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Job Progress Report

ANNUAL PROGRESS REPORT - EVALUATION OF MITIGATION MEASURES IN FISHER RIVER, WOLF CREEK, AND FORTINE CREEK, 1969 - 1970.

a. Status of Water Quality, Erosion and Fish Populations as Related to Railroad Relocation and Stream Channel Changes.

by

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Reservoir Investigation Project

July 14, 1970

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MONTANA FISH AND GAME DEPARTMENT

FISHERIES DIVISION
JOB PROGRESS REPORT

State Montana

Cooperators Corps of Engineers and Montana Fish and Game

Project Title: Evaluation of Mitigative Measures in Fisher River, Wolf Creek and Fortine Creek

Job Title: Status of water quality, erosion and fish populations as related to road and railroad relocation, July 1, 1969 - June 30, 1970.

ABSTRACT

Erosion from construction activities has increased sediment loads in Wolf Creek from Wolf Creek Junction upstream to approximately 3 miles north of the Fairview Overpass. Considerable erosion is occurring along the railroad right-of-way from the north portal of the Flathead tunnel to below Jim Creek. Riffles and pools of Fortine Creek have been heavily silted by this sediment. The susceptibility of the unconsolidated glacio-lacustrine soils in the two watersheds to erosion has compounded the problem.

Water quality and aquatic insect data are in the process of being collected and analyzed.

Background information concerned with stream morphology was gathered.

Fish populations were sampled in Fortine Creek, Wolf Creek and the Fisher River. Data from Fortine Creek indicated that sediment loading from construction activities is limiting trout production in the vicinity of Swamp Creek. The initial data from meadow sections in Wolf Creek indicate suitable game fish habitat has been produced by meandering the channel through willows in the flood plain. Rainbow trout were more numerous in the natural section in Lower Wolf Creek than in the altered section. On the other hand, suckers were more numerous in the altered section than in the natural section. Fish population data from the Fisher River indicated: (1) suckers are more numerous in the channel changes than in the natural section; (2) mountain whitefish are more numerous in the natural section than in the altered section, and; (3) rainbow and cutthroat trout of a harvestable size are comparatively low in both altered and natural sections.

A spawning run of 1,133 mountain whitefish with a potential fecundity of 1,250,000 eggs was passed through fish traps in the mouth of the Fisher River during October 1969. Thirteen of these fish migrated up as far as 14 miles upstream, but the majority of spawning activity appeared to occur in the lower Fisher River.

INTRODUCTION

The Libby Reservoir project is located on the Kootenai River in northwestern Montana approximately 17 miles north of Libby. The concrete dam will rise 420 feet above bedrock and be 2,900 feet long at the crest. The reservoir will be 90 miles long with a gross storage capacity of 5,850,000 acre-feet. Under normal conditions the pool will fluctuate between elevation 2,459 feet and elevation 2,287 feet; a vertical distance of 172 feet. The powerhouse will eventually house eight generators with a maximum combined discharge of 45,000 cfs.

Initial construction activities occurred in 1965. These included: dam construction, reservoir clearing, relocation of villages, highways and railroads. Relocating the Great Northern Railroad involved the channelization of parts of the Fisher River, Wolf Creek and Fortine Creek into man made stream beds. In addition, the construction activities increased erosion rates in the watersheds by exposing large areas of raw earth.

Changes in the stream environment brought about by construction may be harmful to aquatic life. Whitney and Bailey (1959), Johnson (1964) and Elser (1968) documented the detrimental effect of stream channelization upon fish populations in three Montana trout streams. Silt deposition greatly alters the aquatic environment by blanketing spawning areas, killing bottom organisms and preventing light penetration (Apmann and Oatis, 1965). Long periods of slow accumulation of fine sediment are especially harmful. Cordone and Kelly (1961) summarized "Our failure to recognize that even small amounts of sediment may be harmful, may well result in the gradual destruction of the majority of our streams".

Apmann and Oatis (1965) pointed out that caution must be exercised when altering streams because the channels are in delicate adjustment with water discharges and sediment loads. Stream alterations change slopes in the new channel by changing channel length. This increases the tendency towards bed erosion and channel instability because the stream will attempt to equalize the slope in the new channel with the slope upstream and downstream. From this brief discussion it is obvious that if proper aquatic environment is to be maintained, stream alterations must be founded on the principles of stream dynamics, and great care must be excercised to prevent erosion during and after construction.

The purpose of this study is to evaluate the effects of construction activities and stream alterations upon selected parameters of the aquatic environment in the Fisher River, Wolf Creek and Fortine Creek drainages. Parameters being investigated include: sediments, turbidity, water quality, stream morphology, aquatic insect populations and fish populations.

DESCRIPTION OF AREA

The Fisher River rises on the west slopes of the Salish Mountains in Lincoln and Flathead County, Montana, and flows to its confluence with the Kootenai River near Jennings, Montana. The Fisher drains a watershed of about 838 square miles, of which 216 are in the Wolf Creek drainage. The primary land uses in the drainage consist of timber production and cattle ranching. These practices have created erosion problems in some areas.

The Fisher has been extensively channelized during the relocation of the railroad from approximately 2 miles downstream from the mouth of Wolf Creek to the mouth of the Fisher River. Nearly 44 percent of the channel has been altered. A total of 27,420 feet of natural channel has been replaced by 22,625 feet of constructed channel resulting in a loss of 4,795 feet of stream. Gradient in this section was changed from 31 feet per mile to 34 feet per mile.

