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FISH AND HABITAT INVENTORY OF STREAMS IN THE NORTH FORK DRAINAGE OF THE FLATHEAD RIVER

Prepared by

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INTRODUCTION

The maps, narratives and tables presented summarize physical habitat and fish species information for tributaries of the North Fork of the Flathead River. Maps provide sample site locations and pertinent reach information. Narratives briefly describe stream habitat and fish population information. Occasionally, additional information may be included in the narratives. Tables contain values for physical habitat and fish population parameters measured. To assist in orientation, locations of tributary streams in the drainage (Figure 1) and a general summary of physical characteristics including a river kilometer index (Table 1) are provided. A legend for map symbols can be found in Figures 2 and 3.

The data collected spans several years during the Flathead River Basin Fisheries Study (1979-1982) and reported values represent a specific point in time, whether it be a summary of several years or a single survey date. Use of these data should be accompanied by the understanding that:

- 1) Fluvial systems are dynamic and stream channels can change over a period of time altering their physical character as well as orientation,
- 2) Fish populations in the upper Flathead drainage are migratory and while areas identified by our surveys were assuredly important, it was probable that stream reaches not identified as critical during our "point-in-time" survey could have been important during another time of year,
- Fish habitat in stream reaches inventoried may have been previously degraded by land use activities and were not capable of supporting fish at their natural potential, and
- 4) Juvenile fish populations may have been below carrying capacity in some reaches due to inadequate adult spawning escapements resulting from migration barriers in the stream channel, exploitation by anglers, natural phenomena (i.e., catastrophic events) or other causes.

A major benefit of the study was development of our ability to identify relationships between habitat parameters and both important bull trout spawning areas and juvenile westslope cutthroat abundance (Graham et al. 1982, Fraley and Graham 1982). Bull trout spawning occurred in areas of low channel gradient (1 to 2%), with relatively small D-90 (33 to 38 cm), and in larger stream channels (stream orders 3, 4 and 5) where temperatures and streamflows were suitable (mean maximum monthly summer temperatures less than 17.0°C and streamflows large enough to keep the gravels free of anchor ice during the winter incubation period).

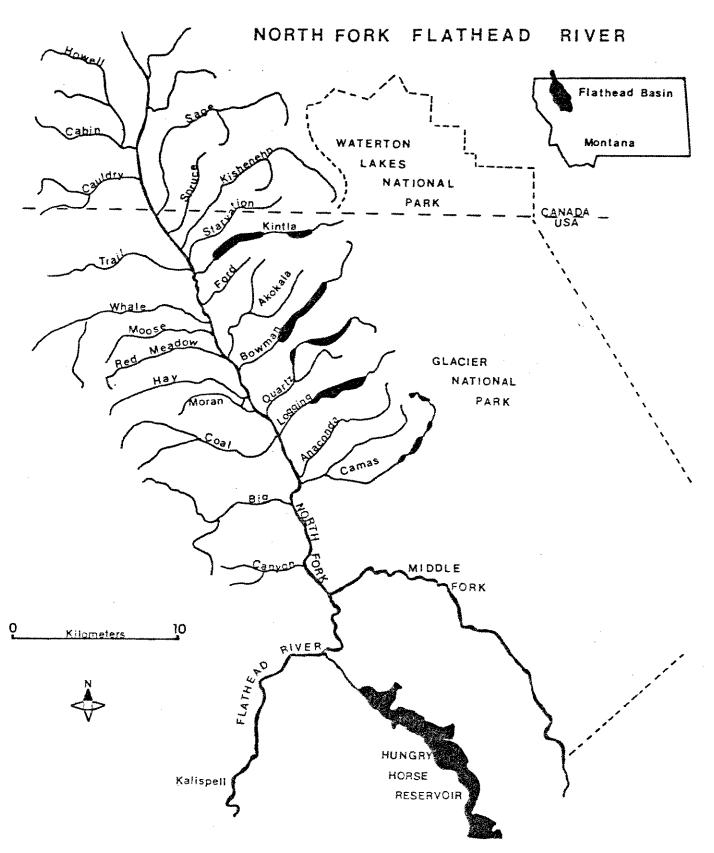


Figure 1. Drainage map of the North Fork Flathead River showing major tributaries.

Reach information and river km location (distance above Middle Fork confluence) for North Fork tributaries surveyed in 1979, 1980 and 1981. Table 1.

Drainage	Distance above M.F. confluence (km)	Reach	Drainage area (km²)	Length (km)	Gradient (%)	Flow at survey (cfs)	Late summer flow (cfs)
Canyon Creek	S . 8	- 2	75.9	14.2 6.3 7.9	3.9 3.7 4.0	21.7	1 1 1 1 1 1 1 1 1 1 1
McGinnis		1 2	16.8	7.5	3.7 8.9 2.6	0.7	†
Kimmerly		; -4	18.5	4.2	. 6	6.94	! ! ! ! ! !
Big Creek	24.3	n 25 E	212.5	21.8 10.4 7.9 3.5	5.55 5.55 5.55 5.55 5.55 5.55 5.55 5.5	39.0 24.8 15.1	39.0
Langford		7 2	12.4	3.2 1.2		1.4	
Hallowatt		~ ~	42.1	12.7 4.1 8.7	4.7.	6	16.3
Werner		y 4	10.3	3.5	8.0	1.6	£
Kletomus		,1	14.0	5.6	7.3	2.7	
Skookoleel		~ ~	22.7	8.0 3.4	8.5 6.9 10.8	1 1 8	
Nicola		, -t	13.6	6.3	7.6	2.7	1 f 1 f 1 f 1 f

Table 1. (continued)

Drainage	Distance above M.E. confluence (km)	Reach	Drainage area (km²)	Length (km)	Gradient (%)	Flow at survey (cfs)	Late summer flow (cfs)
Camas Creek	29.4	C 6	207.2	20.7 3.7 8.3 8.3	0.7 1.1 1.0 0.1	26.4 16.4 19.8	
Dutch		325	71.2	18.0 7.6 5.5 4.9	4.1 1.8 10.1	10.5 10.6 7.1	
Anaconda Creek	29.8		90.1	24.5 18.4 6.1	4.4 2.0 11.7	7.3	1 1 1 1 1 1 1 1 1
Logging Creek	38.8		125.4	7.2	1.6	60.1	28.9
Coal Creek	38.9	- W W 4	211.5	31.2 10.1 8.4 10.5 2.2	1.2 1.2 2.2 7.5	29.3 20.1 1.3	36.6
Cyclone		- 2	34.9	6.5 4.0	2.1 1.5 3.0	1.0	1 1 1 1 1 1 1 1 1 1 1 1
Dead Horse		7	25.2	7.3	4.5 3.8 7.9	 8.6 8.6	; ; ; ; ; ; ; ; ;
South Fork Coal	oal	~~~	34.4	11.0 9.0 2.0	4.5 3.0 11.1	3.0	

Table 1. (continued)

Drainage	Distance above M.F. confluence (km)	Reach	Drainage area (km²)	Length (km)	Gradient (%)	Flow at survey (cfs)	Late summer flow (cfs)
Mathias		7 7	13.2	4.3 1.5 2.8	6.2 2.4 8.0	1.9	0
Quartz Creek	43.4	↔	108.8	10.1	2.0	80.3	
Cumnings		;1 .	36.6	11.8	6.6	5.2	1 1 1 1 1 1
Hay Creek	46.2	C & 4	111.6	27.3 10.7 7.2 7.5 1.9	2.4 1.5 3.4 7.6	21.3 14.4 8.6 1.0	14.8
Moran Creek		4324	23.6	11.4 7.1 1.4 1.8	8 5 7 3 5 5 5 6 6 5	6.7 1.9 3.2	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Bowman	53.9	H	177.9	8.2	1.7	44.5	1
Akokala Creek	54.4	1 2	115.0	16.8 8.0 8.3	2.2 1.4 2.9	101	1 1 1 1 1 1 1 1 1
Parke		35 1	12.1	7.8 1.8 1.4	6.6 4.9 14.4	7.3	3 I t i i i i i i i i i i i i i i i i i i

Table 1. (continued)

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Drainage	Distance above M.F. confluence (km)	Reach	Drainage area (km²)	Length (km)	Gradient (%)	Flow at survey (cfs)	Late summer flow (cfs)
Long Bow		proof.	13.5	6.4	12.3	7.3	}
Red Meadow	59.2	H 48	76.8	29.9 7.7 19.0 3.2	2.0 2.2 0.9 7.6	16.7 12.4 0.8	16.7
Moose Creek	64.2	H 04 100	48.0	21.5 5.2 4.9 11.4	2.9 3.5 8.5 8.5	10.8 9.2 6.7	5.9
Whale Creek	0.99	- 2	165.6	25.4 13.9 11.5	1.0 1.1 0.7	58.8 25.8	55.3
Shorty		7 7	48.0	9.1 4.5 6.5	3.0 5.0	18.6	# # 1 1 1 2 3 1 1
Ford Creek	70.6	3 2 2	32.4 5	12.8 6.9 2.1 3.8	7.3 3.4 2.9 17.0	3.2	2.1
Kintla Creek	78.7	H	101.5	3.5	1.7	125.5	; ; ; ; ; ;
Trail Creek	80.4	,	197.1	27.1	2.3	42.8	42.8

Table 1. (continued)

Drainage	Distance above M.F. confluence (km)	Reach	Drainage area (km²)	Length (km)	Gradient (%)	Flow at survey (cfs)	Late summer flow (cfs)
Ketchican		C1 CS	26.4	3.0 3.0 3.7	3.0 0.5 3.1	1.1	
<u>Yakinikak</u> ¹ /		14845	139.1	15.7 3.0 3.2 3.3 2.7	3.1 1.4 1.5 1.3	33.5 23.8 15.1 16.2 8.0	
Tuchuck		guard	25.7	6.5	1.6		† f 1 1 1 1
Starvation Creek	82.2	7	21.8	11.2 8.0 3.2	2.7 3.1 1.8	17.1	8.94
Kishenehn Creek	85.0	formel	10.2	8.7	; H	67.4	42.1
Spruce Creek	87.7	1 2	15.1	5.5 3.5	2.3 2.6 2.6	4.2	
Sage Creek	91.2	e1	1.6	2.1	0.2	48.3	31.8

1/ Aakinikak Creek is named Trail Creek where it resurfaces as a spring 11.3 km above its confluence with the North Fork Flathead River.

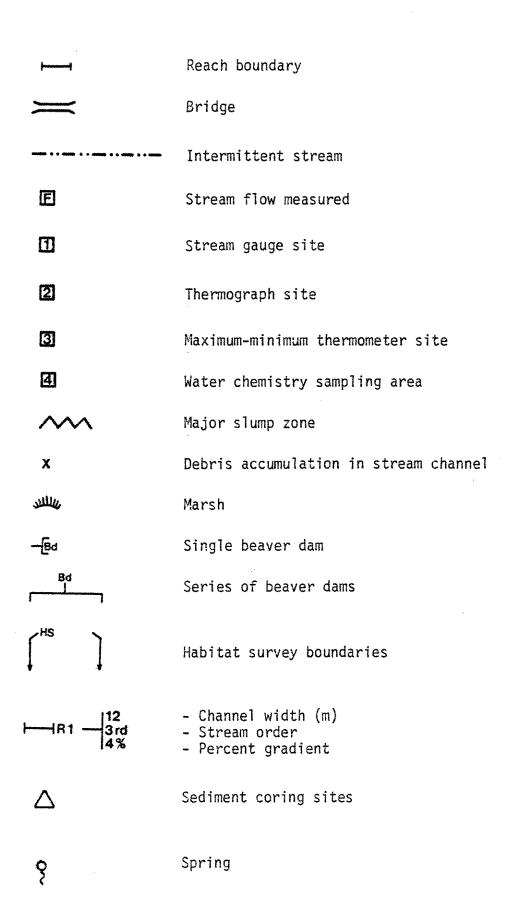


Figure 2. Legend for physical habitat map.

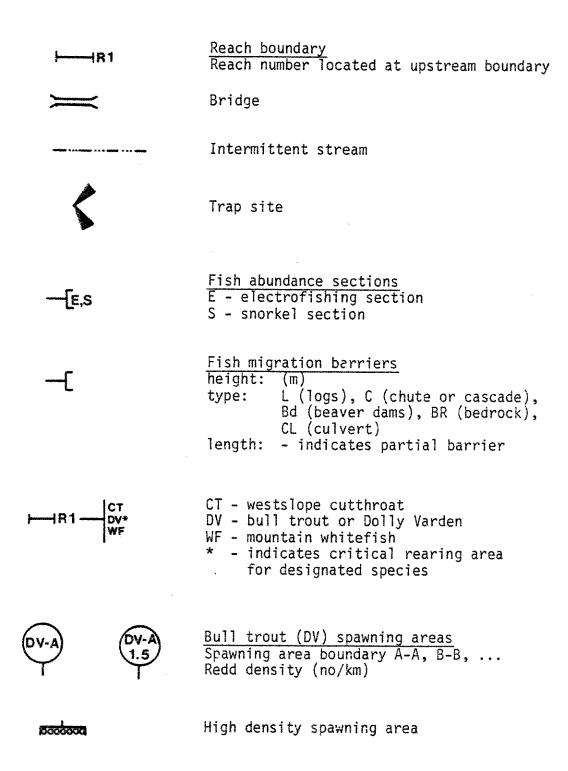


Figure 3. Legend for fish population map.

