMS OF THE STUDY

When the North Fork of the Flathead River was selected by the Montana Fish and Game Department for a study to begin in 1953, the primary objective was to compare the relative success of boat fishermen with that of anglers not using boats. The years following World War II saw a great increase in the numbers of anglers visiting the North Fork, and many of them began using rubber boats which were available as war surplus. As the fishing grew progressively poorer, the claim was made by sportsmen of the area that the boat fishermen were taking the most and the largest fish and were the major contributing factor in the decline of the supposed fish population. In order to determine the importance of the catch of the boat fishermen and whether his take was selective in relation to size

or age classes of the population harvested, a two-year creel census study was proposed.

The North Fork of the Flathead River is one of the diminishing number of streams in the state which still maintains a population of native trout relatively free of competition with exotics. In order to properly manage any game species, basic biological population information is necessary, very little of which is available on the Flathead races of cutthroat and Dolly Varden. In connection with the creel census study, information was to be obtained, where possible, on size and age classes, age at maturity, spawning dates and locations, and movement or migration. When the state concluded, at the end of the 1953 season, that an additional year's work on the creel census was unnecessary, the following objectives were outlined as the basis for the investigative work during 1954.

1. To establish the pattern of trout population in the North Fork and selected tributaries during the late spring, summer and early fall.

2. To obtain records of populations in selected areas for reference in comparison with future populations.

3. To show changes in population based upon migration and, if possible, to determine the extent of migration.

4. To compare the utilization by fish of streams having a lake at their source with streams which do not.

5. To obtain information on the spawning activities of the cutthroat trout.

6. To obtain information on the spawning activities of the Dolly Varden.

METHODS, PROCEDURE, AND SCHEDULE

To obtain information on migration and the pattern of resident or temporary populations within selected areas, five tools were used: creel census, shocking, weirs, nets and tagging and marking.

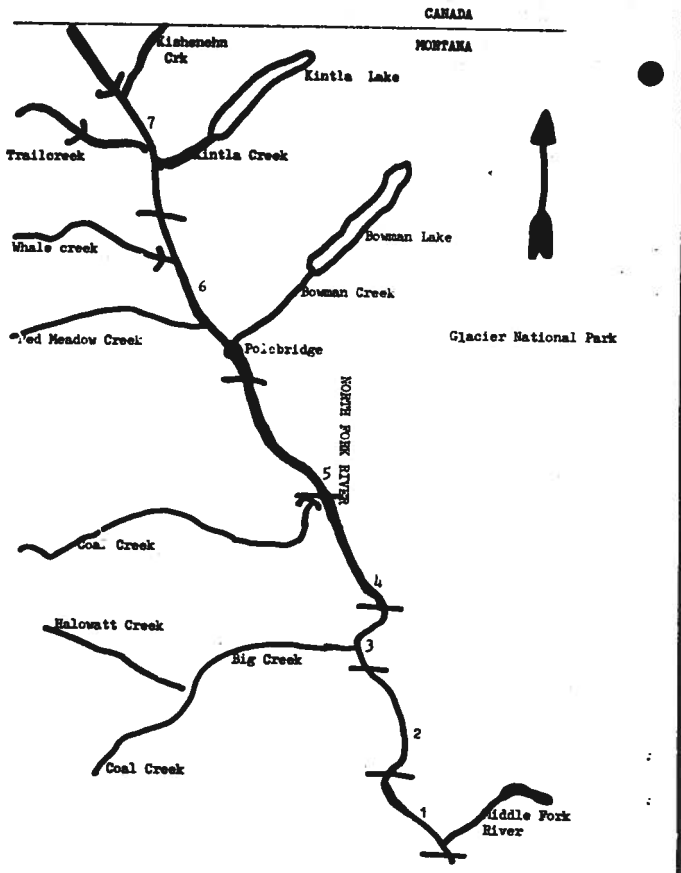
CREEL CENSUS

The North Fork was divided into seven geographic sections (figure 1) for the purpose of showing possible seasonal movement as indicated by a change in fishing success or a change in the size classes of fish throughout the various sections. The area included in the study extended north for 50 miles from the Blankenship Bridge to the Canadian border. A Forest Service road parallels the river on the west, and a Park Service road gives access to one-half of the river on the east side. Patrolling of the river was shared by the writer and one assistant. When angler contacts were made, the following information was recorded: date, stream section, number in party, type of bait, period of day fished, total hours fished, number and average length of each species caught, and angler's home town or state. In addition to direct angler contact, catch information was obtained at the end of the season from dude ranch records. Turbidity and water temperatures were also recorded for possible later correlation with angling success.

A small airplane was used on week-ends and holidays. One round trip was flown in the morning and another in the afternoon. By flying low and rechecking on the return trip it was possible to make accurate counts of both boats and occupants and approximate car counts.

No systematic creel census was conducted in 1954, censusing being conducted only on week-ends or in spare time, and all the information which was obtained by that method was incidental to other work.

Figure 1. Map of the North Fork Drainage of the Flathead River. Only the major tributaries on which work was done are shown. The location of weirs is indicated by arcs.



SHOCKING

The electric shock method as described by Haskell (1940) and Shetter (1948) was used in collecting fish from the stream sections. A portable 2500-watt alternating-current generator providing either 115 or 230-volt current was used by a crew which varied from two to five men. In the absence of electrolytes the 230-volt current was selected. Trials in which the 115-volt current was used gave poor returns. Measured 300-foot stream sections in the selected areas were closed off with blocking nets and worked twice with the electrodes. The section was worked upstream from the lower net and the return trip made downstream. When the presence of large fish was anticipated, both runs were started at the upstream net and the electrodes worked with the current.

Although no shocking program was outlined for 1953, two streams were shocked in late September of that year. One section was shocked on Trailcreek on September 21 and one at the mouth of Kintla Creek on the following day. For 1954, a regular schedule was planned (see Table 1). Selected areas on major streams were to be shocked at monthly intervals throughout the season. Additional shocking would be done when spawning fish were present in the streams. Bowman and Kintla Creeks were chosen as those streams having a lake at their source. Big Creek, Halowatt Creek, Red Meadow Creek, Whale Creek, and Trailcreek (all on the west side) were streams which did not come from lakes. Because of a record snowfall during the winter of 1953-1954 combined with a late spring, runoff lasted longer than for normal years (Figure 2). Those streams which had been selected for shocking carried such a heavy volume of water that it was the end of July before the first work on them could begin. Therefore, as an early-season substitute for the planned program, other smaller streams were shocked one or more times (Table VI) Both Kintla and Bowman Creeks remained at a high level throughout the season, and it was the middle of August before the slow water at the upper end of Bowman Creek could be shocked. No work could be done on the rest of the stream or on any part of Kintla Creek which was still too high to wade in late September.