Wolf Creek rises on the west slopes of the Salish Mountains in Lincoln County, Montana, and flows approximately 37 miles to its confluence with the Fisher River. Wolf Creek flows through canyons and narrow valleys for approximately 15 miles from its source to Fairview. This is a typical small mountain stream with an average gradient of about 40 feet per mile. Comparatively little of this section has been altered. A total of 4,330 feet of natural channel has been replaced by 2,670 feet of altered channel - a net loss of 1,660 feet of stream.

From Fairview to about one mile below the mouth of Little Wolf Creek, Wolf Creek meanders for approximately 7 miles through a mountain meadow. This section possesses good trout habitat, consisting of alternating pools and riffles, stable banks with good willow cover and a gradient of 7 to 10 feet per mile. A dewatering problem exists in the French Ranch during the irrigation season.

Stream channelization in the meadow has accounted for 3,710 feet of natural channel being replaced by 4,540 feet of altered channel, resulting in a net gain of 830 feet of stream channel. The altered channel has been meandered through the willows in the flood plain to approximate a natural channel.

Below Little Wolf Creek, Wolf Creek flows through a narrow valley for approximately 16 miles to its junction with the Fisher River. The gradient in this section averages 24 feet per mile. This section has been channeled extensively during relocation of the railroad. Approximately 21 percent of the channel or 16,990 feet is altered channel which has replaced 20,995 feet of natural channel - a loss of 4,005 feet of stream.

Geological investigations in the Fisher River drainage have been accomplished by Johns (1961). The drainage is underlain by argillite, quartsite and carbonate bearing rocks of the Belt Series (Precambrian). The valleys were invaded by the Cordilleran ice sheet. The melting of this glacier produced a glacial lake which occupied the Fisher River drainage from the Kootenai River to Thompson Lakes. Lacustrine silts from the lake occur extensively along the Fisher and Wolf Creek valleys. The silts are buff colored, unconsolidated and lie horizontal.

Soil investigations were conducted by the U.S. Department of Agriculture (1970) in the Fisher River and Wolf Creek drainage for the area under the proposed Bonneville Power Administration Libby - Loop power transmission line. Three major soil areas were recognized, deep glacial till soils on upland side slopes, shallow rocky soils on upland ridges and deep glacio-lacustrine soils on low terraces.

The glacial till soils have 1/2 to 1-1/2 feet of unconsolidated loessial silt loam surface layers over 5 to 7 feet of slightly sticky and slightly plastic, weakly consolidated cobbly silt loam till. The shallow rocky soils on upland ridges have 2 to 4 inches of unconsolidated loessial silt loam overlying 6 to 12 inches of weakly consolidated very cobbly silt loam. The deep glacio-lacustrine soils consist of 10 feet or more of unconsolidated, poorly graded silts and gravelly silts, deposited on streambeds or in lakes by melted waters from the glaciers. It was concluded that the above soils were in soil erosion class III - indicating they are quite susceptible to erosion.

Fortine Creek rises on the east slopes of the Salish Mountains in Lincoln County, Montana, and flows approximately 40 miles north to its confluence with Graves Creek to form Tobacco River. Fortine drains a watershed of about 180 square miles. Timber production and ranching are the primary land uses in the watershed.

Johns (1963) reported that the area was underlain by argillite, quartsite and carbonate-bearing rocks of the Belt Series (Precambrian). Pleistocene valley glaciers and the Cordilleran ice sheet deposited drift overlain by unconsolidated, glacio-lacustrine silt. Thicknesses of lake bed silts are variable within the valley as the amounts removed by stream erosion are not uniform.

From its source to the mouth of Swamp Creek, about 8 miles, Fortine is a small, mountain, trout stream flowing through a mountain meadow for about one mile, then through a narrow valley. Gradients in this section average 49 feet per mile. Stream alterations are confined to the section between the North Portal of the Flathead Tunnel to about 1/2 mile above the mouth of Swamp Creek. A total of 4,420 feet of natural channel has been replaced by 3,605 feet of altered channel producing a loss of 815 feet of channel.

Downstream from the mouth of Swamp Creek, Fortine has not been altered, but it has been subject to sediment loading from construction activities.

OBJECTIVES

The specific objectives of the project are: (1) Determine quantity of suspended sediments and turbidities above, within and below disturbed areas in the Fisher River and Wolf Creek; (2) Monitor water quality parameters above, within and below disturbed areas in the Fisher River and Wolf Creek; (3) Determine abundance of aquatic insects above, within and below disturbed areas in the Fisher River and Wolf Creek; (4) Determine physical characteristics of the stream channel in altered and natural sections in the Fisher River, Wolf Creek and

Fortine Creek; (5) Determine species composition, species abundance and growth rates of fish populations in natural and altered areas in the Fisher River, Wolf Creek and Fortine Creek; and (6) Determine the value of the Fisher River system as a spawning and nursery area for migratory Kootenai River game fish.

PROCEDURES

Depth-integrating cable-suspended samplers were utilized to collect water samples for determining sediments. Analysis was accomplished by the U.S. Geological Survey. Calculations are based on the quantity of suspended sediment (milligrams per liter) found in each daily sample and are extrapolated to tons per day on the basis of daily discharge recorded by U.S.G.S. Samples were collected at roughly two week intervals at the upstream Fisher station. Location of sample stations is presented in Figure 1.

Instantaneous water temperatures were recorded with a resistance thermometer concurrent with the sediment samples.