Important cutthroat rearing areas could be identified by the presence of abundant cover (instream and overhead), relatively small D-90, and smaller stream channels (stream order 2 and 3).

The following codes were used in the stream habitat and fish population data tables for Pattern and Confinement:

Pattern

- S Straight very little curvature within the reach
- N Sinuous slight curvature within a belt of less than approximately two channel widths
- P Irregular no repeatable pattern
- C Irregular meander a repeated pattern is vaguely present in the channel and the general valley trend is less than 90°
- R Regular meanders characterized by a clearly repeated pattern
- Tortuous meanders a more or less repeated pattern characterized by angles greater than 90°

Confinement

- E Entrenched the stream bank is in continuous contact (coincident with) valley walls
- C Confined in continuous or repeated contact at the outside of major meander bends
- F Frequently confined by the valley wall
- X Occasionally confined by the valley wall
- U Unconfined not touching the valley wall
- N Not applicable (e.g., where no valley wall exists)

For further information on physical and chemical habitat parameters, biological information, and collection methodologies, consult the annual and completion reports prepared during the course of this study (Graham et al. 1980, Fraley et al. 1981, Shepard et al. 1982, Shepard and Graham 1983, Montana Department of Fish, Wildlife and Parks 1983).

CANYON CREEK DRAINAGE

CANYON CREEK REACH I

Channel Characteristics: Date surveyed: 9-3-80 (Figure 4)

Reach I of Canyon Creek is a fourth order tributary. Average wetted width was $6.0\,\mathrm{m}$ in the lower portion and $7.6\,\mathrm{m}$ in the upper segment. The average depth was $30\,\mathrm{cm}$. The reach contained $30\%\,\mathrm{run}$, $60\%\,\mathrm{riffle}$, no pools and $10\%\,\mathrm{pocketwater}$. Low to moderate amounts of channel debris were present with $30\%\,\mathrm{being}$ stable. Very little instream or bank cover was present. The channel gradient was $3.7\%\,\mathrm{and}$ the D-90 was $80\,\mathrm{cm}$. There was a $3\,\mathrm{m}$ falls located $400\,\mathrm{m}$ above the mouth.

Valley Characteristics:

The upper bank slope gradient was 60% in the lower portion (below the falls) and 40-60% above the falls. The valley to channel ratio was 1.5:1 from the mouth to the falls and 1.75:1 from the falls upstream. The channel was confined to entrenched in the lower segment and frequently confined above the falls. The channel pattern was irregular.

Fish Populations: (Figure 5)

Bull trout and westslope cutthroat were present in Reach I. Bull trout were present only below the falls. There may be very limited spawning by adfluvial bull trout below the falls. Resident westslope cutthroat were present above and below the falls. The presence of sculpins has not been documented, but it is possible they are present below the falls.

CANYON REACH II

Channel Characteristics: Date surveyed: 9-3-80 (Figure 4)

Reach II is a third order tributary in the lower portion and becomes intermittent in the upper end. Average wetted width was $5.2\,\mathrm{m}$ and the mean depth was $23\,\mathrm{cm}$. The reach was composed of 65% run, 30% riffle, 3% pool, and 2% pocketwater. Low amounts of debris were present in the floodplain with 30% being stable. Bank cover was less than 10% and the instream cover was moderate. Channel gradient was 4.0% and the D-90 was $33.5\,\mathrm{cm}$.

Fish Populations: (Figure 5)

No fish were observed in Reach II.

McGinnis Creek

Channel Characteristics: Date surveyed: 9-3-80 (Figure 4)

McGinnis Creek is a third order tributary in Canyon Creek drainage. Average wetted width was 2 m and the average depth was 20 cm. McGinnis Creek was composed of 55% riffle, 30% run, 9% pocketwater and 6% pool. Channel debris was moderate with 40% being stable. Vegetation provided low to moderate bank cover, while instream cover was moderate. Stream gradient was 8.9% and the D-90 was 75 m. The reach had a 15 m falls located 1 km above the mouth.

Valley Characteristics:

The upper bank slope gradient was 40-60%. Active slumps which contributed appreciable sediment to the creek were found in the lower half of the reach. The valley to channel ratio was 3:1 and the average valley width was 10 m. McGinnis Creek was entrenched and confined and stream pattern was irregular.

<u>Fish Population</u>: (Figure 5)

Westlope cutthroat, bull trout, and mountain whitefish were observed in this creek. The 15 m falls formed a fish barrier. The above species were present below this falls. Densities of juvenile bull trout showed the section below the falls to be an important rearing area with 1.5 age I or older bull trout per $100\ m^2$ of surface area.

Kimmerly Creek Reach 1

Channel Characteristics: Date surveyed: 9-3-80 (Figure 4)

Kimmerly Creek is a third order tributary in Canyon Creek drainage. Average wetted width was 5.4 m, and the average depth was 21 cm. Kimmerly Creek was composed of 75% riffle, 20% run, 4% pocketwater, and 1% pool. Low amounts of channel debris were present with half being stable. Instream cover and bank cover were moderate. Stream gradient was 9.8% and the D-90 was 27 cm.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 10:1. The average valley width was 100 m. Kimmerly Creek was occasionally confined and had an irregular pattern.

Fish Population: (Figure 5)

Westslope cutthroat were observed in this reach. Spawning and rearing of resident fish occurred here.

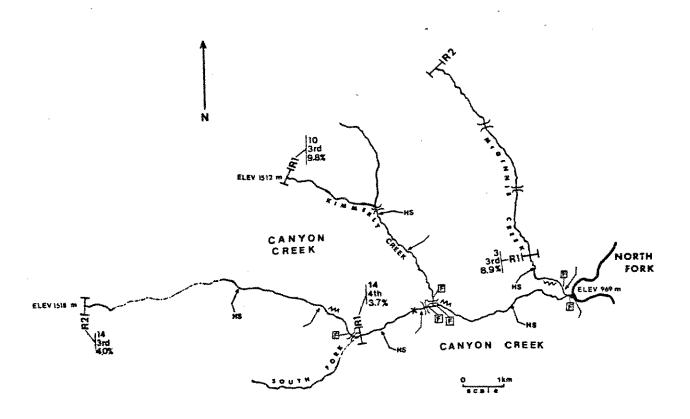


Figure 4. Location of physical habitat parameters by reach for the Canyon Creek drainage.

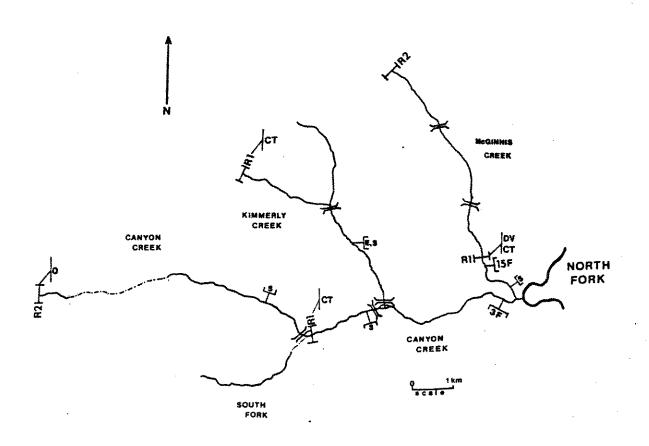


Figure 5. Fish population information by reach for the Canyon Creek drainage.

Table 2. Stream habitat and fish population data for Canyon Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach bounda	гу	Upper elev.(m	Lower reach) boundary	Lower elev.(m)
Canyon Creek	001	DAI	6.3	North Fork	2.2 k mouth Kimme		1201	mouth	969
Physical	Habitat dat	<u>a</u> Ave.	Ave	a .	Ave.		Valley-		
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depti	n for c	hannel idth(m)	'Valley width(m)	channel <u>ratio</u>	<u>c1</u>	Flow haracteristics
4	75.9	7.6	.3		14	75	5	SI	wirling/rolling
Confine- ment	Pattern	Sid chann occuren	el	lverage low flow	Flow du surve (m³/se	y pea	erage k water mp(C)	Turbidity	Maximum pool depth(m)
F	N	Tow	1 %	0.61 ocket-	0.4 % class		s % cl	low ass %cl	1.0 lass % class
% pool	% run	% riffle	<u>\</u>	<u>ater</u>	I pools				oools V pools
0	30	60 % bed mat		10	0	0 0-90	_% 0	Stability 0	100 Bank
% fines	%gravel	% rubbl		oulder	%bedrock		gradient	rating	form
20	30	30	21	0	0	80	3.7	97	repose
Bank Process		ank etic rial	Flood plain <u>debri</u>) (Channel debris	% sta chann debr	el % cove		
failing	flu	vial	mode	rate	low	30	1	1	10
Water che	mistry data								
Cond. (umohs/ cm)	A1k. (mg/1)	Total carbo (mg/l	n	Total phos. mg/l)	No ₃ " (mg/l)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ SO ₄ (mg/1)
							469 400.		
Spawning	<u>da ta</u>								
Number of bull trou redds in reach		ty	bull redd	er of trout s in ach	Redd density (no/km)		Number of bull trout redds in reach	Redd density (no/km)	Year
						*** ==	***		-
Fish popu	lation data								
Density (no/100 m² s	urface are	<u>a</u>)					Mounta	Other species in Eastern
Age 0	<u>Cutthroat</u> Age I Age	e II Ag	e 111+	Age 0	Bull to Age I	rout Age II	Age III+	Whitef	
0		0.2	8.0	0	0	0	0	pres	ent absent
Gionaso (<u> </u>	-	15.,11 4.				
Age 0	<u>Cutthroat</u> Age I Age	e II Aq	e III+	Age 0	Bull to Age I	Age II	Age III+		

Table 3. Stream habitat and fish population data for Canyon Creek Reach 2.

Stream Name	Reach <u>number</u>		each Tribut ength of	-	***************************************	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Canyon Creek	002	DAH 7	.9 Nor		aters	1518	2.2 km fr mouth of Kimmerly	rom 1201
Physical	Habitat dat		Ave.	Ave.		Valley-		
Stream order	Drainage area(km²)	Ave. wetted width(m)	depth for reach(m)	channe l 📑	Valley width(m)	channel ratio	cha	Flow aracteristics
3.		5.2	.23	14	275	20	bı	roken rolling
Confine- ment	<u>Pattern</u>	Side channe occurenc	low	Flow dur survey (m³/sec	/ pea	erage k water mp(C) I	<u> </u>	Maximum pool depth(m)
Х	Р	low	0.29 % pocket-	0.30 % class	ž clas			0.9 % class
<u> </u>	<u>% run</u> 63	% riffle	water	<u>I pools</u>	II poo			
		30 % bed mate	2 rial	6	0-90 0-90		Stability 44	Bank
% fines	<u>%gravel</u>	% rubble	% boulder	%bedrock	(cm)	gradient	rating	<u>form</u>
20	40	30	10	0	33	4.0	82	repose
Bank <u>Process</u>		ank etic <u>ria</u> l	flood plain debris	Channel debris	% sta chann <u>debr</u>	el % cover		% cover- snorkel section
failing	j flu	uvial	low	low	30	1	10	18
Water che	mistry data							
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/1)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ SO ₄ (mg/1)
								and the same
Spawning	<u>da ta</u>							
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	Year		Redd density (no/km) Y	<u>'ear</u>
 Fish popu	 lation data		****					~-
Density (no/100 m² s	urface area)				0 Mountai	other species n Eastern
Age 0	Cutthroat Age I Age		III+ Age (Bull tr Age I	out Age II	Age III+	Whitefi	
O Biomass (O grams/100 m	0 ² surface a	0 0 rea)	0	0	0	absei	nt absent
	Cutthroat			Bull tr		3 Y 7 3	e .	
			111+ Age (Age II	Age III+		
0	0	0	0 0	0	0	0		

Table 4. Stream habitat and fish population data for McGinnis Creek Reach 1.