TAGGING AND MARKING

After being stunned by the current from the electrodes, fish were picked up in a dip net and placed in holding cages. They were then anesthetized in a 0.5 percent solution of urethane (Gerking, 1949). Total lengths to the nearest 0.1 of an inch and weights to the nearest 0.01 of a pound were recorded. Large fish were weighed to the nearest 0.1 of a pound. All fish were either tagged or fin-clipped before release in the area from which they were taken.

Small fish from streams which were shocked only once were marked by clipping both pelvic fins. In streams where shocking was to be repeated, marking consisted of removal of the right pelvic fin in July, removal of the left pelvic fin in August, and removal of both pelvic fins in September. All fish over seven inches long were marked with serially-numbered monel-metal strap tags similar to those described by Shetter (1936) and Rounsefell and Kask (1945). Tags were available in three sizes: 4, 180 and large (Cattle ear tags) as manufactured by the National Band and Tag Company of Newport, Kentucky. They were applied by clamping around the left dentary and then rounded with a pliers to provide for maximum growth without compression of tissue. Scales were collected from a selected sample of both

TABLE I

PROPOSED SCHEDULE OF SHOCKING

Stream	June		July		August		September	
	14-15	16-19	1-2	3,5-7	2-3	4-7	7-8	1-
Langford Creek	x		x					
Halowatt Creek	x		x		x		x	
Big Creek	x		x		x		x	
Red Meadow Creek		x		x		x		x
Whale Creek		x		x		x		x
Trail Creek		x		x		x		x
Bowman Creek		x		x		x		x
Kintla Creek		x		x		x		x

One section on Langford Creek to be shocked; two or three sections on all

cutthroat and Dolly Varden of various sizes so that age determinations could be made. In order to tag as many cutthroat as possible, those fish caught by fly-fishing in spare time and on week ends were also tagged and released.

WEIRS

When work on the 1953 creel census had progressed far enough through the season so that results were becoming apparent, plans for the following year's work were modified to minimize creel census and concentrate on population and migration investigations. In order to make the best use of the time remaining in 1953, arrangements were made to begin a tagging program. Efficient two-way weirs are one of the best means of obtaining information on the migration of fish, particularly when the period of time over which the work can be carried out is limited. Data are obtained at once from fish moving through the weir and further supplemented if the fish are tagged and returns are obtained.

Equipment available for the construction of weirs consisted of metal racks four feet square with the vertical bars spaced one inch apart and of three by four foot racks with a spacing of 3/4 inch. Steel channel fence posts, one for each rack, were used in anchoring the weir. The materials were not acquired until October 1, 1953, at which time a weir was immediately built on Trailcreek. On October 2, all remaining grates were used to block fish movement in Whale Creek. The Trailcreek weir was moved to Whale Creek on October 4. An additional supply of racks was obtained later in the month, and all equipment was used to construct a one-way weir on the 150-foot wide North Fork, one mile above the mouth of Kishenehn Creek. Eighty-four feet of racks were available. The weir was constructed to catch downstream migrants only, and a rock barrier was built to the racks from both shore lines in order to block fish movement except through the weir. Tables XIII and XIV give the location and operation of the weirs on the North Fork and tributaries for both 1953 and 1954.

Based upon information obtained from the use of weirs in 1953, the program for 1954 was planned to include the use of weirs on more streams and over a longer period of time than had been possible in 1953. Material for the construction of additional racks was budgeted for 1954 with this in mind. The operation of weirs was curtailed because of lack of help necessary for maintenance and because of the necessity for personnel from the North Fork to help with projects in other areas. However, weirs were utilized in 1954 on two streams, Coal Creek and Trailcreek, as shown in Table XIV.

FYKE AND GILL NETS

Both fyke and gill nets were used in an attempt to obtain trout to tag. A fyke net 16 feet long and six feet in diameter was constructed of 3/4 inch pipe and covered with one-inch mesh wire fencing. The net was placed in the lower Flathead River for a total of 39 days (Table XV) between August and December, 1954. The mouth of the net was pointed upstream for seven days and downstream the rest of the time. Five gill net sets were made on the lower Flathead River near Creston in November, 1954 (Table II). These sets were checked twice daily.

TABLE II

GRADUATED GILL NET SETS ON THE LOWER FLATHEAD RIVER AND FLATHEAD LAKE IN 1954 AND 1955

Location	Date Lifted	Net Size feet	No. of Cutthroat	No. Dolly Varden
Delta*	8/12/54	12 x 450		4
Delta*	8/19/54	12 x 450		
Delta*	8/19/54	6 x 450		1
Yellow Bay*	8/20/54	12 x 450		1
Creston Dike	11/ 2/54	5 x 250		
Creston Dike	11/ 3/54	5 x 250	1	
Creston Dike	11/ 4/54	5 x 250		1
Creston Dike	11/ 5/54	5 x 250		1
Creston Dike	11/ 6/54	5 x 250		
Yellow Bay*	11/22/54	12 x 150		3
Yellow Bay*	11/22/54	12 x 300		10
Holt*	12/13/54	6 x 450	1	1
Yellow Bay*	12/13/54	12 x 450		12
Yellow Bay*	1/29/54 55	6 x 450		2
Yellow Bay*	1/29/54 55	12 x 450		2
Cliff Rocks*	3/18/54 55	6 x 450		1
Cliff Rocks*	3/18/54 55	12 x 450		

* Net sets made in cooperation with Brunson

RECOVERY OF TAGGED AND MARKED FISH

Recovery was effected by the use of weirs, electric shocker, gill net sets (Table II), and voluntary returns by anglers.

RESULTS

CREEL CENSUS

When the fishing season opened on May 17, 1953, the North Fork was high and turbid (a normal condition). The peak of the spring run-off was reached between June 4 and 13th (Figure 3), but cool weather and rain kept the river high until the middle of July. The usual high-water peak occurs toward the end of May with the river clearing and dropping by the fourth of July. The best fishing of the season, normally, is supposed to be had through the rest of that month. However, the highest catch per hour for all fishermen in 1953 occurred in August (Table III), although the boat fishermen had their best luck in June and July.

The fish taken during the season by the anglers were cutthroat trout (Salmo clarkii), Dolly Varden (Salvelinus malma), rainbow trout (Salmo gairdneri), and Rocky Mountain whitefish (Prosopium williamsoni). Table IV shows the monthly catch composition and totals for the season. Cutthroat comprised from 75-90 percent of the total catch from the opening of the season until the end of August and showed a season total of 83.3 percent. However, it is significant that no cutthroat were taken after the first of September. The Dolly Varden formed 19.5 percent of the catch in June when 39 fish were caught, but only twice as many were taken in July when the number of fishermen on the river was greater than for all the rest of the season combined. Over one-half of all the fish caught were taken during July. Whitefish were unimportant until September and October at which time they constituted a major part of the catch of the few anglers on the river. Only seven rainbow trout were reported for the season.

The total number of anglers checked was 1,375. They fished a total of 5,829 hours and caught 2,597 fish, or an average of .45 fish per hour. The total number of cutthroat caught was 2,164 fish with an average length of 8.5 inches. Dolly Varden totaled 165 fish and averaged 24.3 inches.