Turbidity determinations were conducted on water samples collected for sediment analysis. Corps of Engineers and Federal Water Pollution Control Administration determinations were accomplished with a Hach 2100 Laboratory Turbidmeter.

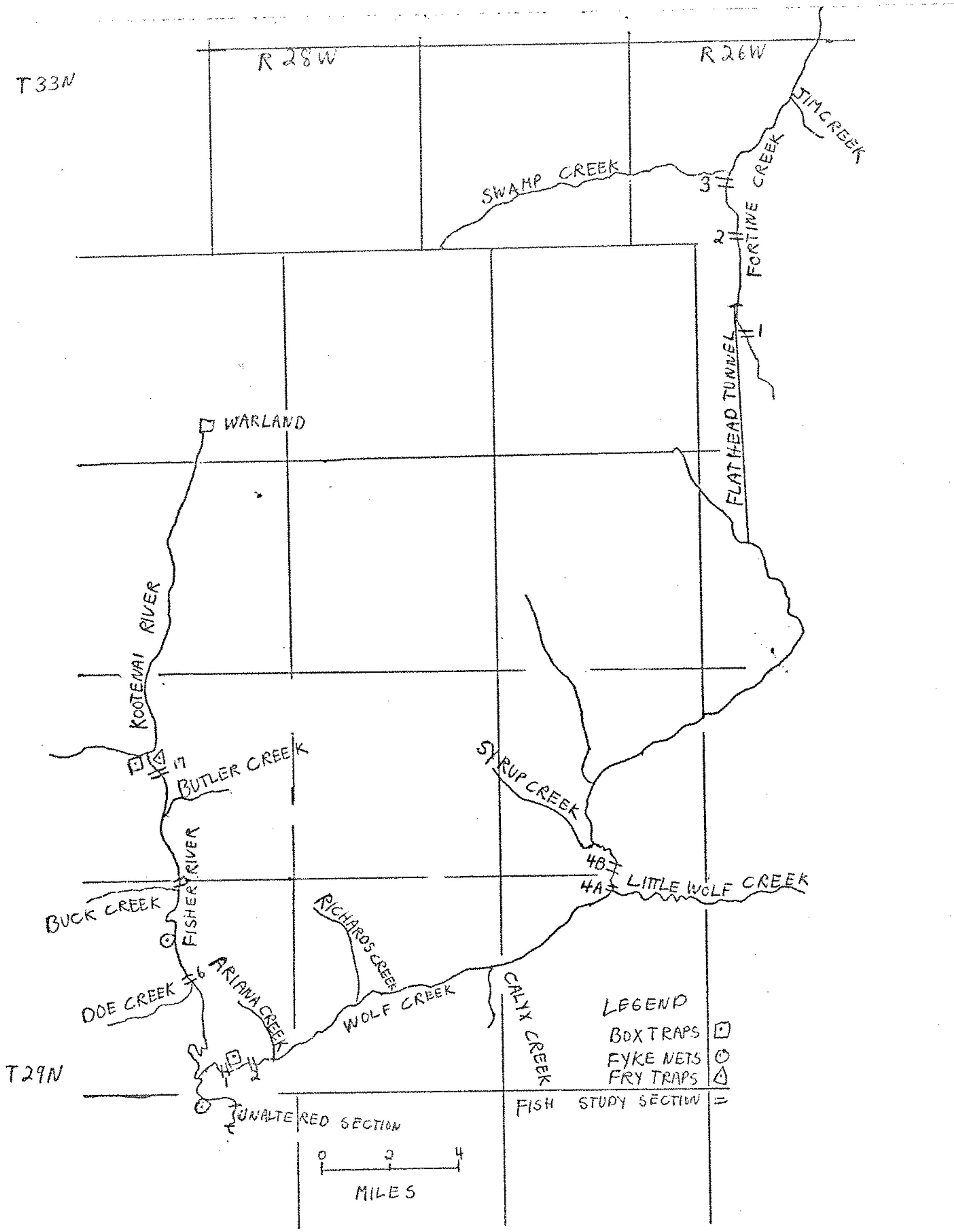
Analyses for the chemical constituents in the Fisher River and Wolf Creek were initiated in the fall of 1967. Analyses were accomplished by the U.S. Geological Survey under a contract with the Corps of Engineers and an informal agreement with the Federal Water Pollution Control Administration. The analyses for Fisher River and Wolf Creek included both composites of daily samples and instantaneous samples.

U.S. Geological Survey laboratory analysis procedures follow Rainwater and Thatcher (1960), except that determinations of calcium, magnesium and manganese were done by atomic absorption. All samples were filtered in the field with a 45 micron filter. The Federal Water Pollution Control Administration generally followed procedures explained in "Standard Methods for the Examination of Water, Sewage and Industrial Wastes", 12th Edition, 1965.

Aquatic insect sampling was initiated in the Fisher River and Wolf Creek by the Corps of Engineers in 1967. Insects were collected with a modified square foot sampler designed by Waters and Knapp (1961). Sample stations were located near the mouth of Wolf Creek, near the mouth of the Fisher and in the Fisher above the mouth of Wolf Creek, (Figure 1).

Organisms were preserved in 70 percent methyl alcohol and sorted from debris in the laboratory. Identification, enumeration and weighing is currently being conducted at the University of Montana laboratory at Yellow Bay on Flathead Lake.

Figure 1. Map of Project Area, Fisher River, Wolf Creek and Fortine Creek.