Stream Name	Reach number	Serial number	Reach <u>Length</u>	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
McGinnis Creek	001	DAG	1.3	North Fork	Falls	1080.0	mouth	960.0

<u>Physical</u> Stream	Habitat dat	<u>a</u> Ave. wetted	Ave. depth for	Ave. channel	Valley	Valley- channel	•	Flow	
order	area(km²)	width(m)	reach(m)	width(m)	width(m)	ratio	*	characteri	<u>stics</u>
3	16.8	2.0	.20	3	10	3		broken/	rolling
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low flow	Flow dui survey (m³/sec	/ pe	verage ak water emp(C)	Turbidity	Maximum pool depth(m	
Χ	P	low	**************************************	0.0			moderate		.
% pool	% run	% riffle	% pocket- water	% class I pools	% clas			class V pools	% class V pools
6	30	55	9	4	12	2	0	64	0
% fines	%gravel	% bed mater % rubble	ial % boulder	%bedrock	D-90 (cm)	% gradient	Stability rating		ank
			······································		***************************************		**************************************	13	orm
30	20	20	10	20	75	8.9	113	r	epose
Bank Process	Ba g en e <u>mater</u>		Flood plain debris	Channel debris	% sta chanr debr	nel % cov		ver sno	cover- orkel ction
failing	j fluv	/ial	1 ow	moderate	e 40	10	1(0 1	8
Water che	mistry data							_	_
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ ⁻ (mg/l)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/l)	Na ⁺ (mg/1)	κ ⁺ (<u>mg/1)</u>	SO ₄ (mg/l)
							1865 1869	49 E	
Spawning	<u>da ta</u>		•						
Number of bull trou redds in reach		у	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	Year	
			**				***		
Fish popu	lation data								
Density (no/100 m² su	rface area)					,	Other spe	0.00
	Cutthroat			Bull tr			Moun Whit	tain efish	Eastern Brk trout
		II Age		Age I	Age II	Age III+			
O Riomass (-	.7 2.		0	0	1.5	pre	sent	absent
0.1016622 (surrace are	<u></u> /						
Age 0	<u>Cutthroat</u> Age I Age	II Age	II+ Age O	Bull tro	out Age II	Age III+			
0	0 8		0	0	0	69			

Table 5. Stream habitat and fish population data for Kimmerly Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Kimmerly Creek	001	DAF	4.2	North Fork	headwaters	1512	mouth	1109

						•			
Physica1	Habitat dat			A		M# 3.7			
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	<u>:</u>	Flow character	istics
3	18.5	5.4	.21	10	100	10	r	rollina	/broken
Confine-		Side channel	Average low	Flow du		verage ak water		Maximum pool	
ment	Pattern	occurence	flow	(m³/se		emp(C)	<u>Turbidity</u>	depth(m	<u>)</u>
-				0.20	_	·=	low	0.3	w •
% pool	% run	% riffle	% pocket- water	% class I pools	% clas			pools	% class V pools
1	20	75 % bed mater		0	D-90	1	Stability	3	ank 0
% fines	%gravel	% rubble	% boulder	%bedrock	(<u>cm)</u>	gradient	1301119	-	orm
20	30	30	20	0	27	9.8	66	re	epose
Bank Process		ank etic <u>ria</u> l	Flood plain <u>debris</u>	Channel debris	% sta chann debi	iel % cov		er sn	cover- orkel ction
failin	q flu	vial	low	low	50	1	11		21
	emistry data					-			
Cond.		Total	Total						
(umohs/ cm)	Alk. (<u>mg/l)</u>	carbon (mg/l)	phos. (mg/l)	$\frac{No_3}{(mg/1)}$	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l <u>)</u>	K ⁺ (<u>mg/l)</u>	50 ₄ (mg/1)
			***		***				***
	3			•					
Spawning	data								
Number of	F		Number of			Number of			
bull trou redds in	ıt Red densi		bull trout redds in	Redd density		bull trout redds in	Redd density		
reach	(no/ki		reach	(no/km)	Year	reach	<u>(no/km)</u>	<u>Year</u>	
***		****		· ·					
Fish popu	lation data								
Density (urface area)		Bull tr			Mount White		ecies Eastern Brk trout
Age 0	Cutthroat Age I Age	e II Age			Age II	Age III+	#III UE	1 1211	DIK CIOUC
0	0 1	9 5.		0	0	0	abse	ent	absent
Biomass (grams/100 m	² surface are	<u>ea</u>)	_ '					
Aga O	Cutthroat Age I Ag	e II Aqe	111+ Age 0	Bull tr Age I	rout Age II	Age III+	•		
Age 0									
0	0 2	16	5 0	0	0	0			

BIG CREEK DRAINAGE

BIG CREEK REACH I

<u>Channel Characteristics</u>: Date surveyed: 9-3-79 (Figure 6)

Big Creek Reach I is a fourth order tributary in the North Fork drainage. Average wetted width was 14 m and the average depth was 30 cm. This reach was composed of 40% riffle, 40% run, 11% pool, and 9% pocketwater. Low amounts of channel debris were present with 30% being stable. Instream and bank cover were low. Stream gradient was 1.5% and the D-90 was 40 cm.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 8:1. Near the mouth of Langford Creek some steep wasting banks over 70 m high and 100 m long were the major features. The average valley width was 150 m. The reach was occasionally confined and had a sinuous pattern.

Fish Populations: (Figure 7)

Westslope cutthroat trout, bull trout, mountain whitefish and sculpins were observed in this reach. This reach had low fish densities. Migratory cutthroat and bull trout utilized the area as a migration corridor to upstream spawning areas.

BIG CREEK REACH II

Channel Characteristics: Date surveyed: 9-3-79 (Figure 6)

Reach II of Big Creek is a third order tributary down to Skookoleel Creek were it becomes fourth order. Average wetted width was 14 m and the mean depth was 30 cm. The reach was composed of 50% run, 30% riffle, 15% pool and 5% pocketwater. Low amounts of channel debris were present with 30% being stable. Bank cover was low and instream cover was moderate. Stream gradient was 2.3% and the D-90 was 40 cm. Several slumping areas were present affecting stream compaction and imbeddedness downstream. A lower gradient, smaller substrate area was present above Skookoleel Creek.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 4.5:1. The average valley width for the lower portion was 150 m, while the upper portion averaged 80 m. The reach was occasionally confined in the lower portion and unconfined in the upper portion. Pattern was sinuous to irregular.

Fish Populations: (Figure 7)

Bull trout, westslope cutthroat and sculpins were found in Reach II. Densities estimates showed this reach was an important rearing area for juvenile bull trout with 3.6 age I or older fish per 100 m² surface area. Spawning by migratory bull trout has been documented in Reach II and four years of redd counts showed an average of 22 redds annually.

BIG CREEK REACH III

Channel Characteristics: Date surveyed: 9-3-79 (Figure 6)

Big Creek Reach III is a third order tributary in the North Fork drainage. Average wetted width was 3 m with an average depth of 15 cm. This reach was composed of 60% riffle, 30% run, 6% pocketwater and 4% pool. Low amounts of channel debris were present with 30% being stable. Instream cover was low and bank vegetation was moderate. Stream gradient was 5.5% and the D-90 was 65 cm.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 3:1. The average valley width was 15 m. The reach was confined and often entrenched and had an irregular pattern. Some slumping occurred along old road cuts.

Fish Populations: Date surveyed: 9-15-79 (Figure 7)

Bull trout were the only fish observed in this section. A 150 m section of the reach was electrofished yielding 43 juvenile bull trout.

Langford Creek Reach I

Channel Characteristics: Date surveyed: 8-30-79 (Figure 6)

Reach I of Langford Creek is a second order tributary to Big Creek. Wetted width averaged 2.5 m and mean depth was 15 cm. The reach consisted primarily of run (70%), while riffle, pool and pocketwater made up 10%, 4% and 16%, respectively. There was a large amount of debris present with 30% being stable. The channel had abundant cover and was overgrown with alder. Abundant instream cover was provided by debris. The channel gradient was 3.0% and the D-90 was 10 cm.

Valley Characteristics:

The upper bank slope gradient was less than 30%, and the valley to channel ratio was 7.5:1. The average valley width was 30 m. The channel was unconfined and had a meandering pattern.

Fish Populations: (Figure 7)

Bull trout, westslope cutthroat, and sculpins were observed in Reach I. This was an important rearing area for cutthroat trout and provided spawning for adult migratory cutthroat. This reach had one of the highest cutthroat densities observed at 40.4 cutthroat per 100 m² surface area. Overall, this reach provided excellent spawning and rearing areas for cutthroat and rearing for juvenile bull trout.

Langford Reach II

Channel Characteristics: Date surveyed: 8-30-79 (Figure 6)

Reach II of Langford Creek begins at the outlet of Mud Lake and is a second order tributary. Average wetted width was 1.6 m and the average depth was 10 cm. Runs made up the majority of the reach (80%), with 10% riffle, 3% pool and 7% pocketwater. There was a large amount of debris present with 10% being stable. The channel had a high percentage of the wetted surface covered by bank vegetation, predominantly alder, and instream cover was high. Channel gradient was 3.5% and the D-90 was 13 cm.

Valley Characteristics:

The upper bank slope gradient was less than 30%, and the valley to channel ratio was 4:1. The average valley width was 12 m. The channel was occasionally confined by valley walls and had an irregular meandering pattern.

Fish Populations: (Figure 7)

Bull trout, westslope cutthroat, and sculpins were observed in Reach II. This was an important rearing area for cutthroat trout and provided spawning habitat for migratory cutthroat. The cutthroat density of 74.4 fish per $100\ m^2$ was one of the highest recorded. The reach also provided rearing areas for juvenile bull trout.

Hallowat Creek Reach I

<u>Channel Characteristics</u>: Date surveyed: 9-1-79 (Figure 6)

Reach I of Hallowat Creek is a fourth order tributary to Big Creek. Average wetted width was 6.0 m, the mean depth was 17 cm, and a maximum depth of 150 cm was recorded. The reach consisted of 40% run, 40% riffle, 6% pool and 14% pocketwater. There was a moderate amount of debris with 20% being stable. Bank cover was low and little instream cover was present. Channel gradient was 1.7% and the D-90 was 30 cm. One major slump zone was located within the reach.

Valley Characteristics:

The upper bank slope had a gradient of less than 30%, and the valley to channel ratio was 7:1. The average valley width was 70 m. The channel was occasionally confined by valley walls and pattern was irregular.

Fish Populations: (Figure 7)

Bull trout, westslope cutthroat, and sculpins were observed in this reach. Both migratory westslope cutthroat and bull trout utilized this reach for spawning. An average of 14 bull trout redds were enumerated annually during four years of survey. Both juvenile bull and cutthroat trout rearing was provided.

Hallowat Creek Reach II

<u>Channel Characteristics:</u> Date surveyed: 9-1-79 (Figure 6)

Reach II of Hallowat Creek contains the upper segment of the creek and is a third order stream. Average wetted width was 5.0 m and the mean depth was 19 cm. The reach had 30% run, 50% riffle, 8% pool and 12% pocketwater. There was very little debris present. Bank cover was limited; however, large boulders were common and provided instream cover. The channel gradient was 4.5% and the bed material was predominantly bedrock illustrated by the large D-90 (75 cm). Some beaver activity was noted and numerous cascades were observed.

<u>Valley Characteristics:</u>

The upper bank slope gradient was 40-60%, and the valley to channel ratio was 6:1. The average valley width was 30 m. The channel was frequently confined by valley walls and pattern was sinuous.

<u>Fish Populations</u>: (Figure 7)

Bull trout, westlsope cutthroat trout, mountain whitefish and sculpins were observed in this reach. Spawning by adfluvial bull trout has been documented here.

Werner Creek Reach I

Channel Characteristics: Date surveyed: 9-3-79 (Figure 6)

Werner Creek is a second order tributary to Hallowat Creek. Average wetted width was 6 m, and the average depth was 25 cm. Werner Creek contained 40% run, 30% riffle, 25% pocketwater and 5% pool areas. Channel debris was moderate with 30% stable and of large size. Vegetation provided

abundant bank cover, while instream cover was moderate. Stream gradient was 8.0% and the D-90 was 60 cm.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 8:1. The average valley width was 80 cm. Werner Creek was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 7)

Westslope cutthroat and bull trout were observed in this creek. Bull trout were found only below the Hallowat Creek Road. Fish densities were moderate for westslope cutthroat and low for bull trout. Log and debris jams near the mouth made upstream migration difficult during periods of low flow and the Hallowat Road culvert may have been a barrier at low flows.

Kletomus Creek Reach I

<u>Channel Characteristics</u>: Date surveyed: 9-1-79 (Figure 6)

Kletomus Creek is a third order tributary to Hallowat Creek. Average wetted width was 3 m and the average depth was 13 cm. Kletomus Creek contained 60% riffle, 30% run, 7% pool and 3% pocketwater. Channel debris was moderate, with only 20% stable. Bank cover and instream cover were moderate. Stream gradient was 7.3% and the D-90 was 40 cm. Several 1 m - 2 m high log jams and rock cascades were found which may impede upstream movement of spawning bull trout.