A comparison of the relative success of the boat and the bank fishermen shows that the boats produced the best fishing during June, July and August. Boat fishermen represented 13 percent of the total number of fishermen and took 31 percent (4.3 fish per person on each trip) of all fish taken. They spent 50 percent more time on the river for each fishing trip and took .7 fish per hour, which, though higher than the bank fisherman's .4, is well below the state average of 1.2 fish per hour (Phenicie and Bishop, 1950).

The use of an airplane on week-ends and holidays was of great help in checking on the number of fishermen and the areas in which they were concentrated. Table V shows the number of cars and boats counted during the season. Censusing covered 108 week days and 43 holidays and week-ends.

Figure 3. River depths and water temperatures at Polebridge, 1953. Depth is indicated by the solid line; temperature is shown by the broken line.

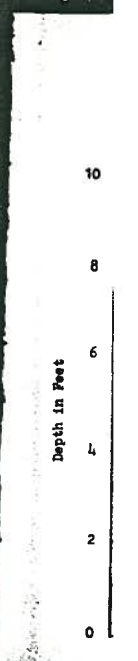


TABLE IV

THE NUMBER OF EACH SPECIES OF GAME FISH CAUGHT BY MONTH WITH AVERAGE LENGTH IN INCHES AND COMPOSITION PERCENTAGE OF THE CREEL ON THE NORTH FORK OF THE FLATHEAD RIVER IN 1953

Month	Dolly Varden	Ave. Length	% of Catch	Cut-throat	Ave. Length	% of Catch	White-fish	Ave. Length	% of Catch
Bank Fishermen									
May	2	24.0	7.3	25	12.0	89.0	1	12.0	3.7
June	32	25.3	20.6	113	9.7	72.4	11	10.0	7.0
July *	58	26.4	6.1	830	8.6	88.4	49	9.4	5.2
Aug.	23	23.2	3.6	525	7.8	82.0	92	9.8	14.4
Sept.*	1	34.0	5.0	0			15	9.0	75.0
Oct.	3	23.0	6.2	0			45	9.8	93.8
Total	119	25.3	6.5	1,493	8.6	81.4	213	9.7	11.7
Boat Fishermen									
May	0			0			0		
June	7	22.0	16.4	36	8.8	83.6	0		
July	24	22.0	4.6	486	8.3	92.6	14	9.3	2.8
Aug.	14	21.8	7.3	149	8.0	78.0	28	9.3	14.7
Sept.	1	22.0	14.0	0			6	9.0	86.0
Oct.	0			0			0		
Total	46	22.0	6.1	671	8.3	87.6	48	9.2	6.3
Total Bank and Boat Fishermen									
May	2	24.0	7.3	25	12.0	89.0	1	12.0	3.7
June	39	24.4	19.5	149	9.5	75.0	11	10.0	5.5
July **	82	25.3	5.6	1,316	8.5	90.0	63	9.4	4.3
Aug.	37	22.7	4.4	674	7.9	81.0	120	9.7	14.6
Sept.**	2	28.0	7.4	0			21	9.8	77.8
Oct.	3	23.0	6.2	0			45	9.8	93.8
Total	165	24.3	6.4	2,164	8.5	83.3	261	9.5	10.0

* Rainbow trout - July - 3, average length 10.5, 0.3 percent of catch
Sept - 4, average length 12.0, 20.0 percent of catch

**Rainbow trout - July - 3, average length 10.5, 0.1 percent of catch
Sept - 4, average length 12.0, 14.8 percent of catch.

TABLE V

THE NUMBER OF BOATS AND CARS CONTACTED BY MONTHS FOR WEEK DAYS AND FOR WEEK-ENDS AND HOLIDAYS FROM MAY 17 TO OCTOBER 14, 1953, ON THE NORTH FORK OF THE FLATHEAD RIVER

Month	Contacts during week days: Cars	Boats	No. of Fishing Days	Contacts on week-ends & holidays: Cars	Boats	No. of Fishing Days
May*	0	0	11	11(11)**	2(1)**	4
June	36	0	22	27(2)	2(0)	8
July	130	25	23	123(200)	16(19)	8
August	75	10	21	72(74)	10(15)	10
September	4	3	21	6(15)	1(4)	9
October	3	0	10	2	0	4
Total	248	38	108	241(302)	31(39)	43

* Creel census taken on week-ends only
** Car and boat counts made by airplane indicated in parenthesis

Contacts were made with nearly all of the anglers on the river during the week and approximately 80 percent of those fishing on week-ends and holidays. The distribution of anglers was checked while making the census to show possible movement of fish by a change in the catch per hour or size classes within various sections; however, no valid conclusions could be drawn from such information at the conclusion of the study. The distribution of fishermen was affected by road construction on the west side of the river and only a few fishermen fished in the lower sections, except at the Blankenship Bridge, during much of the summer.

Although some creel census information was obtained on the North Fork in 1954, the data are too meager to use in making a comparison of results with 1953. The prolonged high water stage lasted until late in July of 1954, (Figure 2), and fishing was delayed even longer than in the previous year. Records of dude ranches showed, in general, that catches of both cutthroat and Dolly Varden were smaller than in 1953.

The information available from both years indicates that most of the larger cutthroat, fish between 13-18 inches, have disappeared from the river by August. Table IV indicates that the average length of cutthroat showed a monthly decline from 12.0 inches in May to 7.8 inches in August. Cutthroat taken in May and June of 1953 ranged from 8 to 17 inches in length. Of 674 fish taken in August only one large cutthroat, a 17 inch fish, was reported. The other fish ranged between 6-11 inches. This matter will be considered in more detail under Discussion.

SHOCKING IN 1953

Primary objective of shocking in 1953 was to obtain fish for tagging. One 300 foot section in the spawning area on Trailcreek was shocked

on September 21, 1953, and produced four mature Dolly Varden which ranged from 23.2 to 32.2 inches in length. These fish had not yet spawned. In addition to the large fish, nine young Dolly Varden, 4-6 inches long, were taken. The adults were tagged and the immatures were marked by removal of both pelvic fins. On September 22nd, the shocker was used on a section at the mouth of Kintla Creek, but no fish of any kind were taken.

EARLY SEASON SHOCKING, 1954

As a result of the prolonged spring run-off, the proposed program of periodic shocking on the selected larger tributaries was delayed until late in July. Work was begun in the smaller streams which would not wash out the blocking nets and could be waded. All sections were 300 feet long except in a few cases where shocking was not feasible because of fast water or obstructions, and 150-foot sections were used in those. Table VI shows the results obtained on the various streams checked. In streams where more than one section was shocked, letter designations in the table were used to differentiate each section -- "A" representing the section farthest downstream.