Stream length, gradients and length of stream channeled were determined from Corps of Engineers maps (scale: one inch = 400 feet). Contour maps from the U.S. Geological Survey (scale: one inch = 1,320 feet) were used to determine stream lengths and gradients for sections of the Fisher River above the mouth of Wolf, Wolf Creek above Syrup Creek and most of Fortine Creek. Determinations of stream lengths in Wolf Creek and Fortine Creek from the contour maps were subject to some error because the scale was too small for accurate measurements.

Lengths and widths of sample sections, except for the natural section of the Fisher, were determined with a one-hundred foot tape.

Fish populations were sampled with electro-fishing gear. Continuous and pulsed direct current was utilized. Captured fish were anesthesized with MS-222, measured, weighed, fin-clipped, scale sampled and released. In general, methods outlined by Vincent (1969) were followed in computing population estimates and confidence limits.

Standard box traps with chicken wire leads and fyke nets were utilized to capture fish migrating from the Kootenai River into the Fisher system. Box traps were fished in the fall, whereas fyke net traps were fished in the spring. After being processed, fish were released upstream from the trap.

Two fry traps similar to those used by Northcote (1969) were placed in the Fisher River during June and July to monitor the movement of trout fry downstream to the Kootenai River. The location of fish and fry traps is presented in Figure 1.

Sampling of spawned mountain whitefish eggs was accomplished by stirring gravel and capturing eggs downstream in a small net.

FINDINGS

Sediments

Water Quality: Bonde (1969) pointed out that construction activities caused abnormal amounts of sediment in Wolf Creek throughout the fall of 1967 and into the winter of 1967-68. Sediment loading from construction activities occurred in the Fisher River during November, December 16 and January 1968. Bonde (1969) associated increased sediment loads, without a corresponding increase in discharge as construction-related sediment.

Additional sediment loading related to construction activities occurs when melting snow and/or rain causes run-off from the exposed, raw earth in the project area. The susceptibility to erosion of the unconsolidated glacio-lacustrine soils in the project area has intensified this problem.

Erosion along the railroad and in the channel changes was documented in April 1970 with photographs. From the mouth of the Fisher River upstream to Wolf Creek Junction erosion is not a serious problem. However, from Wolf Creek Junction upstream to Syrup Creek, erosion from the railroad is increasing sediment loads in Wolf Creek. In addition 12 channel changes have banks which are eroding directly into Wolf Creek. The railroad passes through a series of cuts and fills from the Fairview overpass north, approximately three miles. Erosion in this section is quite serious and reaches Wolf Creek directly or via culverts.

Considerable erosion from the railroad into Fortine Creek occurs from the north portal of Flathead tunnel downstream to Jim Creek. Sediments from this section of the railroad have caused heavily silted riffles and pools of Fortine Creek. The erosion problem in the Fortine drainage is especially serious when one considers that the Tobacco River system, of which Fortine is one of the two major tributaries, potentially possesses the largest amount of spawning and nursery area in the U.S. for migratory game fish from Libby Reservoir.

Bonde (1969) reported on water quality parameters of the Fisher River drainage. Total alkalinities ranged from 35 ppm to 123 ppm in the Fisher River during the 1967-68 water year. Waters with total alkalinities in the above range were given a production index of medium to high for plant and fish life by Moyle (1949).

Water quality data for the 1968-69 water year has been compiled and will be presented in a future report. Water quality data for the 1969-70 water year is in the process of being collected.

Aquatic Insects: Bonde (1969) indicated that the numbers of insects in the major construction area of the Fisher River, downstream from the mouth of Wolf Creek, were much lower than those found upstream of construction activities. Insect populations in lower Wolf Creek were comparable to those recorded in the Fisher above construction.

Insects collected during the present report period have not yet been analyzed.

Stream Morphology

Fortine Creek: The locations of sample sections in Fortine Creek are presented in Figure 1. Section 1 is 900 feet long and has an average width of 13 feet. This section appears to possess good trout habitat. It consists of alternating pools and riffles with good willow cover in many areas. Section 2 corresponds to channel change 2898-2906 on the Swamp Creek to Stryker Contract. The section sampled is 575 feet long and averages 19 feet wide. In the upper part of the channel the main current is deflected along rip-rap at the bottom of the railroad grade. The rip-rap provides good cover for trout in this area. Section 3 located immediately upstream from the mouth of Swamp Creek is 870 feet long and averages 12 feet wide. This section appeared to possess the best trout habitat - stable banks, excellent willow cover and frequent pools interspersed between riffles.

Wolf Creek: The locations of sample sections in Wolf Creek are presented in Figure 1. Section 1 corresponds to channel change 1 in the Ariana Creek to Jennings Contract. The section sampled was 1,000 feet long with an average width of 34 feet. Sloughing and eroding banks in this channel change have contributed considerable amounts of sediment. Rip-rap provides some cover for trout and other fishes. Section 2 is an unaltered channel about one mile upstream from Section 1. Section 2 is 1,000 feet long and has an average width of 28 feet. This section provides fair to poor trout habitat. Comparatively little willow cover exists along the stream channel and pool development is poor.

Section 4A is equivalent to channel change 5A in the Beaver State Contract. This channel has been meandered through the willows in the flood plain and part of it utilizes one bank of the channel of Little Wolf Creek. Section 4A is 850 feet long and 17 feet wide. Pool development is excellent in this section and the undisturbed bank of Little Wolf provides good willow cover. Section 4B, about 0.5 mile upstream from Section 4A, is an 850 foot long unaltered channel. This section is good trout habitat; deep pools alternate with riffles, willow cover is extensive and bank stability good.