Valley Characteristics:

The upper bank slope gradient was greater than 60% and the valley to channel ratio was 7:1. The average valley width was 45 m. Kletomus Creek was frequently confined and had an irregular pattern.

Fish Populations: (Figure 7)

Westslope cutthroat and bull trout were observed in this creek. Migratory westslope cutthroat and bull trout probably utilize this creek for spawning and rearing.

Skookoleel Creek Reach I

<u>Channel Characteristics</u>: Date surveyed: 8-31-79 (Figure 6)

Skookoleel Creek Reach I is a third order tributary in Big Creek drainage. Average wetted width was 8 m and the average depth was 12 cm.

Reach I of Skookoleel Creek was composed of 40% pocketwater, 30% run, 20% riffle and 10% pool. Channel debris was moderate with 30% being stable. Overhanging vegetation provided abundant bank cover, while instream cover was moderate. Stream gradient was 6.9% and the D-90 was 90 cm.

Valley Characteristics:

The upper bank slope gradient was 30% and the valley to channel ratio was 2:1. The average valley width was 25 m. Skookoleel Creek was occasionally confined and had an irregular pattern. Braiding, split channels, and wasted banks were common.

Fish Populations: (Figure 7)

Westslope cutthroat trout were observed in this reach. Resident westslope cutthroat were present, and it was unknown whether migratory cutthroat used the area. Fish densities were low. Bull trout were also observed.

Skookoleel Creek Reach II

Channel Characteristics: Date surveyed: 8-31-79 (Figure 6)

Skookoleel Creek Reach II is a second order tributary in Big Creek drainage. Average wetted width was 4 m and the average depth was 12 cm. This reach contained 60% riffle, 30% run, 6% pocketwater, and 4% pool. Channel debris was moderate, with very little being stable (10%). Bank vegetation provided limited cover, while instream cover was high. Stream gradient was 10.8%, and the D-90 was 25 cm.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 12:1. The average valley width was 100 m. Skookoleel Creek was unconfined and had an irregular pattern.

Fish Populations: (Figure 7)

Westslope cutthroat, probably residents, were observed in this creek.

Nicola Creek Reach I

Channel Characteristics: Date surveyed: 8-31-79 (Figure 6)

Nicola Creek is a second order tributary in Big Creek drainage. Average wetted width was 5 m, and the average depth was 20 cm. Nicola Creek contained 50% riffle, 30% run, 12% pocketwater, and 8% pool. Channel debris was moderate, with 20% being stable. Overhanging vegetation

provided abundant bank cover, while instream cover was low. Stream gradient was 7.6% and the D-90 was 58 cm. Several partial barriers to upstream migration were present in the form of log jams and rock cascades up to 2 m high.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 10:1. The average valley width was 80 m. Nicola Creek was occasionally confined and had an irregular pattern.

<u>Fish Populations</u>: (Figure 7)

Westslope cutthroat and bull trout were observed in the creek, mainly near the mouth. Resident westslope cutthroat were identified, and overall fish densities were low in the creek.

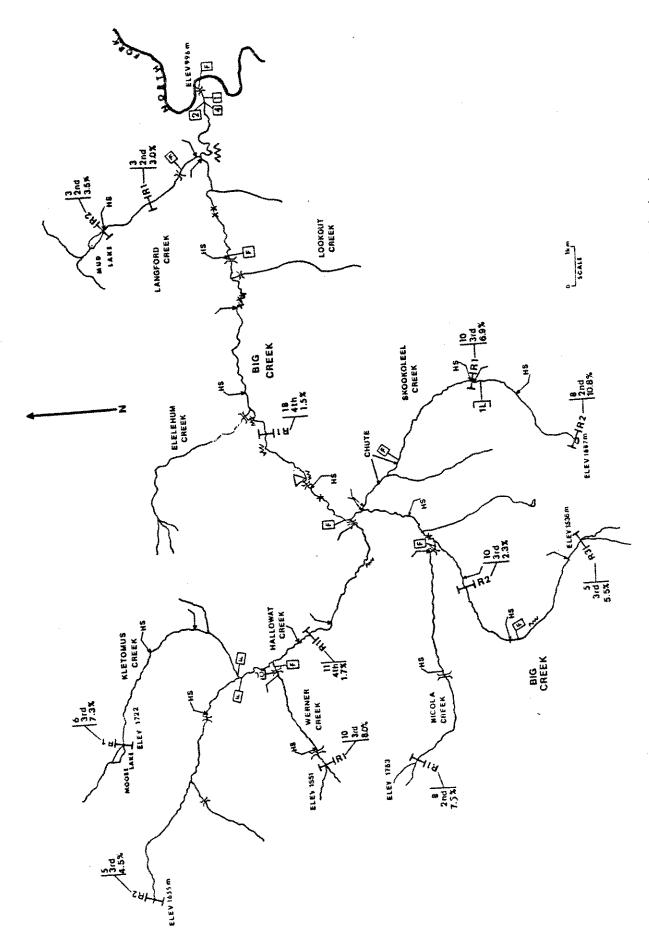
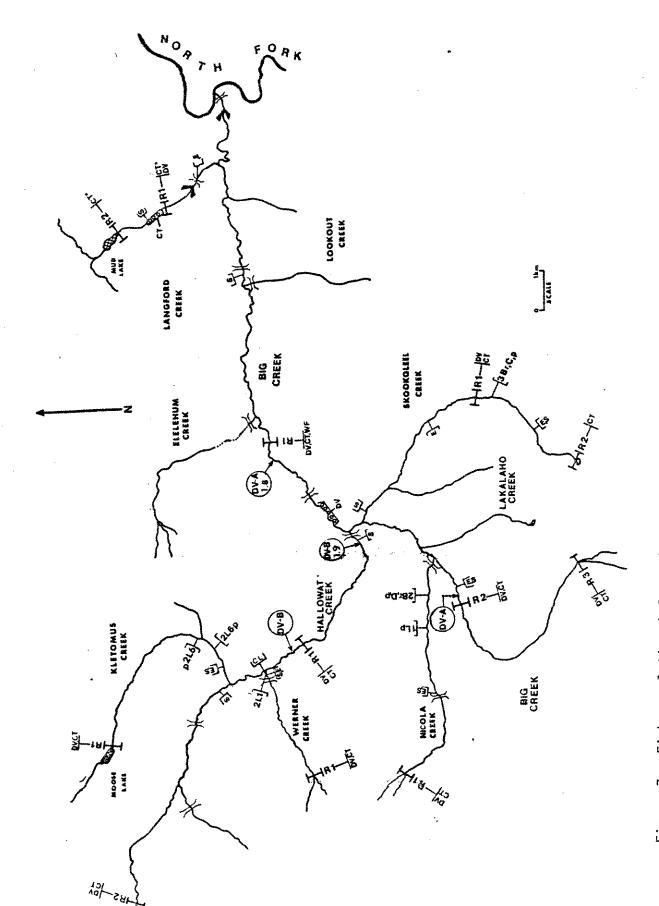


Figure 6. Location of physical habitat parameters by reach for the Big Creek drainage.



Fish population information by reach for the Big Creek drainage. Figure 7.

Table 6. Stream habitat and fish population data for Big Creek Reach 1.

Stream Name	Reach number	Serial number	Reach <u>Length</u>	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Big Cr.	001	DBF	10.4		1 km above Elelehum Cr.	1158	junction with North Fork Flathead Rive	

nhi.a.i	United and distance								
Stream order	Habitat data Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio		Flow characteris	stics
4	212.5	14.0	. 30	18	150	8		swirling	T
		Side	Average	Flow du		verage		Maximum	•
Confine- ment	Pattern	channel occurence	low flow	survey (m³/sec		nk water emp(C)	Turbidity	pool depth(m)	•
Χ	Р	moderate	<u>1.10</u>	1.4		L4	l ow	1.7	
			% pocket-	% class	% clas	ំន ទ	lass %	class	class
<u> </u>	3 run	% riffle	water	I pools	II poo	ols III			V pools
11	40	40 % bed mater	9	20	9 D-90	ë ,	25 Stability	46 Ba	0
§ fines	%gravel	% rubble	S boulder	5bedrock	(cm)	gradient	rating	fo fo	
30	30	20	10	10	40	1.5	99	re	pose
	Bā	ink	Flood		⊸ sta	ble		: c	over-
Bank	gene		plain	Channel debris	chann				rkel
Process failing	<u>mater</u> flu	vial	<u>debris</u> low	low	debr 30		<u>py</u> <u>overt</u> 1(tion .0
1411111	9 114	VIUI	ION	1 044	J	, 1	Ţŗ	, 1	.u
Water ch	emistry data						,		
Cond.		Total	Total	_		++	+	ĸ [÷]	
(umohs/ cm)	Alk. (mg/l)	carbon (mg/1)	phos. (mg/1)	No₃¯ (mg/l)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/l)	Na [†] (mg/l <u>)</u>	K (mg/1)	SO ₄ (mg/1)
		1.06	.005	0.15	24.3	0.63			2.2
				0110		0.00			£ 0 £
Spawning	data								
Number o		· 1	Number of bull trout	Redd		Number of bull trout	Redd		
redds in	densit	ty	redds in	density	.	redds in	density	W	
reach	(no/kr		reach	(no/km)	Year	reach	(no/km)	<u>Year</u>	
0	0.	0 80	6	0.8	79	1	0.1	81	
Fish pop	ulation data							2.1	
Density	(no/100 m ² st	urface area)					Moun	Other spectain	Eastern
Age 0	Cutthroat Age I Age	e II Age	III+ Age 0	Bull tr Age I	out Age II	Age III+	Whit	efish	Brk trout
70 0		$0^{\frac{1}{10}}$. 0	0	0	0	pre	sent	absent
Biomass	(grams/100 m ²	surface are	ea)				•		
- ""	Cutthroat			Bull tr	out				
Age 0		e II Age	III+ Age 0		Age II	Age III+			

0 0 3 0 0 0 0

Table 7. Stream habitat and fish population data for Big Creek Reach 2.

Stream Name	Reach number	Serial number	Reach <u>Length</u>	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Big Cr.	002	DBE	7.9	North Fork	1.5 km above Nicola Cr.	1344	1 km above Elelehum Cr.	1158

Physical Physical	Habitat dat	<u>a</u> Ave.	Ave.	Ave.		Valley-			**
Stream <u>order</u>	Drainage <u>area(km²)</u>	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio		Flow characteri	stics
3	* ***	5.0	.44	10	150	5		rolling	
Confine-		Side channel	Average low	Flow dur survey	pea	verage ak water		Maximum pool	
ment	Pattern	occurence	flow	(m³/sec	<u></u>	emp(C)	Turbidity	depth(m	<u>)</u>
Χ	P	low	% pocket-	0.70 % class	% clas			1.5 class	% class
<u>% pool</u>	<u>د run</u>	% riffle	water	<u>I pools</u>	II por			V pools	V pools
15	50	30 * had matan	5	5	5 D-90	1!	o Stability	75 Ba	ank
% fines	%gravel	<pre>% bed mater % rubble</pre>	% boulder	%bedrock	(cm)	gradient	rating	f	orm
10	50	20	20	0	50	23	99	r	epose
	В	ank	Flood		% sta		W max		cover- orkel
Bank Process	g en mate	etic rial	plain debris	Channel <u>debris</u>	chani debi				ction
failir	****	vial	moderate	moderat	e 20	1		1	20
Water ch	emistry data	<u>i</u>							
Cond.		Total	Total		Ca ⁺⁺	Mg ⁺⁺	Na ⁺	κ+	504
(umohs/ cm)	Alk. (mg/l)	carbon (mg/l)	phos. (mg/1)	No ₃ - (mg/1)	(mg/1)	(mg/1)	<u>(mg/1)</u>	(<u>mg/1)</u>	(mg/1)
C									
Spawning	1 data								
Number o			Number of bull trout	Redd		Number of bull trout	Redd		
bull tro redds in	e densi	ity	redds in	density (no/km)	Year	redds in reach	density (no/km)	Year	
<u>reach</u> 15	_ <u>(no/k</u> 2.:		<u>reach</u> 6	0.9	79	23	3.3	81	
			U	Q.5	19	23	J.J	O1	
	oulation data	-						Other sp	
Density	(no/100 m ² s			Bull tr	rout			ntain <u>tefish</u>	Eastern Brk trout
Age 0		ge II <u>Age</u>	111+ Age (Age I	Age II	Age III+			
0	(grams/100 m	0 0 0^2 surface ar		7 0.1	0.1	0.1	pi	resent	absent
BTOMASS			/ /	aull t	-out				
Age 0	Cutthroat Age I Age	c g <u>e II Age</u>	III+ Age (Age II	Age III+			
- 0	0 (כ	0 1	1	2	5			

Table 8. Stream habitat and fish population data for Big Creek Reach 3.