Dutch Creek and Ford Creek are tributaries on the Park side of the North Fork. All the other streams are located on the west side of the river between Big Creek and the Canadian border. In shocking a total of 4,650 feet in twelve different streams, 91 cutthroat, 5 Dolly Varden, and 2 brook trout were collected. Of the cutthroat, twelve were mature fish which had spawned; and of these twelve, eleven, taken in Langford Creek in June, appeared to be hatchery yellowstone cutthroat. Those cutthroat taken in section "B" on Bowman Creek were probably hatchery trout also, since Park Service records show that small cutthroat had been planted in Bowman Lake near the outlet earlier in the summer.

PERIODIC SHOCKING, 1954

The results of the periodic shocking of selected areas during July, August, and September are shown in Tables VII through XI. The planned work on Kintla and Bowman Creeks was not accomplished because of water conditions. Reports from anglers indicated that cutthroat were caught in both streams during the month of July, but apparently moved out later in the summer. Delayed until the middle of August by high water conditions, the shocking of two sections on Bowman Creek on August 1st and 17th produced no cutthroat over 5.2 inches long. The partial collapse, during the early summer, of both Polebridge and the Blankenship bridge required a roundabout trip of over 100 miles through Columbia Falls and West Glacier in order to reach the east side of the North Fork. In view of the extra day required of travel time and the apparent lack of cutthroat in Bowman Creek in late summer, work on it was not repeated. Shocking operations on the selected streams on the west side of the river were carried out as completely as water conditions and available help would permit.

Table XII shows the season totals of cutthroat and Dolly Varden collected and recovered by periodic shocking. Only one mature cutthroat was taken by use of the shocker in these streams. No mature Dolly Varden were found in the earliest shocking on all streams, but 14 were taken in three streams after the middle of August. No mature fish were recovered with the shocker. Immature Dolly Varden totaled 235, and 17 were recovered with the

TABLE VI

EARLY SEASON SHOCKING, 1954

Stream	Date	Section length feet	Average width feet	Water temp F.	No. of cutthroat	Average length inches	Range inches
Moose Cr. A	June 22	300	20	41	1	16.0	
Moose Cr. B	July 13	300	18	47	7	5.0	3.0 - 7.0
Langford Cr.	June 23	150	10	48	11	15.5	15.0 -16.5
Ford Cr.	June 24	300	10	44	2	5.0	3.5 - 6.0
Tepee Cr. A	July 6	150	12	46	6	7.5	5.0 - 8.2
Tepee Cr. B	July 8	150	13	47	2	5.0	4.0 - 6.0
Moran Creek	July 8	300	40	45	1	5.0	
Coal Cr. C	July 9	300	8	43	4	6.0	4.2 - 7.1
Coal Creek A	July 22	300	35	45	0		
Coal Cr. B	July 22	300	20	44	4*	7.0	5.1 -10.0
Cyclone Cr.	July 9	300	10	44	2	5.2	4.1 - 6.3
Spruce Cr.	July 13	300	5	48	5**	4.0	2.0 - 7.3
Colts Cr.	July 14	300	13	55	15	5.5	3.2 - 8.1
Hay Cr.	July 20	300	25	47	10	5.5	2.9 - 8.5
Dutch Cr.	July 23	300	18	58	4	4.0	2.2 - 6.5
Bowman Cr. A	Aug. 17	300	60	60	3#	4.7	4.4 - 6.0
Bowman Cr. B	Aug. 16	300	60	60	9##	4.4	3.2 - 5.2

* Two four inch Dolly Varden also taken in this section
** Two six inch brook trout also taken in this section
# Two Dolly Varden (11.0" and 15.8) also taken in this section
One twenty inch Dolly Varden also taken in this section

TABLE VII

PERIODIC SHOCKING OF TRAILCREEK, 1954

Date	Section	Section Length feet	Ave. Width feet	Water Temp. F.	Cutthroat No.	Cutthroat Ave. L. Inches	Cutthroat Ranges Inches	Dolly Varden No.	Dolly Varden Ave.L. Inches	Dolly Varden Range Inches	Dolly Varden Range Inches	Recovery
Aug.20	A	450	40	47	2	10.6	6.0-15.2	17	4.5	3.7	6.3	
								1*	26.2			
July 29	B	150	35	43	0			2	3.9	3.8	4.0	
Aug.20	B	300	30	47	0			1	5.0			
								5*	25.2	24.3	28.8	
Sept.22	B	300	25	44	0			2	4.0	3.0	5.0	
								2*	25.4	22.8	28.0	
July 29	C	300	20	42	1	6.1		6	4.9	4.2	5.5	
Aug.24	C	300	18	43	2	6.8	6.5- 7.0	11	5.0	4.3	5.9	1 D.V.
Sept.21	C	300	15	43	0			10	5.4	3.6	9.8	

* Spawning fish

TABLE VIII

PERIODIC SHOCKING OF WHALE CREEK, 1954

Date	Section	Section length feet	Ave. width feet	Water temp F.	Cutthroat No.	Cutthroat Ave.L. Inches	Cutthroat range Inches	Dolly Varden No.	Dolly Varden Ave.L. Inches	Dolly Varden range Inches	Recovery
July 30	A	300	50	43	0			0			
July 30	B	150	25	42	3	8.3	7.1 - 9.8	0			
Aug.24	B	300	20	44	6	8.5	7.0 -10.0	8	5.8	4.8 - 8.0	
Sept.22	B	150	18	43	4	9.7	8.8 -12.2	9	6.9	5.9 - 9.5	1 D.V.

TABLE IX

PERIODIC SHOCKING OF RED MEADOW CREEK, 1954

Date	Section	Section length feet	Ave. width feet	Water Temp F	Cutthroat No.	Cutthroat Ave.L. Inches	Cutthroat range Inches	Dolly Varden No.	Dolly Varden Ave.L. Inches	Dolly Varden range Inches	Recovery
July 19	A	300	22	46	7	4.7	3.5 - 5.6	7	4.2	3.1 - 5.2	
Aug.18	A	300	18	48	9	5.6	3.8 - 7.5	15	4.2	3.0 - 5.1	1 C.T.
Sept.24	A	300	12	43	6	6.0	4.4 - 7.5	19	4.0	1.8 - 5.7	
Aug. 18	B	300	10	48	6	5.9	5.5 - 6.8	2	5.0	3.6 - 6.4	2 C.T.
Sept.24	B	300	8	43	4	7.5	6.2 - 8.7	3	7.0	6.2 - 8.2	2 D.V.

climax species are larch (Larix occidentalis), Douglas Fir (Pseudotsuca taxifolia), Englemann spruce (Picea encelmanni), and yellow pine (Pinus ponderosa). Subclimax stands of lodgepole pine (Pinus contorta) cover extensive burned areas. In 1910 major forest fires working down from Canada burned large areas in the northern part of the valley. Other important fires occurred in 1917, 1919, 1929, and 1936 and burned much of the lower half of the valley and portions of most of the drainages west of the river.