Fisher River: The locations of Fisher River sample sections are presented in Figure 1. The unaltered Fisher section is located 2 river miles above the mouth of Wolf Creek. The section is 2.9 miles in length and the gradient averages 20 feet per mile. Deep pools are interspersed between riffles, with log jams and debris providing cover in most pools. Erosion from unstable banks is a problem in some areas. In general, this section appears to be fair trout habitat.

One-thousand feet of channel change 6, 1,000 feet of channel change 12 and 1,500 feet of channel change 17 were sampled in the Fisher River. The width of these channel changes varied between 110 and 150 feet. Pool development is evident in most channel changes, but overhead cover is lacking. The channels are virtually straight and lack meanders.

In review, preliminary stream morphology data was determined. Willow cover and meanders are lacking in channel changes, but pool development is evident. Next year, thalweg, pool-riffle relationships and sinuosity will be determined for permanent fish population sections.

Fish Populations

Fortine Creek: The age and growth data from fish population sampling in Fortine Creek are presented in Table 1. Growth of trout in all three sections is moderate with most brook, cutthroat and rainbow trout reaching a harvestable size of seven inches in their third summer of life. Growth rates are comparable in the three sections.

The age structure of the trout populations varied somewhat among the three sections. Age I fish comprised the majority of trout taken in sections 1 and 2 with Age II and Age III trout being represented by successively smaller percentages. Age I fish in section 3 dominated the rainbow population, but Age II and Age III fish comprised 66 percent and 67 percent of the cutthroat and brook trout populations, respectively.

The age structure of most trout populations in streams is comparatively stable being dominated by Age I fish with the older age groups comprising successively smaller percentages of the population. McFadden and Cooper (1962) suggested that deviations from this scheme encountered in three Pennsylvania streams were correlated with adverse environmental conditions. The most obvious factor which may be inhibiting trout reproduction in Station 3 is sediment loading from construction activities. Peters (1967) demonstrated the detrimental effect of sediment loads on hatching success of trout eggs in Bluewater Creek, Montana.

The species composition and numbers of fish per hundred feet of stream are given in Table 2 for the Fortine Creek sections. Trout comprised 73 percent of the fish from section 1, 87 percent of the fish from section 2 and only 41 percent of the fish taken from section 3. In addition, trout were nearly twice as numerous in sections 1 and 2 than in section 3. These data suggest a comparatively poor trout population in Station 3 which would seem to be related to silt from construction activities. Saunders and Smith (1965) demonstrated the detrimental effect of silt on brook trout populations in small streams.

In review, it appears that the channel change habitat in section 2 is maintaining a trout population comparable to that in the unaltered section, section 1, located above construction activities. In contrast, a comparatively poor trout population was indicated in an unaltered section, section 3, which has been subject to increasing sediment loads from construction activities.

Wolf Creek: The age and growth data for game fish taken from section 1 (channeled area) and section 2 (natural area) are summarized in Table 3. The growth of rainbow trout is moderate with fish achieving a harvestable size of 7 inches during their third summer of life. The age structure of the trout populations can be considered normal. Age I trout comprised 71 - 74 percent of the population followed by successively decreasing percentages of Age II, III and IV fish. Few trout appeared to live more than three years. Whitefish growth in both sections was comparable to the growth recorded in the Fisher River.

The data in Table 4 indicate marked differences exist in the numbers and species of fish collected from the two sections. Rainbow trout were more than twice as numerous in section 2 than in section 1. On the other hand, largescale and longnose suckers were six times as abundant in section 1 than in section 2. Northern squawfish comprised 6 percent of the fish taken in Station 1, but they were not collected from Station 2. These data suggest that the habitat in Station 1 (an altered section) has been conducive to the build-up of rough fish populations.

Table 1. Age and growth of rainbow, cutthroat and brook trout from Fortine Creek, August 1969

Age	Rainbow trout: Average 1/ Total Length	Rainbow trout: Percent Age Composition	Cutthroat trout: Average Total Length	Cutthroat trout: Percent Age Composition	Brook trout: Average Total Length	Brook trout: Percent Age Composition
Section I						
I+			4.1 (26)2/	81	5.4 (20)	63
II+			6.4 (5)	16	7.7 (10)	31
III+			8.4 (1)	3	9.9 (2)	6
Section II						
I+	4.6 (8)	50	4.8 (34)	81	6.3 (7)	100
II+	6.3 (8)	50	7.2 (6)	14		
III+			9.9 (2)	5		
Section III						
I+	4.8 (10)	77	4.8 (1)	17	5.1 (3)	33
II+	6.3 (2)	15	7.4 (2)	33	6.9 (3)	33
III+	7.5 (1)	8	8.4 (2)	33	9.6 (3)	34
IV*			11.4 (1)	17		

1/ Total length in inches at capture.
2/ Number of fish aged in parentheses.

Table 2. Species composition and numbers of fish collected per 100 feet of Fortine Creek, August 1969

Species	Section I Number	Section I Percent of Population	Section II Number	Section II Percent of Population	Section III Number	Section III Percent of Population
Cutthroat	2.9	32	4.6	56	.7	18
Rainbow	.1	1	1.2	21	1.5	8
Brook	3.5	40	.7	10	1.3	15
Suckers	1.0	12	.5	6	2.4	28
Others 1/	1.3	15	.5	7	2.6	31

1/ Includes redside shiners, torrent sculpins, and mountain whitefish.