Stream Name	Reach number	Serial number	Reach <u>Length</u>	Tributary <u>of</u>	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Big Cr.	003	DAC	3.5	North Fork	Headwaters	1536	1.5 km above Nicola Cr.	1344

Physical	Habitat data	a							
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel <u>ratio</u>		Flow character	
3		3.0	.15	5	15	3		brokei	n
Confine- ment	Pattern	Side channel occurence	Average low flow	Flow du surve (m³/sec	y pe	verage ak water emp(C)	<u>Turbidity</u>	Maximum pool depth(n	D .
C	Р	l ow	**** ****	0.43	}	179. 440	low	0.0	3
% poo1	% run	% riffle	% pocket- water	% class I pools	% cla II po		lass %	class pools	% class V pools
4	30	60	6	0	0	0	1	.00	0
% fines	%gravel	% bed mater % rubble	ial % boulder	%bedrock	D-90 (cm)	gradient	Stability <u>rating</u>		orm
10	20	30	30	10	65	5.5	8 9	r	epose
Bank <u>Process</u>	Ba gene <u>mater</u>		Flood plain debris	Channel debris	% sta chana debi	nel % cov		er sn	cover- orkel ction
failing	fluv	ial	l ow	low	30	10	20	,	0
Water cher	nistry data			•					
Cond. (umohs/ _cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/1)	Total phos. (mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K [†] (<u>mg/1)</u>	SO ₄ (mg/1)
			***			-			
Spawning	<u>data</u>								
Number of bull trou redds in reach	t Redd densit (no/km	У	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
****				alle alge	**. ***				
Fish popul	lation data								
Density (r	no/100 m² su	rface area)					Mount	Other spe ain	<u>Ecies</u> Eastern
Age 0 7	Cutthroat lge I Age O	<u> </u>	1 <u>1+</u>	Bull tr Age I O	out Age II O	Age III+	White		Brk trout
Biomass (grams/100 m²	surface are	-	V	•	U	abse	:11 L	absent
	Cutthroat			Bull tro	out				
	ige I - Age	<u> 11 Age I</u>	II+ Age 0	Age I	Age II	Age III+			
n	0 (1 0	Λ	Λ	Ο	Λ			

Table 9. Stream habitat and fish population data for Langford Creek Reach 1.

Lower

Upper

Stream Name	Reach number	Serial number	Reach T Length	ributary of	reach boundar	<u> </u>		Upper elev.(m	reach boundar	ry	Lower elev.(m)
Langfor Creek	rd 001	DBD		orth ork	.5 km Big Cr			1082	mout	h	1045
Physical Stream order	Habitat dat Drainage area(km²)	Ave. wetted width(m)	Ave. depth reach		Ave. hannel idth(m)	Valley width(m)	ci	illey- nannel ratio		Flow characteri	<u>stics</u>
2	12.4	2.5	.15		3	12	Account	7		rolling Maximum	/placid
Confine- ment	Pattern	Sid chann occuren	el _	erage low low	Flow du survey (m³/sec	/ P	Average eak wa temp((iter	Turbidity	pool depth(m	<u>)</u> .
U	R	low	- % po∈		0.04 % class	% c1				0.9 % class	% class
<u>% pool</u> 4	<u>% run</u> 70	<u>% riffle</u> 10	wa1	ter	I pools	<u>II p</u> 8	<u>001s</u>		0001s	IV pools 79	V pools O
		% bed mat	erial	.1		D-90	ana	% idient	Stabilit rating	y Ba	ink orm
<pre>5 fines</pre>	<u>%grave1</u> 60	<u>% rubbl</u> 10	e <u>% bou</u> 10	lider	%bedrock	(cm) 10		3.0	69	- <u>''</u> rep	
20		ank	Flood	÷	Ū		table		03	•	cover-
Bank Process		etic	plain debris	-	Channel debris		nnel bris	% cove			rkel tion
stable	fluv	vial	mode	rate	high	30	0	30	80) (40
Water cher	nistry data									÷	
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbo (mg/l	n pi	otal nos. 1/1)	No ₃ - (mg/l)	Ca ⁺⁺ (mg/l)		Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l	K ⁺ (<u>mg/1)</u>	SO. (mg/l)
***	नक्तंत्र ज्ञातंत्र							400 April.	-,-	98-98:	
Spawning	data										
Number of bull trou redds in reach	t Red densi (no/ki	ty	Number bull t redds reac	trout in	Redd density (no/km)	Year	bu] rec	ber of 1 trout ds in each	Redd density (no/km)	Year	
				-					AMPLY HERA.	400, 300.	
Fish papu	lation data			i						Other spe	ries
Density (no/100 m² s Cutthroat		<u>a</u>)		Bull tr	out				untain itefish	Eastern Brk trout
	Age I Age	<u>e II Ag</u>	e III+	Age 0	Age I	Age II	Age	111+			
	.8 grams/100 m		88.6 area)	0	0	0		0	ab	sent	absent
	Cutthroat		A TITA	Age C	Bull tr		400	111+		-	
Age 0			e <u>111+</u> 204	Age 0 0	Age I	Age II	Age	0			
3	14	U 1	404	U	J	U		J			

Table 10. Stream habitat and fish population data for Langford Creek Reach 2.

Stream Name	Reach number		Reach Length	Tributa:	Upper ry reach boundar	-	Upper elev.(m	Lower reach) boundary	Lower elev.(m)
Langfo Creek	rd 002	DAD 2	2.0	North Fork	Mud L	.ake	1143	.5 km a Big Cr.	
				•					
Physical	Habitat data								
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave depti reac	for	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	ch	Flow aracteristics
2		1.6	.10		3	12	3		rolling
Confine- ment	Pattern	Side channe occurenc	:1	verage low flow	Flow du surve (m³/se	y pea	verage ik water emp(C)	Turbidity	Maximum pool . depth(m)
Χ	N	low	 ~		()		us	low	0.2
% pool	% run	% riffle	<u> </u>	ocket- ater	% class <u>I pools</u>	% clas	ols III p	ools <u>IV po</u>	ss % class ools V pools
3	80	10 % bed mate	7 erial		0	0-90	25	75 Stability	0 Bank
% fines 40	<u>%gravel</u> 40	% rubble 10	•	oulder 10	% <u>bedrock</u> O	<u>(cm)</u> 13	gradient 3.5	rating 84	<u>form</u> steep
.0					Ü			07	
Bank Process	gene <u>mater</u>		Flood plain <u>debri</u>		Channel debris	% sta chanr debr	el % cove		% cover- snorkel section
stable	fluv	/ial	mode	rate	high	10	20	90	35
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/l)		Total phos. mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K ⁺ SO ₄ (mg/1)
-++ 		Net set	-	*** ***		*** HE	***		
Spawning	da ta								
Number of bull trou redds in reach		:у	bull redd	er of trout s in ach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km) Y	ear
		***	-	-		±¢ 446			-
	<u>lation data</u> no/100 m² su	irface area)						ther species
	Cutthroat			Ago A	Bull tr		Age III+	Mountai Whitefi	
5.0		.5 60		Age 0 O	Age I O	Age II O	0	absen	t absent
	Cutthroat				Bull tr	out		•	
Age 0	Age I Age	II Aqe	111+	Age 0	Age I	Age II	Age III+		
6	0 16	3 190	00	0	0	0	0		

Table 11. Stream habitat and fish population data for Hallowat Creek Reach 1.

Stream Name	Reach number		each Tribut ength of	•	<u>y</u>	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Hallowa Creek	t 001	DBC 4	.1 Nort Fork			1266	junctio Big Cre		1198
Physical	Habitat dat	a							
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel <u>ratio</u>	<u>2</u>	Flow haracteris	<u>stics</u>
4	42.1	7.0	.27	11	80	8	b	roken	•
Confine- ment	Pattern	Side channel occurence	Average low flow	Flow dur survey <u>(m³/sec</u>	pea	rerage k water mp(C)	<u> </u>	Maximum pool depth(m)	
Χ	Р	low	 % pocket-	% class	1 % clas	6 s % c1a	low % c	1.2	% class
<u>% pool</u>	% run	% riffle	water	1 pools	II poo	ils III po	001S <u>IV</u>	00018	<u>V pools</u>
6	40	40 % bed mater	14 ial	0	17 0-90	1	Stability	Ва	0 nk
% fines	%gravel	% rubble	<u>% boulder</u>	%bedrock	<u>(cm)</u>	gradient	rating	fo	rn
30	30	25	10	5	50	1.7	86		pose
Bank <u>Process</u>		ank etic <u>ria</u> l	Flood plain debris	Channel debris	% sta chann debr	el % cover		r sno	over- rkel tion
failing	flu	vial	low	medium	30	1	1	1	0
Water che	mistry data				-	•		•	
Cond. (umohs/ cm)	A1k. (mg/1)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)

Spawning	data			·					
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
8	1.9	80	2	0.5	79	14	3.5	81	
Fish popu	lation data			•				Other spe	nine
Density (urface area)					Mount	ain	Eastern Brk trout
Age 0		<u>e II Age</u>	III+ Age C		Age II	Age III+	<u>White</u>	: 138	DIR GIUUL
0	0 0.		0.6	0	0	0.8	abse	ent	absent
Riomass (Gutthroat	² surface ar	<u>ca</u>)	- Bull tr	out				
Age 0	Age I Ag	e II Age	III+ Age C		Age II	Age III+			
0	0	2 0	1	0	0	37			

Table 12. Stream habitat and fish population data for Hallowat Creek Reach 2.

Stream <u>Name</u>	Reach number		each Tributa ength of	Upper ary reach boundar	ry	Upper elev.(m	Lower reach) boundary		Lower elev.(m)
Hallowa Creek	at 002	DBB	8.7 Nort Fork		above bridge	1655	4.1 km mouth	from	1266
					•				
Physical	Habitat dat	<u>a</u> Ave.	Ave.	Ave.		Valley-			
Stream <u>order</u>	Drainage <u>area(km²)</u>	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio	<u>c</u>	Flow haracteris	stics
3	-	5.0	.19	5	30	6		oroken	
Confine- ment	<u>Pattern</u>	Side channe occurence		Flow du surve <u>(m³/se</u>	y pea	verage k water emp(C)	Turbidity	Maximum pool depth(m)	_
F	N	low	30.0	.28	o/ _1.1		low	0.9	e -1
* pool	% run	% riffle	% pocket- water	% class I pools				lass pools	% class V pools
8	30	50 % bed mater	12	2	Б-90	28	Stability	64	nk 0
% fines	%gravel	% rubble	% boulder	%bedrock		gradient	rating		irm
10	20	20	20	30	85	4.5	91	re	ose
Bank Process		ank etic rial	Flood plain debris	Channel debris	% sta chann debr	iel % cove		r sno	over- rkel tion
stable	f1u	vial	low	nil	20	1	10	10)
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	κ ⁺ (<u>mg/1)</u>	50. (mg/1)
		in ac	olet wire		1816 est	*** ***		reals reserve	
Spawning	<u>data</u>								
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)		Number of bull trout redds in reach	Redd density (no/km)	Year	
									
Fish popu	lation data	-							
Density (no/100 m² s	urface area)				Mounta		£astern
Age 0	Cutthroat Age I Ag	e II Age	III+ Age 0	Bull t Age I	rout Age II	Age III+	White	<u>fish</u>	3rk trout
0	0	0 0	0	0	0	0	abs	ent	absent
Biomass (² surface a	rea)						
Age O	Cutthroat Age I Ag		III+ Age 0	Bull t Age I	rout Age II	Age III+			

Table 13. Stream habitat and fish population data for Werner Creek Reach 1.