TABLE X

PERIODIC SHOCKING OF HALOWATT CREEK, 1954

Date	Section	Section Length feet	Ave. Width feet	Water Temp F.	Cutthroat No.	Cutthroat Ave.L. Inches	Cutthroat Range Inches	Dolly Varden No.	Dolly Varden Ave.L. Inches	Dolly Varden Range Inches	Re. covery
July 28	A	300	25	52	4	7.2	4.7 -10.2	11	4.3	3.0 - 6.2	
Aug. 19	A	300	20	50	3	6.3	4.5 - 8.5	15	4.6	2.5 - 8.0	2 D.V.
								1*	23.3		
Sept.23	A	300	18	47	2	6.4	3.0 - 9.8	11	4.2	2.0 - 6.7	1 D.V.
July 28	B	300	20	44	2	5.9	4.8 - 7.0	13	4.5	3.0 - 6.2	
Aug.19	B	300	15	46	2	9.2	8.8 - 9.6	24	4.6	2.4 - 6.1	3 D.V.
Sept.23	B	300	12	46	1	7.7		9	5.3	4.1 - 6.1	2 D.V.

TABLE XI

PERIODIC SHOCKING OF BIG CREEK, 1954

Date	Section	Section Length feet	Ave. Width feet	Water Temp. F.	Cutthroat No.	Cutthroat Ave.L. Inches	Cutthroat Range Inches	Dolly Varden No.	Dolly Varden Ave.L. Inches	Dolly Varden Range Inches	Re. covery
Aug.19	A	300	45	51	3	6.6	4.8 - 7.6	6	5.0	3.7 - 6.6	
Sept.23	A	300	35	48	0			3	5.2	4.2 - 6.6	1 D.V.
July 28	B	300	40	52	0			6	4.1	3.3 - 4.8	
Aug.19	B	300	35	48	2	8.9	7.6 -10.2	11	5.2	3.4 - 6.6	1 D.V.
								1*	22.0		
Sept.23	B	300	30	47	0			6	5.2	3.3 - 6.2	1 D.V.
Sept.23	B	300	30	47	0			2*	24.5	22.0 -27.0	

*Spawning fish

objective was to compare the relative success of boat fishermen with that of anglers not using boats. The years following World War II saw a great increase in the numbers of anglers visiting the North Fork, and many of them began using rubber boats which were available as war surplus. As the fishing grew progressively poorer, the claim was made by sportsmen of the area that the boat fishermen were taking the most and the largest fish and were the major contributing factor in the decline of the supposed fish population. In order to determine the importance of the catch of the boat fishermen and whether his take was selective in relation to size

TABLE XII

SEASON TOTALS OF FISH COLLECTED AND RECOVERED BY PERIODIC SHOCKING, 1954

Stream	Total length shocked (feet)	Number of Cutthroat	Number recovered	No. available for recovery	Number of Dolly Varden	Number recovered	No. available for recovery
Trailcreek	2,100	5*	0	5	67**	1	65
Red Meadow Creek	1,500	32	1	22	46	4	24
Whale Creek	900	13	0	9	17	1	8
Big Creek	1,500	5	0	5	35***	3	24
Walowatt Creek	1,800	14	0	11	84****	8	64
Totals	7,800	69	1#	52	249	17#	185

* 1 mature
** 10 mature
*** 3 mature
**** 1 mature
\# All immature fish

possible of 185. Only one cutthroat was recovered of a possible 52. Use of a weir in Trailcreek later in the year gave recovery of one cutthroat and six Dolly Varden tagged while using the shocker.

ONE-WAY WEIRS IN 1953

Results obtained from the use of one-way weirs in 1953 are shown in Table XIII. The first downstream weir was placed in Trailcreek on October 1st. A survey was then made of the Dolly Varden spawning beds located upstream, but few fish were seen, and when only one was taken in the weir in three days it became apparent that the major run had left the stream. The weir was then removed and used in the construction of a down-stream weir on Whale Creek which had had a barrier of grates placed across it on October 2nd. A check of upper Whale Creek on September [illegible] had shown that the Dolly Varden were still present in the spawning area. [illegible]sh were observed in the pools above the weir, but apparently would not enter the weir itself. This difficulty was overcome by using the electric shocker to collect the fish for tagging.

The Whale Creek weir was removed on October 12 after 24 fish had been tagged from the stream. Few new fish had come downstream in the last several days prior to removal of the weir. Additional racks had been obtained and a downstream weir was built on the North Fork one mile above the mouth of Kishenehn Creek. Leaf-fall required regular cleaning of the racks to prevent their washing out. The last daily cleaning was done between nine in the evening and midnight, and it was noticed that the Dolly Varden moved into the trap during that time. They were netted and placed in a holding cage until morning at which time they were tagged and released. No difficulty was experienced in having fish avoid the weir at night; however, no fish were ever present in the holding pool in the morning when the weir was checked. If fish did come in after midnight, they found their way back upstream again by daylight. This was noted many times in the whitefish, which might number fifty fish in the holding pool at midnight, but no more than five or six would still be there on the following day.

During the nineteen days that the trap was operated on the North Fork, only twelve Dolly Varden were taken. These straggled in, one or two fish being taken on some nights, none on others. The last fish taken was a ripe female netted at night while she was fighting the current on the downstream side of the weir in an attempt to find her way upstream. Only two seven inch cutthroat were taken. Shetter (1938), in a study on a Michigan stream, mentioned that racks having 3/8 inch spacing between the vertical bars were necessary to hold six inch fish. However, because of the comparatively fast current at the site of the weir, the 3/4 inch and 1 inch spacing on the racks used was effective in stopping whitefish as small as five inches.

A three-day rain at the end of October caused the weir to wash out on November 1, 1953. It was not rebuilt because the materials were then required for use in another part of the district. During the month of October, 36 Dolly Varden and 2 cutthroat had been taken in the downstream weirs, and 1 Dolly Varden was taken while traveling upstream. Of the Dolly Varden, 16 were females and 21 were males. Total lengths ranged from 21.8 inches to 32.5 inches, and weights varied between 3.0 and 10.5 pounds.

TABLE XIII

RESULTS OBTAINED FROM THE OPERATION OF ONE-WAY WEIRS IN 1953

Location	Date installed	Date removed	Total days	Number of cutthroat	No. of Male Dolly Varden	No. of female Dolly Varden	Total Dolly Varden
Trailcreek	Oct. 1	Oct. 4	3	0	1	0	1
Whale Creek	Oct. 2	Oct. 12	10	0	15	9	24
North Fork	Oct. 13	Nov. 1	19	2	5	7*	12
Totals			32	2**	21	16	37

* One ripe female traveling upstream
** Both seven inches long

TABLE XIV

RESULTS OBTAINED FROM THE OPERATION OF TWO-WAY WEIRS IN 1954

Location	Date installed	Date removed	Total days	Cutthroat Direction downstream	Cutthroat Direction upstream	Total cutthroat	Dolly Varden Direction downstream (M)	Dolly Varden Direction downstream (F)	Dolly Varden Direction upstream (M)	Dolly Varden Direction upstream (F)	Total Dolly Varden
Coal Creek	July 27	Aug. 2	6	1	0	1	0	0	0	0	0
Coal Creek	Aug. 6	Aug. 25	19	0	0	0	0	1	1	3	5
Trailcreek	Sept. 9	Oct. 12	28	4	0	4	50	68	12	11	141
Total			53	5	0	5	50	69	13	14	146