Table 3. Age and growth of rainbow trout and mountain whitefish from Wolf Creek, August 1969

Section I

Age	Rainbow trout Average 1/ Total Length	Rainbow trout Percent Age Composition	Mountain whitefish Average Total Length	Mountain whitefish Percent Age Composition
I+	5.2 (10)2/	71	5.9 (7)	83
II+	7.6 (3)	21	8.2 (2)	17
III+	8.2 (1)	8		

Section II

Age	Rainbow trout Average Total Length	Rainbow trout Percent Age Composition	Mountain whitefish Average Total Length	Mountain whitefish Percent Age Composition
I+	5.1 (27)	74	5.9 (14)	78
II+	7.4 (3)	12	8.4 (3)	16
III+	8.5 (2)	8	10.4 (1)	6
IV+	10.2 (1)	4		

1/ Total length in inches at capture
2/ Number of fish aged

Table 4. Numbers of fish per thousand feet of stream and species composition for Wolf Creek, August 1969

	Section I		Section 2	
Species	Number	Percent of Population	Number	Percent of Population
Rainbow	15	8	39	24
Mountain whitefish	12	6	18	11
Suckers	54	29	9	5
Squawfish	10	6	-	-
Others 1/	96	51	97	60

1/ Includes redside shiners, longnose dace and torrent sculpins.

Wolf Creek - Meadows: The age and growth data for Station 4A (altered section) and Station 4B (unaltered section) are summarized in Table 5. Growth of rainbow and brook trout is moderate in both sections with fish achieving a harvestable length of seven inches in their third summer of life. Brook trout grew slightly faster than rainbow trout. Mountain whitefish exhibited a similar growth pattern in both sections - most fish attaining a harvestable size of 10 inches in their sixth summer of life. The age structure of the rainbow trout populations in both sections can be considered normal. In contrast the paucity of Age I+ brook trout indicates poor recruitment of the 1968 year class. In addition, the age structure of mountain whitefish appears abnormal with Age I+ fish comprising less than 15 percent of the population in both sections. Silt from construction activities would probably effect the reproductive success of fall spawning fish more than the spring spawning rainbow because spring run-off scours silt from spawning gravels, making them more suitable for incubation of eggs. Also, longer incubation periods for fall spawners exposes the eggs to extended periods of sediment loading.

Population estimates were calculated for Section 4A and Section 4B. The small sample sizes obtained necessitated grouping rainbow and brook trout and grouping age classes. It follows that the estimates are subject to bias introduced by size-selectivity of the gear. However, the data should be comparable, because both stations were sampled and analyzed in the same manner. The efficiency of the gear ranged from 29 percent to 43 percent for trout and varied between 48 percent and 64 percent for whitefish. The point estimates indicate that Section 4B had approximately 28 percent more trout and 11 percent more whitefish than Section 4A. The overlapping of confidence intervals indicates the differences are not statistically significant.

Table 5. Age and growth of rainbow trout, brook trout and mountain whitefish from Wolf Creek August 1969

	Rainbow trout		Brook trout		Mountain whitefish	
Age	Average 1/ Total Length	Percent Age Composition	Average Total Length	Percent Age Composition	Average Total Length	Percent Age Composition
Section 4A						
I+	4.8 (18)2/	62	– –	–	5.8 (5)	15
II+	6.9 (5)	17	8.6 (10)	63	7.0 (18)	52
III+	9.2 (6)	21	11.3 (4)	25	9.2 (7)	20
IV+			13.7 (1)	6	9.5 (3)	10
V+			14.2 (1)	6		
VI+					11.4 (1)	3
Section 4B						
I+	4.8 (26)	76	5.7 (2)	18	5.6 (5)	7
II+	7.3 (4)	12	8.8 (6)	55	6.9 (17)	25
III+	8.8 (4)	12	11.5 (3)	27	8.1 (15)	22
IV+					9.2 (13)	19
V+					9.9 (7)	11
VI+					11.6 (6)	9
VII+					12.9 (3)	5
VIII+					12.9 (1)	2

1/ Average total length in inches at capture.
2/ Number of fish aged in parentheses.

The preceding data suggest that comparatively minor differences exist between the fish populations in Sections 4A and 4B as shown in Table 6. Thus, it appears that suitable fish habitat has been created by meandering the stream channel through the flood plains, utilizing a part of the channel of Little Wolf Creek in the process.

Table 6. Estimated trout and mountain whitefish populations for two 850 foot sections of Wolf Creek, August 1969

Species	Section 4A	Section 4B
Trout		
Size range	3.9" - 14.2"	3.9" - 12.0"
Total number 1/	77 (±31)2/	93 (±49)
Mountain whitefish		
Size range	6.1" - 11.4"	6.5" - 13.6"
Total number	35 (±14)	40 (±10)

1/ Rainbow trout and brook trout of all age groups were lumped together because of small sample sizes.

2/ Confidence intervals for the population estimates expressed at the 95 percent level are shown in parentheses.

Fisher River Fish Population Data

Growth data for game fish collected in the altered sections and in the natural section are presented in Table 7 and Table 8, respectively. Growth of rainbow and cutthroat is comparable in all sections with most fish attaining lengths of seven inches in their third summer of life. Mountain whitefish, in the natural section, achieve sizes of 10 inches in their fourth summer of life. Growth of whitefish is similar in the altered areas.