Lower

Upper

Stream <u>Name</u>	Reach number		Reach Length	Tributar of	y reach boundary		Upper elev.(m	reach boundary		Lower elev.(m)
Werner Creek	001	DA8	3.2	North Fork	headwa	ters	1551	juncti Hallow	on with vat	1287
Physical Stream order	Habitat dat Drainage area(km²)	<u>a</u> Ave. wetted width(m)		n for	Ave. channel width(m)	Valley width(m)	Valley- channel ratio		Flow characteris	stics
3	10.3	6.0	.2	5	10	80	8	t	umbling:	/rollin
Confine- ment	Pattern	Sid channo occuren	e e l	Average low <u>flow</u>	Flow dur survey (m³/sec	pea	erage k water mp(C)	Turbidity	Maximum pool depth(m)	•
Χ	Р	low	œ.	 pocket-	0.04 % class	% clas	 s %cl	low %	class.1	% class
% pool	% run	% riffle		water	<u>I pools</u>	II poo	<u>ls III p</u>	ools IV	<u>pools</u>	<u>V pools</u>
5	40	30 % bed mat	erial	25	0	3 p-90	13	Stability	-	ink 0
% fines	%gravel	% rubble	e %	boulder	% <u>bedrock</u>	<u>(cm)</u>	gradient	<u>rating</u>	<u>tc</u>	orm
20	40	15		15	10	60	8.0	81	re	pose
Bank Process		ank etic <u>ria</u> l	Floo plai <u>debr</u>	n	Channel debris	% sta chann debr	el % cove		er sno	cover- orkel ction
stable	flu	vial	mode	rate n	noderate	30	20	30		26
Water che	mistry data	1								
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbo (mg/l		Total phos. (mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO. (mg/1)
				···	***				-	****
Spawning	data									
Number of bull trou redds in reach		ity	bul rec	ber of 1 trout ds in each	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
	-									
Fish popu	lation data	<u>1</u>							0.1	
	no/100 m² s	;	a) e III+	Age 0	Bull tr Age I	rout Age II	Age III+	Moun Whit	Other spe tain efish	Eastern Brk trout
Age 0	Age I Ag	<u>je II Ag</u>	1117	rge o		^	0	ساني		

0

0

Bull trout

0

Age II

0

0

Age III+

0

absent

absent

0

Age 0

0

0

Age I

0

Age 0

0

0.5

Age II

6

Biomass (grams/100 m² surface area)

Cutthroat

1.7

Age III+

Table 14. Stream habitat and fish population data for Kletomas Creek Reach 1.

Stream <u>Name</u>	Reach number			Upper utary reach of bounda	ıry	Upper elev.(s	Lower reach boundary		Lower elev.(m)
Kletoma Creek	as 001	DAE 5	5.6 Nor For		e Lake	1772	juncti Hallow	on with	1312
								•	
Physical Physical	Habitat data	a Ave.	Ave.	Ave.		V-11			
Stream order	Drainage area(km²)	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	Valley- channel ratio		Flow characteris	tics
3	14.1	3.0	.13	6	45	8		roken/ro	
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low flow	e Flow du surve <u>(m³/se</u>	ey p	Average eak water temp(C)	Turbidity	Maximum pool depth(m)	
F	Р	low	**************************************	0.82	- av . 5		low	0.6	
<u>% paol</u>	<u>% run</u>	% riffle	% pocket- water	- % class I pools					class pools
7	30	60 % bed mater	3	0		15		85	. 0
% fines	%gravel	% rubble	% boulder	r %bedrock	D-90 (cm)	gradient	Stability rating	Bar for	
20	40	10	10	20	40	7.3	95	rep	ose
Bank Process	Ba gene mater		Flood plain debris	Channel debris	char	table nnel % cove oris canop		er snor	· - ·
stable	bed	rock	low	moderat	ie 2	20 10	20	20	
Water chem	istry data								
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	50 ₄ (mg/1)
			·		***			THE THE	am. em
Spawning o	<u>fata</u>								
Number of bull trout redds in reach	Redd densit (no/km	у	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year	
		***					***	man suce.	
Fish popul	ation data								
Density (n	o/100 m ² sur	rface area)					Mounta		ies astern
Age 0 A	<u>Cutthroat</u> ge I Age	II Age I	II+ Age	Bull to O Age I	rout Age II	Age III+	White	fish [Brk trout
O Biomass (g		0.3 surface are	3 0 <u>a</u>)	0	0	0	abse	ent a	bsent
Age 0 A	<u>Cutthroat</u> ge I Age	II Age I	II+ Age (Bull tr O Age I	out Age II	Age III+			
0) 9	0	0	0	0			

Table 15. Stream habitat and fish population data for Skookoleel Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributa:	Upper ry reach boundary	,	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Skookol Creek	eel 001	DA9	4.6	North Fork	4.6 km mouth	from	1521	junction Big Cree		1204
Physical Stream order 3 Confinement X	Drainage area(km²) 22.7 Pattern	Ave. wetted width(m) 8.0 Sid chann occuren	el ce % p	ocket-	Flow dur survey (m³/sec 0.09 % class	peal <u>ten</u> % class	9 % cla	tuurbidity low ss %c1	Maximum pool depth(m)	/broken
<u>% pool</u> 10	<u>% run</u> 30	% riffle 20		ater O	1 pools	11 poo1 3	<u> </u>	<u>ols IV p</u> 78	001s	<u>V pools</u> .0
% fines	%gravel	% bed mat % rubbl	erial	oulder	%bedrock	D-90 (cm)		Stability rating	Ва	nk irm
20	20	30		0	20	90	6.9	86		pose
Bank <u>Process</u>	Ba gene <u>mater</u>		Flood plain debri		Channel debris	% stab channe debri	l % cover		sno	over- rkel tion
stable	f1 ụ\	/ial r	nodera	te mo	oderate	30	50	20	ė š	21
Water che	mistry data									
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbo (mg/l	n	Total phos. mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/l)
					make Amer			***	****	
Spawning	data									
Number of bull trou redds in reach		ty	bull redd	er of trout s in ach	Redd density (no/km)	<u>Year</u>		Redd density (no/km)	Year	
		₩		-	***				***	
	lation data		-1						Other spe	
Density (no/100 m² su Cutthroat				Bull tro	ut		Mounta Whitef		Eastern 3rk trout
0	Age I Age O C grams/100 m²)	e III+ O area)	Age 0 O	Age I O	Age []	Age III+ O	abse	ent	absent
D : CALEGO 22	Cutthroat	CAS INC.	<u>~ . ~ ~ ,</u>		Bull tro	out				
Age 0		II Ag	e III+	Age 0		Age II	Age III+			

0

Table 16. Stream habitat and fish population data for Skookoleel Creek Reach 2.

Stream <u>Name</u>	Reach number	Serial number	Reach T Length	ributary of	Upper reach boundar			ipper elev.(m)	Lower reach bounda	<u> </u>	Lower elev.(m)
Skookol Creek	eel 002	DBA		lorth Fork	Lake a headwa		:	1887	4.8 k mouth	km from 1	1521
Stream order	Habîtat dat Drainage area(km²)	Ave. wetted width(m)	Ave. depth (_reach(Valley width(m)	cha <u>ra</u>	ley- nnel tio		Flow character	istics
2		4.0 Side	.12		8 Elaw dum	100	Average	12		swirlir Maximu	•
Confine- ment	Pattern	channi occuren	e1 1	rage ow ow	Flow dur survey (m³/sec	р	eak wat temp(C)	er	Turbidity	foog	
U	P .	1ow		····	-000-000	_	9		low	0.4	_
% pool	% run	% riffle	% poo		% class I pools	% cl II p	ass ools	% cla <u>III po</u>		% class IV pools	% class V pools
4	30	60	6		0		0	0		45	55
% fines	%gravel	% bed mate % rubble		lder	%bedrock	D-90 (cm)	grad		Stabilit rating	•	Bank form
20	20	30	10		20	25	10	1.8	86	Υ	epose
Bank <u>Process</u>	-	ank etic rial	Flood plain debris	(Channel debris	cha de	table nnel bris	% cover	ove_	over s rhang s	cover- morkel ection
failing	fluy	ial	modera	te m	oderate]	10	1	1	0	28
Water che	mistry data										
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l	n ph	tal os. /1)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)		Mg ⁺⁺ mg/1)	Na ⁺ (mg/1	κ ⁺) (<u>mg/1</u>	SO ₄ (mg/1)
deside Militer		alles reser	-	-					***		***
Spawning	data								,		
Number of bull trou redds in reach		ty	Number bull t redds reac	rout in	Redd density (no/km)	Year	bull redd:		Redd density (no/km)	Year	
							_	_	**		
Fish popu	lation data									045	
Density (no/100 m² s		<u>a</u>)			_				Other s untain	Eastern
Age 0	Cutthroat Age I Ag	e II Ag	e III+	Age 0	Bull tr Age I	Age II	Age	<u> </u>	<u>wn</u> :	<u>itefish</u>	Brk trout
0	0		0	0	0	0	0		al	bsent	absent
Blomass (grams/100 m		area)	_	4 וויים	Au t					
Age 0	<u>Cutthroat</u> Age I Ag		e III+	Age 0	Bull tr Age I	Age II	Age	11+			
0	0	0	0	0	0	0	0				

Table 17. Stream habitat and fish population data for Nicola Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	reach boundary	1	Upper elev.(m	reach boundary	·	Lower elev.(m)
Nicola Creek	001	DA7	6.3	North Fork	headw	aters	1753	mouth		1274
Physical Stream order	Habitat dat Drainage area(km²)	<u>a</u> Ave. wetted width(m)		h for c	Ave. hannel idth(m)	Valley width(m)	Valley- channel ratio		Flow characteri	stics
2	13.6	5.0	.2	0	8	80	10		tumbling	
Confine- ment	<u>Pattern</u>	Sid chann occuren	el	Average low <u>flow</u>	Flow dur survey (m³/sec	pea	erage k water mp(C)	Turbidity	Maximum pool depth(m	
X	Р	low			0.82			low	0.9	ov _1
% pool	% run	% riffle		pocket- water	% class I pools	% clas	ls III	0001s I	class V pools	% class V pools
8	. 30	50 % bed mat		12	1	7 0-90	2: %	9 Stability	63 ₈	ank 0
% fines	%gravel	% rubbl	e %	boulder_	%bedrock	<u>(cm)</u>	gradient	rating	<u>f</u>	orm
20	40	20	•	17	3	58	7.6	87	r	epose
Bank Process		ank etic <u>ria</u> l	Floo- plain <u>debr</u>	n (Channel debris	% sta chann <u>debr</u>	el % cov		ver sn	cover- orkel ction
stable	flų	vial	1 ov	V	modera	te 20.	20	5	0 1	0
Water che	mistry data									
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbo (mg/l	n	Total phos. (mg/l)	No ₃ ~ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K [†] (<u>mg/1)</u>	SO. (mg/1)
	Aller State				300 WA					
Spawning	data									
Number of bull trou redds in reach		ty	bul red	ber of 1 trout ds in each	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	Year	
			-							
Fish popu	lation data	<u>.</u>							04h	
Density (no/100 m² s Cutthroat Age I Ag		<u>ea)</u> je III+	Age 0	Bull tr Age I	out Age II	Age III+		Other sp ntain tefish	Eastern Brk trout
0	0	0	0	0	0	0	0	abs	ent	absent
Biomass (grams/100 m	ı ^z surface	area)							
Age 0	Cutthroat Age I Ag	e II Ag	e III+	Age 0	Bull tr Age I	Age II	Age III+			

0 0

0

0

0

0

CAMAS CREEK DRAINAGE

CAMAS CREEK REACH I

Channel Characteristics: Date surveyed: 8-6-80 (Figure 8)

Camas Creek Reach I is a fourth order tributary in the North Fork drainage. Average wetted width was 12 m and the average depth was 32.5 cm. This reach was composed of 60% run and 40% riffle. Channel debris was low, with 50% being stable. Bank and instream cover were both low. Stream gradient was 1.1% and the D-90 was 40 cm. Two major slump zones appeared at 1.5 and 2.0 kilometers below the upper reach break.

Valley Characteristics:

The upper bank slope was 30-40% and the valley to channel ratio was 4:1. The average valley width was 150 m. Camas Creek was occasionally confined and had an irregular meandering pattern.

<u>Fish Populations</u>: (Figure 9)

Westslope cutthroat, mountain whitefish and sculpins were observed in this reach. In addition, suckers and northern squawfish were observed. Both resident and migratory cutthroat populations were present.

CAMAS CREEK REACH II

Channel Characteristics: Date surveyed: 8-6-80 (Figure 8)

Camas Creek Reach II is a third order tributary in the North Fork drainage. Average wetted width was 12 m and the average depth was 22 cm. Reach II was composed of 48% run, 37% riffle, 15% pocketwater and a trace pool. Channel debris was low with 25% being stable. Overhanging vegetation provided only slight bank cover, while instream cover was moderate. Stream gradient was 1% and the D-90 was 69 cm. Two major slump zones were present 1.5 kilometers below the upper reach break and a debris accumulation was present just below the lower slump.

Valley Characteristics:

The upper bank slope was 30--40% and the valley to channel ratio was 3:1. The average valley width was 60 m. Reach II was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 9)

Westslope cutthroat, mountain whitefish and sculpins were observed in this reach. In addition, redside shiners and suckers were observed. Both resident and migratory cutthroat populations were present.

CAMAS CREEK REACH III

Channel Characteristics: Date surveyed: 8-6-80 (Figure 8)

Camas Creek Reach III is a second order tributary in the North Fork drainage. Average wetted width was 17 m and the average depth was 22 cm. Reach III was composed of 100% run. Channel debris was low, with 90% being stable. Bank and instream cover were both low. Stream gradient was 0.1% and the D-90 was 1 cm. Stream bed material was mostly fines (80%) and 20% organic material.