Note: All Dolly Varden taken in both years were mature fish

0 4 Miles
Scale

and Kask (1945). Tags were available in three sizes: 4, 180 and large (Cattle ear tags) as manufactured by the National Band and Tag Company of Newport, Kentucky. They were applied by clamping around the left dentary and then rounded with a pliers to provide for maximum growth without compression of tissue. Scales were collected from a selected sample of both

TWO-WAY WEIRS IN 1954

Table XIV shows the results obtained from the operation of two-way weirs in Coal Creek and in Trailcreek. The Coal Creek weir was in operation for a total of 25 days (excluding the four-day period in early August when the crew was working on another project and the weir was removed), and took one cutthroat and one Dolly Varden moving downstream. The Dolly Varden, taken on August 23, was a small female which had completed spawning. One male and three female Dolly Varden were taken while moving upstream.

The Trailcreek weir was in operation from September 9 to October 12, 1954. During that period four cutthroat moved downstream, 118 Dolly Varden moved downstream, 23 Dolly Varden moved upstream, and four of the latter returned downstream after spawning. Of the Dolly Varden moving downstream, six were fish which had been collected with the electric shocker and tagged prior to their departure from the spawning grounds. One of the cutthroat had also been collected with the shocker and tagged earlier in the season. The spent Dolly Varden ranged from 19.3 to 34.3 inches long, and weights varied from 1.9 to 15.0 pounds.

Although the ripe fish would enter the upstream trap either at night or during the day, the downstream fish seldom entered the trap during the day, and it was necessary to remove them from the holding pen at night and place them in a live box until the following morning. Fish would arrive between eight and ten in the evening, with few appearing later.

The weir was removed on October 12, 1954, to be used on another project, and no further work was done on the North Fork that year.

FYKE AND GILL NET SETS, 1954

A fyke net was operated on the lower Flathead River for a total of 39 days in 1954 (Table XV). The net was located at Foy's Bend in late August and and early September and at the Creston dike in September, October, and November. The mouth of the net faced upstream for seven days and downstream for 32 days. Distance from shore ranged from 50 to 150 feet and depths of the set varied between 8 and 40 feet. Although cutthroat frequently were taken by anglers in the region of the dike in October and early November, none was taken in the fyke net. The only trout taken by the net were one 20 inch Dolly Varden caught on October 26th and a 17 inch rainbow trout caught on November 9th. Other fish taken were represented by squawfish, Columbia River chub, suckers, Kokanee, and Rocky Mountain whitefish. Chubs and kokanee comprised the major portion of the catch.

Gill nets were set in the lower Flathead River and in Flathead Lake during the last half of 1954 and the early part of 1955. The locations, dates, and catch of Dolly Varden and cutthroat are summarized in Table II. In the six net sets made in the lower Flathead River in November and December of 1953, only three Dolly Varden, all immature, were taken. However, net sets in Yellow Bay during that same period showed an apparent concentration of large Dolly Varden which were feeding on the spawning kokanee (Oncorhynchus nerka) present in the bay. Although net sets made in various sections of Flathead Lake during previous years (Brunson, et.al., 1952) would take cutthroat trout occasionally, none was taken in any of

the net sets made in the lake during this study or others set by Brunson since 1953 (Brunson, unpublished). Only two cutthroat were taken in net sets in 1954, and both fish came from nets set in the river.

TAGGING AND MARKING, 1953

The program of tagging and marking cutthroat and Dolly Varden on the North Fork was not begun until the fall of 1953. Table XVI shows the streams worked and the number of Dolly Varden tagged from each. Six male and six female Dolly Varden were collected by shocking and netting in the spawning area on Trailcreek on September 21 and 22. These fish, also tagged and released, were ripe, but had not yet begun to spawn. Nine immature Dolly Varden, three to six inches long, were marked by clipping both pelvic fins.

The one-way weir placed on Whale Creek (Table XIII) in early October took nine spent females and fifteen spent males which were tagged and released downstream. The one-way weir on the North Fork above Kishenehn Creek (Table XIII) took twelve mature Dolly Varden which were tagged and released. Five were spent males, six were spent females, and one a ripe female traveling upstream.

The season total for 1953 was forty-eight Dolly Varden tagged and nine fin-clipped. No cutthroat were tagged.

TAGGING AND MARKING, 1954

A total of 99 cutthroat was tagged and released during 1954. Table XVII shows the location, date, method used, number of fish, average length of fish tagged. Of the various methods used, fly-fishing produced the most fish with the least effort. However, little spare time was available during the period when fishing was productive, and only 54 fish were taken in that manner. Shocking produced 41; three entered a weir, and one was taken, uninjured, in a gill net set on the lower Flathead River.

Table XVIII shows the Dolly Varden tagged during 1954. Only one was taken by fishing, and no attempt was made to take more by that method since it was known from previous experience that these fish could be taken more successfully in weirs placed in the spawning streams. Of the 150 mature fish tagged during the year, 17 were collected by shocking, and 132 were taken in two-way weirs. Seven immature Dolly Varden were also tagged. Five were taken while shocking in the tributaries, and two from the lower Flathead River were caught in fyke and gill net sets.

In order to obtain as much information as possible, all fish too small to tag were marked by fin-clipping (Table XIX). A total of 88 cutthroat and 212 Dolly Varden was marked in this manner. All of these fish were collected by shocking.

RECOVERY OF TAGGED AND MARKED FISH

In the five streams which were shocked periodically during 1954, 3 cutthroat and 15 Dolly Varden had been recovered by the time the final

TABLE XV MISSING

BRUNSON n.d. Species summary has net set data in Table XV

... two or three sections on all other streams

1954

Depth feet	Dist. from shore(ft.)
40	150
40	150
25	100
25	100
25	100
40	150
40	150
8	50
8	50
8	50
8	50
8	50
8	50
8	50
8	50
8	50
8	50
8	50
8	50
30	100

n all others

TABLE XVI

RECORD OF DOLLY VARDEN TAGGED IN 1953

Location	Inclusive dates	Method	Males	Females	Total	Ave.length inches	Range inches
Trailcreek	Sept. 21-Sept.22	shocking, netting	6	6	12	28.4	23.2 - 33.2
Whale Creek	Oct. 2 - Oct. 12	one-way weir	15	9	24	25.2	21.8 - 32.5
North Fork	Oct. 13- Nov. 1	one-way weir	5	7	12	27.5	22.5 - 31.0
Total			26	22	48	26.5	21.8 - 33.3