Rainbow trout populations in most sections were dominated by Age I+. An exception to this occurred in Channel Change 17, where 69 percent of the cutthroat collected were Age II+. These fish had the silvery coloration of downstream, migrant juveniles found in tributaries of Hungry Horse Reservoir. Few rainbow and cutthroat trout of a harvestable size were collected from altered and unaltered sections. The unaltered sections of the Fisher River had a large population of whitefish more than 10 inches in length, but few whitefish more than 10 inches were collected from the altered areas.

The species composition varied considerable from one channel change to another (Table 9). Rainbow were relatively numerous in channel changes 6 and 12, whereas cutthroat were the predominant trout in channel change 17. Whitefish comprised 33 percent of the population in channel change 12, but comprised less than 8 percent of the sample in channel change 6 and 17. Suckers comprised between 12 and 52 percent of the fish taken in the channel changes. Whitefish were the dominant fish in the unaltered section, comprising 93 percent of the fish collected; followed by rainbow and cutthroat trout 7 percent, and suckers less than 1 percent.

A standing crop estimate for mountain whitefish from the natural section of the Fisher River is presented in Table 10. The capture efficiency of the gear for all size groups greater than 7 inches was 9 percent.

The percent of age composition and age group numbers were calculated for age groups II through V+. A lack of recaptures precluded a population estimate for Age I fish. The electro-fishing gear is inefficient in narcotizing smaller fish in large streams. The age structure appears normal with the older age groups being represented by successively smaller numbers.

The standing crop estimate of 242 whitefish weighing 86 pounds per 1,000 feet of stream (approximately 1 surface acre) indicates that the Fisher River is a moderately productive stream. This correlates with the productive index of the stream indicated by chemical data and insect populations (Bonde, 1969).

Population estimates could not be calculated for rainbow trout, because of insufficient sample sizes. Several habitat problems in the drainage may be limiting trout populations: comparatively heavy silt loads; unstable banks with poor willow cover and large flucuations in flows. Intensive logging, road building and livestock operations intensify and contribute to these habitat problems.

The preliminary data collected in 1969 indicate that game fish and rough fish have repopulated the channel changes. Suckers are more numerous in the channel changes than in the natural area. Populations of trout of harvestable size are comparatively low in both altered and natural sections. Mountain whitefish appear to be more numerous in the natural areas than in the altered areas. Growth of game fish is comparable in both habitat types. Full evaluation of the fish populations will not be possible until population estimates are available from the altered and natural areas.

Table 7. Age and growth of rainbow trout and mountain whitefish from an unaltered section of the Fisher River, August 1969

Age	Rainbow trout Average Total Length	Rainbow trout Percent Age Composition	Mountain whitefish Average Total Length
I+	5.3[1] (15)[2]	87	6.6 (12)
II+	7.6 (6)	13	8.4 (19)
III+			10.0 (23)
IV+			11.2 (29)
V+			12.5 (13)
VI+			13.8 (4)
VII+			14.8 (2)
VIII+			16.8 (1)
IX+			18.3 (1)

1/ Total length at time of capture.
2/ Number of fish aged in parentheses.

Table 8. Age and growth of rainbow trout, cutthroat trout and mountain whitefish from channel change areas in Fisher River, August 1969

Age	Rainbow trout Average Total Length		Rainbow trout Percent Age Composition	Cutthroat trout Average Total Length		Cutthroat trout Percent Age Composition	Mountain whitefish Average Total Length		Mountain whitefish Percent Age Composition
Channel Change 6									
I+	5.0 1/	(32) 2/	84	-	-	-	6.1	(3)	50
II+	7.2	(6)	16	-	-	-	8.5	(3)	50
III+				-	-	-			
Channel Change 12									
I+	5.6	(32)	86	-	-	-	6.3	(28)	76
II+	6.8	(5)	14	7.2	(2)		8.7	(5)	13
III+							9.6	(4)	11
Channel Change 17									
I+	5.3	(3)	60	5.6	(4)	25	6.3	(9)	65
II+	6.9	(2)	40	6.9	(11)	69	7.3	(1)	7
III+				9.7	(1)	6	9.4	(2)	14
IV+									
V+							12.5	(1)	7
VI+							14.5	(1)	7

1/ Total length at time of capture.
2/ Number of fish aged in parentheses.

Table 9. Numbers of fish per 1,000 feet of channel change in Fisher River and species composition of samples, August 1969

	Channel Change 6		Channel Change 12		Channel Change 17	
Species	Number	Percent of Population	Number	Percent of Population	Number	Percent of Population
Rainbow	38	26	34	30	5	3
Cutthroat	2	1	2	2	11	6
Mountain whitefish	6	4	37	33	13	8
Suckers	55	39	39	12	90	52
Others	43	30	30	23	51	31

Table 10. Estimated mountain whitefish population and standing crop by Age groups in a 2.9 mile unaltered section of the Fisher River, August 1969

Age	Length Range In Inches 1/	Percent Age Composition	Standing Crop Number	Standing Crop Pounds
II+	7.5 - 9.9	34	1,269	267
III+	9.1 - 11.2	28	1,019	267
IV+	10.1 - 12.9	21	780	334
V-VIII+	11.6 - 18.3	17	629	444
TOTALS			3,697	1,312
Confidence Limits 2/			±32%	±32%

1/ Total length at time of capture, September 1969.
2/ Confidence intervals expressed at the 95 percent level.