Valley Characteristics:

The upper bank slope was 30% and the valley to channel ratio was 20:1. The average valley width was 400 m. Reach III was unconfined and had an irregular pattern. Nearly all of this reach was located in a broad grassy meadow.

Fish Populations: (Figure 9)

Westslope cutthroat and sculpins were observed in this reach. Both resident and migratory cutthroat populations were present. Underwater visibility was poor due to cloudy water conditions.

Dutch Creek Reach I

Channel Characteristics: Date surveyed: 8-26-80 (Figure 8)

Dutch Creek Reach I is a third order tributary in the Camas Creek drainage. Average wetted width was 8.8 m, and the average depth was 22 cm. This reach was composed of 57% run, 37% riffle, 3% pool and 3% pocketwater. Channel debris was low with 10% being stable. Bank cover was low and instream cover was moderate. Stream gradient was 1.8% and the D-90 was 23 cm. Three different major slump zones appeared in the lower end of this reach.

Valley Characteristics:

The upper bank slope was 30% and the valley to channel ratio was 14:1. The average valley width was 200 m. Reach I of Dutch Creek was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 9)

Westslope cutthroat, mountain whitefish, and sculpins were observed in this reach. Both resident and migratory cutthroat populations were present.

Dutch Creek Reach II

Channel Characteristics: Date surveyed: 8-26-80 (Figure 8)

Dutch Creek Reach II is a second order tributary in the Camas Creek drainage. Average wetted width was 6.6 m and the average depth was 25 cm. Reach II was composed of 47% riffle, 45% run, 5% pool and 3% pocketwater. Channel debris was low with 30% being stable. Bank and instream cover were both moderate. Stream gradient was 2.0% and the D-90 was 60 cm. Three different major slump zones appeared in the lower two kilometers of this reach.

Valley Characteristics:

The upper bank slope was 30-40% and the valley to channel ratio was 8:1. The average valley width was 100 m. Dutch Creek was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 9)

Westslope cutthroat and sculpins were observed in this reach. Density estimates showed this reach was an important rearing area for cutthroat trout with 12.2 cutthroat per $100~\text{m}^2$ surface area. Both resident and migratory populations were present.

Dutch Creek Reach III

Channel Characteristics: Date surveyed: 8-26-80 (Figure 8)

Dutch Creek Reach III is a second order tributary in the Camas Creek drainage. Average wetted width was 7.6 m and the average depth was 24 cm. Reach III was composed of 53% run, 26% pocketwater, 16% riffle and 5% pool. Channel debris was low with 30% being stable. Bank cover was low, while instream cover was moderate. Stream gradient was 10.1% and the D-90 was 104 cm. Small cascades structured by large boulders were characteristic of the reach.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 3:1. The average valley width was 50 m. Reach III was frequently confined and had an irregular pattern. A 1 km feature at the lower end of Reach III was braided, had a gradient less than 1% and a D-90 of 24 cm.

Fish Populations: (Figure 9)

Westslope cutthroat and sculpins were observed in this reach. Both resident and migratory cutthroat populations were present. The feature at the lower end of Reach III was a prime rearing and spawning area for cutthroat trout.

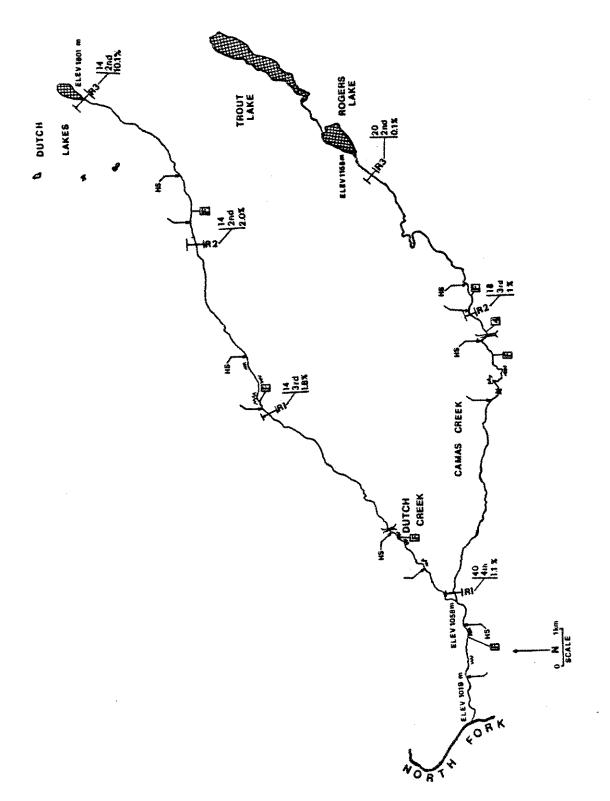


Figure 8. Location of physical habitat parameters by reach for Camas and Dutch Creeks.

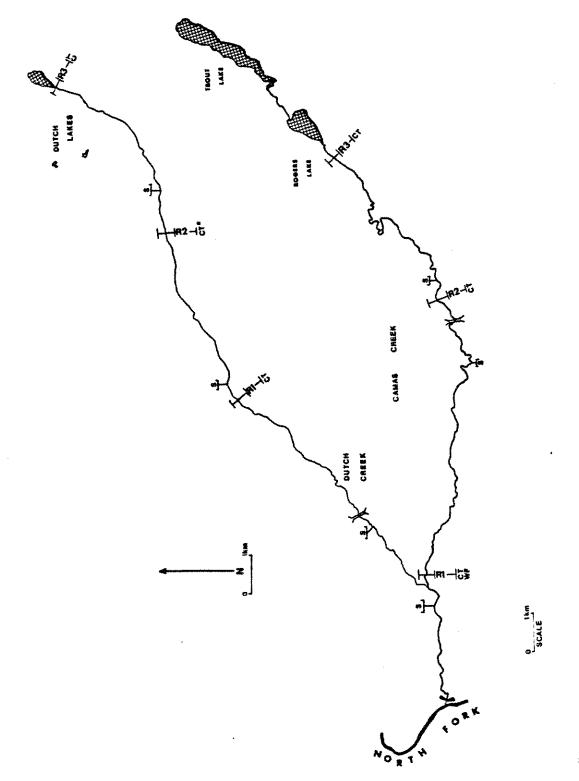


Figure 9. Fish population information by reach for Camas and Dutch Creeks.

Table 18. Stream habitat and fish population data for Camas Creek Reach 1.

Stream Name	Reach <u>number</u>		each Tributa ength of	Upper ary reach boundar	<u> </u>	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Camas	Cr. 001	DBW	3.7 Nort Fork		up from Dutch	1060	mouth	1019
<u>Physical</u>	Habitat dat	<u>a</u> Ave.	Ave.	Ave.		Valley-		
Stream order	Drainage area(km²)	wetted width(m)	depth for reach(m)	channe1	Valley width(m)	channel ratio	••	Flow characteristics
4	207.2	17.0	.32	40	150	4		broken rolling
Confine- ment	<u>Pattern</u>	Side channe occurence		Flow dur survey (m³/sec	peal	erage k water np(C)	Turbidity	Maximum pool depth(m)
Χ	С	low	ent nor	0.75		0	Tow	1.2
% pool	% run	% riffle	% pocket- water	% class I pools	% class			class % class pools V pools
0	60	40	0	0	0	100	0	_
% fines	%gravel	<pre>% bed mater % rubble</pre>	% boulder	%bedrock	D-90 (cm)	gradient	Stability rating	Bank <u>form</u>
17	30	43	10	0	40	1.1	88	repose
Bank Process	Ba gene mater		Flood plain debris	Channel debris	% stab channe debri	1 % cover		· · · · · · · · · · · · · · · · · · ·
failin	g fluv	/ial	moderate	low	50	1	2	10
Water ch	emistry data		•					
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ ° (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K ⁺ SO ₄ (<u>mg/1)</u> (<u>mg/1)</u>
40	35	1.36	.011		10.0	.027	0.7	0.7
Spawning	data							
Number or bull tro- redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)			Redd density (no/km)	Year
				-	***			
Fish pop	ulation data							
	(no/100 m² su			Bull tro			Mount White	
Age 0			111+ Age 0	Age I		Age III+		ant abaart
0.2 Biomass	0 (grams/100 m ²	0 (surface ar		0	0	0	pres	sent absent
Age O	Cutthroat Age I Age	e II Age	111+ Age 0	Bull tro Age I		Age III+		

Table 19. Stream habitat and fish population data for Camas Creek Reach 2.

Stream Name	Reach number		leach Tributa ength of	Upper ry reach boundar	Y	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Camas	Cr. 002	DBV 8	.3 North Fork	2 km u Rt 7 B	ıp from Iridge	1143	.2 km up		1060
							Creek		
Physical	Habitat dat	Ave.	Ave.	Ave.		Valley-			
Stream <u>order</u>	Drainage <u>area(km²)</u>	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio	ch	Flow maracteris	tics
3	55.4	12.1	.22	18	60	3	b	roken	rolling
Confine- ment	Pattern	Side channe occurenc	l ow	Flow dun survey (m³/sec	y peal	erage k water mp(C)	urbidity	Maximum pool depth(m)	•
X	P	Tow		0.46			noderate	1.2	
% pool	% run	% riffle	% pocket- water	% class I pools	% class				% class V pools
1	48	37	14	5	11	6	78		0
% fines	%gravel	% bed mate % rubble	rial % boulder	%bedrock	D-90 (cm)	gradient	Stability <u>rating</u>	Ba <u>fo</u>	nk <u>rm</u>
20	30	30	20	0	69	1.0	80	re	ose
Bank Process		ank etic rial	Flood plain debris	Channel debris	% stat channe debri	el % cover		sno	over- rkel tion
failin			1ow	Tow	25	1	1	2	20
Water che	mistry data		•						
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO. (mg/1)
40	35					* *****			
Spawning	data							•	
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	Year		Redd density (no/km)	Year	
***						- -			
Fish popu	lation data								_
<u>Density (</u>	no/100 m² se Cutthroat			Bull tr			Mounta Whitef		ies Eastern Brk trout
Age 0		e II <u>Age</u>).2 O.	<u> </u>	Age 1 O	Age II O	Age 111+ 0	nwaca	nt	abcont
-	grams/100 m				J	V	prese	:116	absent
	Cutthroat		777. X A	Bull tr		Ago III+			
Age 0	Age I Age	<u>≥ II Age</u>	<u> </u>	Age I	Age II	Age III+			

Table 20. Stream habitat and fish population data for Camas Creek Reach 3.

Stream Name	Reach number		Reach Tribut Length of		ry	Upper elev.(m	Lower reach) boundary		Lower elev.(m)
Camas C	r. 003	DBU	8.7 North Fork	ı Roger	s Lake	1155	2 km ur Rt. 7 E		1143
Ohurical i	Habitat data	a.							
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	<u>.c</u>	Flow haracteris	tics
2	*****	12.0 Side	1.50 Average	20 Flow du	400	20 verage		placid Maximum	
Confine- ment	Pattern	channe occurenc		surve (m³/se	y pe	ak water	Turbidity	pool depth(m)	•
U "1	P	modera	% pocket-	0.5 % class	% cla		high ass *.c		% class
<u>% pool</u> O	<u>% run</u> 100	<u>% riffle</u>	<u>water</u> O	<u>I pools</u> 0	II pod		0018 <u>14 </u>	<u>poo1s</u> 0	<u>v pools</u> 100
% fines	%gravel	% bed mate % rubble	rial	%bedrock	D-90 (cm)	% gradient	Stability rating	Bai foi	nk
100	0	0	0	0	1	0.1	63	f	- lat
Bank Process	Ba gene mater		Flood plain debris	Channel debris	% sta chanr debr	iel % cover		r snor	
stable	fluv	ial	Tow	low	90	1	1		
Water chem	istry data		4						
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/l)</u>	SO ₄ (mg/1)
						000 Max	***	week areas	*****
Spawning o	lata			·					
Number of bull trout redds in reach	Redo densit (no/km	у	Number of bull trout redds in reach	Redd density (no/km)	Year		Redd density (no/km)	Year	
***** SMA	चर्मन व्यक्त		**						
***************************************	ation data							Other spec	ies
Density (n	io/100 m² su Cutthroat			Bull tr	out		Mounta Whitef	in	Eastern Brk trout
<u>Age 0 A</u>		<u> </u>	<u> </u>	Age I O	Age II	Age III+			
	rams/100 m²	-	_	U	0	0	abser	Ιζ	absent
Age 0 A	Cutthroat ge I Age	II Age	III+ Age 0	Bull tr Age I	out Age II	Age III+	•		

Table 21. Stream habitatand fish population data for Dutch Creek Reach 1.