Location	Dat
Langford Cr.	June 17
Moose Cr.	June 22
Ford Cr.	June 24
Tepee Cr.	July 6
Yakinikak Cr.	July 7
Colts Cr.	July 14
Logging Cr.	July 12
Quartz Cr.	July 16
North Fork	July 11-
Hay Cr.	July 20
Halowatt Cr.	July 28-
Coal Cr.	July 22
Whale Cr.	July 30-
Red Meadow Cr.	Aug. 18-
Big Creek	Aug. 19-
Trail Creek	Aug. 20
Trail Creek	Sept. 30
Creston Dike	Nov. 11

TABLE XVII

RECORD OF CUTTHROAT TAGGED IN 1954

Location	Dates	Method	Number	Ave. length inches	Range inches
Langford Cr.	June 17, 23	netting & shocking	6	10.0	7.0 - 16.5
Moose Cr.	June 22	shocking	1	16.0	
Ford Cr.	June 24	shocking	1	6.0	
Tepee Cr.	July 6	shocking	3	7.3	6.8 - 8.2
Yakinikak Cr.	July 7	fishing	1	8.0	
Colts Cr.	July 14	shocking	1	7.7	
Logging Cr.	July 12	fishing	4	11.1	10.5 - 12.0
Quarts Cr.	July 16	fishing	15	11.5	7.5 - 13.0
North Fork	July 11-Aug.8	fishing	34	9.1	7.0 - 20.7
Hay Cr.	July 20	shocking	1	8.5	
Halowatt Cr.	July 28-Aug.19	shocking	8	8.7	7.0 - 10.2
Coal Cr.	July 22	shocking	2	8.8	7.5 - 10.0
Whale Cr.	July 30-Sept.22	shocking	10	9.2	7.0 - 12.2
Red Meadow Cr.	Aug. 18-Sept.24	shocking	4	8.2	7.4 - 8.7
Big Creek	Aug. 19-Sept.23	shocking	3	8.2	7.6 - 10.2
Trail Creek	Aug. 20	shocking	1	15.2	
Trail Creek	Sept.30	weir	3	14.9	14.6 - 15.1
Creston Dike	Nov. 11	gill net	1	14.8	

and November, 1954. The mouth of the net was pointed upstream for seven days and downstream the rest of the time. Five gill net sets were made on the lower Flathead River near Creston in November, 1954 (Table II). These sets were checked twice daily.

TABLE XVIII

ADULT AND IMMATURE DOLLY VARDEN TAGGED IN 1954

Location	Dates	Method	No. Mature Males	No. Mature Females	Total	Ave. L Inches	No. Immature	Ave. L Inches
North Fork	8/8	fishing			1*	23.3		
Coal Cr.	8/8-23	two-way weir	1	4	5	25.7		
Bowman Cr.	8/16	shocking					1	15.8
Halowatt Cr.	8/19	shocking	1		1	23.3	1	8.0
Big Cr.	8/19-9/23	shocking	1	2	3	23.6		
Whale Cr.	8/24	shocking					1	8.0
Trailcreek	8/20-9/22	shocking	5	8	13	26.6	1	9.8
Trailcreek	9/12-10/14	two-way weir	54	73	127	27.4		
Red Meadow Cr.	9/24						1	8.2
Lower Flathead River	10/26-11/4	fyke and gill net					2	18.5
Totals			62	87	150	27.1	7	12.4

* Sex undetermined

The use of an airplane on week-ends and holidays was of great help in checking on the number of fishermen and the areas in which they were concentrated. Table V shows the number of cars and boats counted during the season. Censusing covered 108 week days and 43 holidays and week-ends.

TABLE XIX

IMMATURE DOLLY VARDEN AND CUTTHROAT FIN-CLIPPED IN 1954

Location	Dates	No. of Cutthroat	Ave.L Inches	No. of Dolly Varden	Ave.L Inches
Moose Creek	July 13	6	4.8		
Spruce Creek	July 13	3	4.2		
Ford Creek	June 24	1	3.5		
Tepee Creek	July 6-8	5	5.6		
Moran Creek	July 8	1	5.0		
Coal Creek	July 9	4	6.0	2	4.0
Cyclone Creek	July 9	2	5.2		
Colts Creek	July 14	14	5.5		
Hay Creek	July 20	9	4.5		
Dutch Creek	July 23	4	3.0		
Red Meadow Creek	July 19-Sept.24	27	5.8	44	4.2
Halowatt Creek	July 28-Sept.23	6	6.2	74	4.4
Big Creek	July 28-Sept.23	2	6.1	29	5.2
Trailcreek	July 29-Sept.22	4	6.3	48	4.6
Whale Creek	July 30-Sept.22			15	6.2

TABLE XX

RECOVERY BY SHOCKING OF TAGGED AND MARKED FISH, 1954

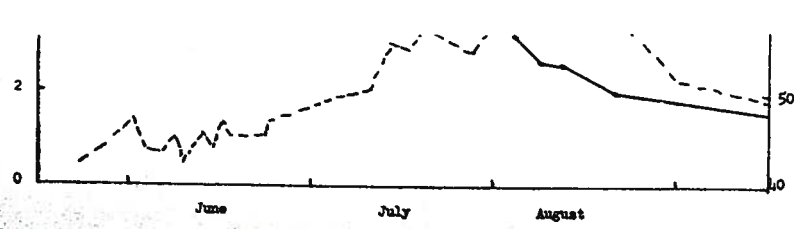
Stream	No.Cutthroat recovered	Number possible	No.Dolly Varden recovered	Number possible
Trailcreek	0	5	1	54
Whale Creek	0	6	1	9
Red Meadow Cr.	3	19	2	22
Halowatt Cr.	0	11	8	56
Big Creek	0	5	3	21
Total	3	46	15	162

Table XXI

RECOVERY OF TAGGED CUTTHROAT TROUT, 1954

No.	Date Tagged	Length Inch	Location	Date Recovered	Length Inch	Location
1145*	7/6	8.2	Teepee Cr.	Late July		Teepee Cr.
1184*	7/7	8.0	Yakinikak Cr.	Late July		Yakinikak Cr.
50536**	7/11	20.7	Mouth Moose Cr.	July 12	20.7	In North Fork
1186	7/12	10.5	Logging Cr.	July 19	10.5	Logging Cr.
1200	7/16	13.0	Quartz Cr.	Aug.28	13.0	L. Quartz L.
211	7/16	13.0	Quartz Cr.	Sept.14	13.0	L. Quartz L.
214*	7/20	10.5	Mouth Whale Cr.	Early Aug.		Mouth Whale Cr.
260	8/18	7.5	Red Meadow Cr.	Sept.24	7.5	Red Meadow Cr.
50541	8/20	15.2	Trailcreek	Sept.15	15.2	Trailcreek weir

* from local information; tags not turned in.
** recovered two miles downstream



Total	2,597	558	1,375	2.5	5,829	0.45

shocking was completed. Assuming possible movement between sections on the individual streams, but no movement between streams, the number of marked or tagged cutthroat available for recovery was 46, and the number of Dolly Varden possible was 162 (Table XX).