Table 11. Growth and age composition of mountain whitefish spawning run, October 1969

Age	Length At Capture	Percent Age Composition
II+	9.7 (23) 1/	11
III+	10.8 (74)	36
IV+	11.9 (61)	30
V+	12.8 (34)	17
VI+	13.5 (6)	3
VII+	14.4 (5)	3

1/ Number of fish aged.

Fisher River Migratory Fish Data

Trapping of fall spawning fish commenced on September 15, 1969 and continued through November 20, 1969. During this time, 1,133 whitefish were passed through the trap in the mouth of the Fisher. Approximately 88 percent of these fish were captured between October 8 and October 22 when water temperatures in the Fisher taken in the morning, ranged from 46° F. to 35° F. A total of 797 fish were sexed by stripping sexual products from ripe fish. The sex ratio of these fish was 1.4 males to 1.0 female. Since the males ripened earlier than the females, the sex ratio may be slightly biased. Male whitefish averaged 11.6 inches in total length and ranged from 7.4 to 15.9 inches. Females had an average length of 11.6 inches also, ranged from 9.0 to 16.8 inches in length and averaged .50 pounds at a length of 11.6 inches.

The estimated fecundity of the whitefish spawning run from the Kootenai River into the Fisher River was determined to be 1,250,000 eggs. The estimate was calculated by multiplying the estimated total pounds of females times the average number of eggs per pound of whitefish from the Madison River (Brown, 1952).

Growth data and age composition of the spawning run are presented in Table 11. Growth of these white fish is somewhat faster than that recorded for whitefish from the natural section of the Fisher River. These Kootenai River whitefish averaged 1.3, 0.8, 0.7, and 0.3 inches longer at Ages II+, III+, IV+, and V+ respectively than Fisher River whitefish. Age III+ and IV+ fish were predominant, comprising 66 percent of the spawning run. The data indicate that some precocious fish mature and spawn at Age II+, but the majority of whitefish do not mature until Age III+.

A total of 80 whitefish were captured in the trap located near the mouth of Wolf Creek, but none of these were fish from the Kootenai River. The upstream Fisher trap, approximately 14 miles from the mouth of the Fisher River, captured 310 fish. Of these, 13 were Kootenai River whitefish which had been marked and passed through the trap in the mouth of the Fisher.

Riffles area which appeared suitable for whitefish spawning were sampled in December. Whitefish appeared to prefer comparatively clean gravel and rubble in the lower ends of pool and upper parts of riffles for spawning. Whitefish eggs were relatively common, zero to nine, in the lower mile of the Fisher River, including channel change 17. Eggs were found in one small area below channel change 12, but none were collected from changes 3, 5, 6 and 11. Eggs were more abundant, up to 21 per sample, in the natural section of the Fisher River. The large numbers of eggs in the natural section were probably spawned by the large resident population. The paucity of eggs in the middle part of the Fisher can be related to a low resident population of adult fish coupled with little spawning in the area by migratory fish. The vast majority of the eggs in the lower mile of the Fisher must have been spawned by migratory whitefish from the Kootenai River, because population sampling in August indicated a low population of adult whitefish in this area.

In review, it appears that considerable numbers of whitefish enter the Fisher River from the Kootenai River to spawn. Although a few migrate as far as 14 miles upstream, the majority appear to spawn in the lower couple miles of the Fisher River.

Only three Dolly Varden were passed through the trap in the mouth of the Fisher. Dolly Varden from Flathead Lake migrate into the Flathead River during July and August (Hanzel, 1966). If a similar migration pattern occurs in the Kootenai River, the Dolly Varden migration would have occurred before trapping commenced in the Fisher River.

Spring Spawners: Two fyke nets were installed in the Fisher River on April 9, 1970 to monitor the movements of cutthroat and rainbow trout. As of May 10th a spawning run had not materialized. Presumably, water temperatures were not sufficiently high to trigger a spawning run from the Kootenai River.

RECOMMENDATIONS

1.) Seed eroding areas along the railroad right-of-way from Wolf Creek Junction to approximately three miles north of the Fairview Overpass.

2.) Plant willows along water line and seed above water line on eroding banks in channel change 1 of the Ariana Creek to Jennings Contract and channel changes 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, and 12 of the Little Wolf Creek to Ariana Creek Contract.

3.) Seed eroding areas along the railroad right-of-way from the north portal of the Flathead Tunnel downstream to Jim Creek.

4.) Plant willows along water line and seed above water in channel change 2984 of the Swamp Creek to Rock Creek Contract and channel changes 2898, 2893, 2864, 2846, and 2827 of the Swamp Creek to Stryker Contract.

5.) Monitor erosion in project area and specify critical problem areas.

6.) Delete aquatic insect sampling for one year. This will permit time for a more detailed analysis of fish populations.

7.) Lengthen sections in Fortine Creek and Wolf Creek to 2,000 feet in order to provide adequate samples for population estimates.

8.) Replace plugs in channel changes between French Ranch and mouth of Wolf Creek.

9.) Evaluate fish populations in channel changes 3 through 7 in the Fisher River. This is an 8,825 foot section which is now 78 percent altered channel. Prior to construction the gradient and sinuosity were almost identical to those in the natural section of the Fisher.

10.) Continue monitoring the spring and fall spawning runs of game fish from the Kootenai River into the Fisher River.

Prepared by Bruce May

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