Of the 46 cutthroat available in the streams, 16 were tagged, and one of the three recoveries was a tagged fish which had been collected in the same section the previous month. Of the 162 Dolly Varden, 16 were tagged fish; however, all recoveries from shocking were fin-clipped fish. Fish marked in July were recovered in August, and fish marked in August were recovered in September, but no fish were taken two months after marking.

Of the 99 cutthroat tagged in 1954, information on four was received from tags sent to the Montana Fish and Game Department; one was recovered by shocking; one entered the Trailcreek weir, and three were known to have been caught by anglers who did not send the tags to Helena (Table XXI). Recoveries showed little movement of fish from the time of tagging, and five were taken in the same general area in which they had been tagged. The fish showing the greatest movement was a 20.7 inch cutthroat tagged at the mouth of Moose Creek on July 12, 1954. It was caught two miles down river on the following day. No recoveries were reported after September 1954.

Nine tagged Dolly Varden were recovered in a two-way weir operated on Trailcreek in the fall of 1954 (Table XXII). Three were tagged while moving upstream through the weir and were recovered on their return trip. Total time spent above the weir ranged from one to three weeks. Weight loss and spent condition showed that these three fish had spawned during that period. The other six recoveries were from eight mature Dolly Varden collected and tagged while using the shocker on upper Trailcreek in August and September.

Seven fish tagged on the North Fork by the writer (Table XXIII) were recovered in various parts of the lake and support the theory that the Dolly Varden migrate from the upper North Fork to the Flathead Lake. Recovery of a Dolly Varden tagged on Trailcreek in the fall of 1952 (the only fish tagged that year) was made in the lake early in 1953 by a fisherman. This fish was tagged by Frank Stefanich, Fisheries Biologist employed by the Montana Fish and Game Department (personal correspondence). Of the 48 Dolly Varden tagged in the fall of 1953, one recovery was reported from Flathead Lake on November 17th of that year, one month after the fish had been tagged. No other Dolly Varden tagged in 1953 have been reported. The six tags recovered during the winter of 1954-1955 were all from fish tagged in Trailcreek in the fall of 1954.

ACE, GROWTH AND MATURITY

In order to determine the age classes represented by the spawning population of cutthroat and Dolly Varden and the classes represented by the immature populations of both, a randomly selected scale sample was collected from fish of all available size classes. The scales were read with the aid of a microprojection machine, and, assuming a linear relationship between the anterior scale radius and the total length of the fish, calculated lengths were determined with a nomograph (Hile, 1950; Joeris, 1950; Lowry, 1951). This work was done at Montana State College in Bozeman,

TABLE XXII

RECOVERY OF TAGGED DOLLY VARDEN AT THE TRAILCREEK WEIR IN 1954

Tag No.	Date tagged	Location tagged	sex	Length inches	Weight pounds	Date recovered	Length inches	Weight pounds	Weight loss
F7-105	Aug. 20	Upper Trailcreek	F	26.8	7.5	Oct.4*			
F7-107	Aug.20	Upper Trailcreek	F	27.0	7.5	Oct.3	27.0	6.8	.7**
F7-109	Aug.20	Upper Trailcreek	F	28.8	8.8	Sept.19	28.8	7.5	1.3
F7-116	Sept.14	Upper Trailcreek(W)	M	32.0	12.0	Oct.5	32.0	10.8	1.2
F7-117	Sept.14	Trailcreek weir	F	31.0	12.8	Sept.21	31.0	10.3	2.5
F7-140	Sept.20	Trailcreek weir	F	26.8	7.5	Sept.29	26.8	6.4	1.1
F7-150	Sept.21	Upper Trailcreek	F	27.0	6.0	Sept.26	27.0	5.5	.5
F7-158	Sept.22	Upper Trailcreek	M	32.5	12.5	Oct. 4	32.5	11.4	1.1
F7-159	Sept.22	Upper Trailcreek	F	26.5	5.8	Oct. 1	26.5	5.3	.5

* Fish taken at weir by poachers who left tag only.
** This fish had not spawned because of injury to the spinal column when collected with the shocker in August.

mation occurred in the late spring. Annulus formation in the lake trout (Salvelinus nemaycush) is arbitrarily fixed at May 1st by Kennedy (1954).

Increment	3.4	2.8	3.8	2.9	2.8

SUMMARY

1. A creel census was carried out on the North Fork in 1953, to show the fish population pattern as determined from the fisherman's catch. Little variation of the 8.5 inch average length (Range: 6.0-20.5 inches) of all cutthroat taken was found throughout the length of the river which was studied. Average size was highest early in the season. The average length of all Dolly Varden caught was 23.3 inches (range: 19.0-34.0 inches). Catch per hour was low as compared to the state average. The catch of the boat fishermen was not considered to be the cause of poor fishing.

2. Periodic shocking of tributary streams demonstrated a small population of immature cutthroat and a few spawning cutthroat. Many immature Dolly Varden were present, and mature fish were found during July and August.

3. Use of one-way weirs in 1953 yielded two cutthroat and 36 Dolly Varden, all taken during downstream migration.

4. Fyke and gill net sets in the lower Flathead River yielded one cutthroat and two Dolly Varden for tagging and release. Gill net sets in Flathead Lake yielded one tagged Dolly Varden.

5. Forty-eight Dolly Varden were tagged in 1953. In 1954, 99 cutthroat and 150 Dolly Varden were tagged; 88 cutthroat and 212 Dolly Varden were fin-clipped.

6. Shocking gave recovery of three cutthroat and 15 Dolly Varden. Nine tagged cutthroat were recovered in weirs or by anglers. Nine tagged Dolly Varden were recovered in the Trailcreek weir. Seven tagged Dolly Varden were recovered in Flathead Lake.

7. Mature cutthroat were between three and five years old. The majority of fish caught by anglers was two years old. Mature Dolly Varden were between five and eight years old.

8. Immature cutthroat left the tributaries at the age of two or three years. Immature Dolly Varden left the tributaries at the age of three or four years. The majority of the cutthroat apparently left the North Fork by the end of August.

9. No cutthroat were recovered more than two miles down river from the point of tagging. Seven Dolly Varden traveled over 100 miles and were recovered in Flathead Lake.

10. Cutthroat were observed spawning during the month of June and those caught in the river in early July were spent.

11. A spawning study of the Dolly Varden was conducted in 1953 and 1954. The majority of the fish spawn during the month of September, but some spawning occurs in August and October. Eighteen spawning beds were studied in 1953; 74 spawning beds were studied in 1954. Many beds had spawning fish on them. The spawning act and habits of fish are described.

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Average Length	3.4	4.8	6.2	8.0	16.4	22.8	24.9	30.4	32.0
Range	(3.0-	3.9-	6.0-		15.8-	19.3-	21.8	28.8-	
	(4.0	6.6	6.5		17.0	26.3	27.5	32.5	

	(4.5	8.1	11.5	15.9	21.7	26.2	29.7	
Average Length	3.0	5.9	9.2	13.2	18.0	22.3	27.2	30.7
Increment	3.0	2.9	3.3	4.0	4.8	4.3	4.9	3.5

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