Stream Name	Reach number		each Tribut ength of	•	ry	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Dutch Creek	001	DB2 7	.6 Nor For		km up fro 7 bridge	om 1195	mouth	1085
Physical	Habitat dat					Wall Face		
Stream <u>order</u>	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	· <u>ch</u>	Flow aracteristics
3	71.2	8.8	.22	14	200	14	ro	lling
Confine- ment	<u>Pattern</u>	Side channel occurence		Flow di surve (m³/se	ey peak	rage water p(C) T	urbidity	Maximum pool depth(m)
Х	Р	moderat	e	0.2	9 _		OW ~ -1-	1.0
% pool	% run	% riffle	% pocket- water	% class				
3	57	37	3	6	31	19	44	0
% fines	%grave1	<pre>% bed mater % rubble</pre>	ial % boulder	%bedrock	D-90 (cm)	% gradient	Stability rating	Bank form
30	40	20	10	0	23	1.8	91	repose
Bank Process	Ba gene mate		Flood plain debris	Channel debris	% stab channe debri	1 % cover-	- % cover overhang	% cover- snorkel section
failin	ıg flu	vial	moderate	low	10	10	3	13
Water che	mistry data							
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K ⁺ SO ₄ (mg/1)
		***			** **	aim aire		
Spawning	data							
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	, t		Redd density (no/km) Y	'ear
					484 488		1000 AUT 1	m
Fish popu	lation data						0	them energias
Density (no/100 m² st	urface area)		6 35 -			Mountai	
Age 0	<u>Cutthroat</u> Age I Age	<u>II Age</u>	III+ Age 0	Bull t Age I	rout Age II A	\ge III+	Whitefi	sh 8rk trout
2.1	1.5 2. grams/100 m ²			0	0	0	prese	ent absent
	Cutthroat		***	Bull t				
Age 0	<u>Age I Age</u>	e II Age	111+ Age 0	<u>Age I</u>	Age II A	lge III+		

Table 22. Stream habitat and fish population data for Dutch Creek Reach 2.

Stream Name	Reach number		Reach Length	Tributary of	Upper reach boundary	<i>t</i>	Upp <u>ele</u>	er r	ower each oundary		Lower elev.(m)
Dutch Creek	002	DB1		lorth Fork		km up Rt. 7	13			up from bridge	1195
Stream order	Habitat dat Drainage area(km²)	Ave. wetted width(m)	Ave. depth <u>reach</u>	for charge (m) wi	······································	Valley width(m)	Valley channe ratio	1	·	Flow characteris	
2 Confine-	<u></u>	6.6 Side channe	1	erage low	Flow dur	_ pe	7 iverage ak water			broken/r	olling
X	Pattern	modera	te % po	low - cket-	(m³/sec 0.30 % class) % cla		n % class			% class V pools
5 fines	<u> </u>	<pre>% riffle 47 % bed mate % rubble</pre>	3 erial	ulder :	I pools 0 bedrock	11 po 29 D-90 (cm)			-	pools 42 Bai fo	0 1k
10	<u>*grave1</u>	30		0	0	60	2.0		94		" pose
Bank Process		ank etic <u>ria</u> l	Flood plain debris		nannel debris	% st chan deb	nel %	cover- anopy	% coverna	er sno	over- rkel tion
failin	-	ıvial	low	1	OW	30		16	15	1	7
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbor (mg/l)	ı p		No ₃ * mg/1)	Ca ⁺⁺ (mg/l)	Mg (mg		Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/l)
Spawning	<u>data</u>				·						
Number of bull trou redds in reach	t Red densi (no/ki	ty	Numbe bull redds rea	trout in	Redd density (no/km)	<u>Year</u>	Number bull tr redds i reach	out R n den	edd sity /km)	<u>Year</u>	
		**** ****	380c i	***				****	-	***	
Density (• II <u>Age</u>	.7	Age 0	Bull tro	out Age II	Age III	-	Mount White abse	efish .	Eastern Brk trout absent
	Cutthroat Age I Age	e II Age	111+	Age 0	Bull tro	Age II	Age III	<u> </u>			

Table 23. Stream habitat and fish population data for Dutch Creek Reach 3.

Stream Name	Reach number	Serial number	Reach Length	Tributar of	Upper y reach boundary		Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Dutch Creek	003	OBZ	4.9	North Fork	Dutch	Lake	1801	10.2 km (Rt. 7 ro	up from 1304 ad
Physical	Habitat dat	<u>a</u> Ave.	Avi	a .	Ave.		Valley-		
Stream <u>order</u>	Drainage area(km²)	wetted width(m)			channel width(m)	Valley width(m)	channel ratio	<u>c ha</u>	Flow racteristics
2		5.0		-	14	50	4		roken
Confine- ment	Pattern	Sid chann occuren	e1	Average low <u>flow</u>	Flow dur survey <u>(m³/sec</u>	pea	erage k water mp(C)]		Maximum pool depth(m)
F	Р	modera	te 🖫	 oocket-	0.20 % class	% clas	_ s %cla	low ss %cla	1.0 % class
% pool	<u>% run</u>	<u>% riffle</u>		vater	I pools	II poo	ls <u>III po</u>	ols IV po	ols V pools
5	53	16 % bed mat		26	0	D-90 13	%	Stability	'5 0 Bank
% fines	%gravel	<u>% rubbl</u>	e % l	ooulder 20	# <u>bedrock</u> O	(cm)	gradient 10.1	<u>rating</u>	<u>form</u>
20	30	20		30	U	104		82	repose
Bank Process		ank etic <u>ria</u> l	Flood plair debr	1	Channel debris	% sta chann debr	el % cover		% cover- snorkel section
failing	flu	uvial	mode	rate	Tow	30) 3	10	18
Water cher	mistry data								
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbo (mg/l		Total phos. (mg/l)	No ₃ (mg/1)	Ca^{++} $(mg/1)$	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ 50 ₄ (mg/1)
								***	*** *** ***
Spawning	data								
Number of bull trou redds in reach	t Red dens i (no/ki	ty	bul red	per of I trout is in each	Redd density (no/km)	Year		Redd density (no/km) Y	ear
					* .	अवर्तिः जेतान		-	**** ***
Fish popu	lation data							•	than annai
	no/100 m² si Cutthroat		a) e III+	Age 0	Bull tr Age I	out Age II	Age III+	Mountai Whitefi	
0.7		.3 1.	6	0	0	0	0	absent	t absent

Age III+

50

Age II

16

Age 0

1

Age I

0

Age 0

0

Bull trout Age I Age II

0

Age III+

ANACONDA CREEK DRAINAGE

ANACONDA CREEK REACH I

Channel Characteristics: Date surveyed: 8-8-80 (Figure 10)

Anaconda Creek Reach I is a third order tributary in the North Fork drainage. Average wetted width was 7.6 m and the average depth was 20 cm. Reach I of Anaconda Creek was made up of 55% run, 30% riffle, 11% pocketwater and 4% pool. Channel debris was low, with 35% being stable. Overhanging vegetation provided slight bank cover, while instream cover was moderate. Stream gradient was 2.0%, and the D-90 was 38 cm. The lower 1.5 km of this reach was a marsh area partially formed by beaver activity.

Valley Characteristics:

The upper bank slope was 30-40% and the reach had a valley to channel ratio of 3:1. The average valley width was 75 m. Reach I was occasionally confined and had an irregular meandering pattern.

Fish Populations: (Figure 11)

Westslope cutthroat, mountain whitefish, longnose suckers and sculpins were observed in this reach. This reach was an important cutthroat rearing area supporting migratory and resident populations at a density of 10.5~age I or older fish per $100~\text{m}^2$ surface area.

ANACONDA CREEK REACH II

Channel Characteristics: Date surveyed: 8-9-80 (Figure 10)

Anaconda Creek Reach II is a second order tributary in the North Fork drainage. Average wetted width was 5.4 m and average depth was 15.5 cm. Reach II consisted of 90% riffle, 5% run and 5% pocketwater. Channel debris was low with 30% being stable. Overhanging vegetation provided only a trace of bank cover while instream cover was moderate. Stream gradient was 11.7% and the D-90 was 44 cm.

<u>Valley Characteristics</u>:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 2:1. The average valley width was 20 m. Anaconda Creek was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 11)

Westslope cutthroat trout and sculpins were observed in Reach II.

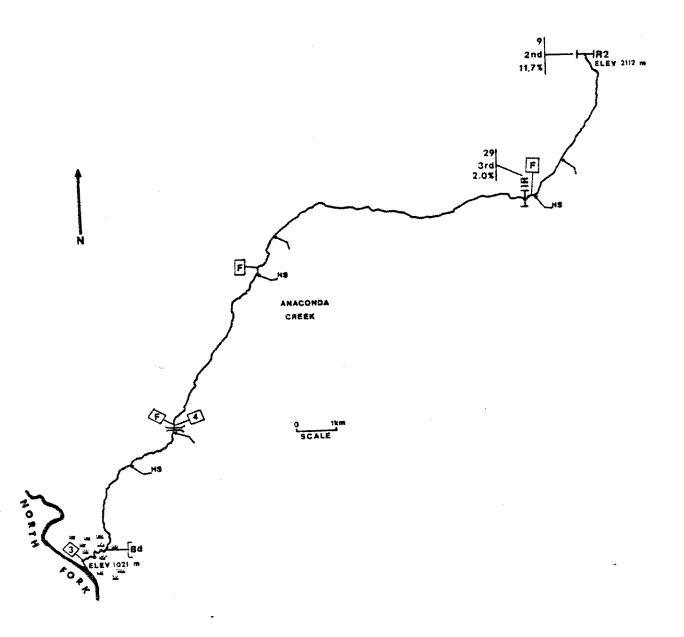


Figure 10. Location of physical habitat parameters by reach for Anaconda Creek.

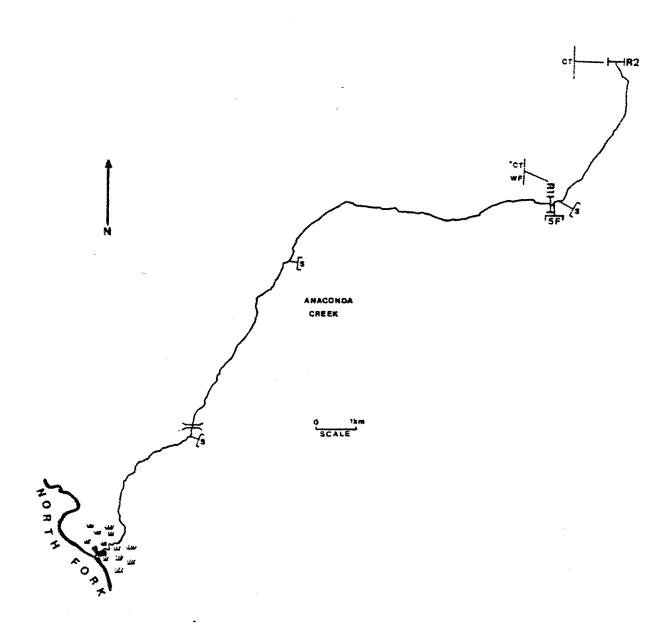


Figure 11. Fish population information by reach for Anaconda Creek.

Table 24. Stream habitat and fish population data for Anaconda Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)	,
Anaconda Creek	001	DB5	18.4	North Fork	Falls 19 km up from mouth	1399	mouth	1021	

Physical	Habitat dat	a						
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for _reach(m)	Ave. channel width(m)	Vallěy width(m)	Valley- channel ratio		Flow characteristics
3	101.5	7.2	.18	29	75	3		broken rolling
Confine- ment X	<u>Pattern</u> P	Side channel occurence	Average low flow	Flow dur survey (m³/sec	y pe c) <u>t</u>	verage ak water emp(C)	Turbidity	Maximum pool depth(m)
^	Р	moderate	9 0.21 % pocket-	0.21 % class	% cla	21 ss * * c	low	0.9 class % class
S pool	% run	% riffle	water	I pools	II po	ols III	pools IV	pools V pools
5	54	38	3	11	45	22		
% fines	%gravel	<pre>% bed mater % rubble</pre>	3 boulder	%bedrock	D~90 (cm)	gradient	Stability rating	Bank form
30	40	20	10	0	38	2.0	93	repose
Bank Process	gene mater		Flood plain debris	Channel debris	% sti chan debi	nel % cov		% cover- er snorkel
failin	g flu	vial	low	low	35	6	. 6	14
Water cher	mistry data							
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ SO ₄ (<u>mg/l) (mg/l)</u>
33	19	1.20	.007	-144 3M	5.8	.017	1.8	0.9
Spawning	data					٠		
Number of bull trou- redds in reach	t Redo densit (no/kn	ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>
	₩ ==				Mor ann	***		
Fish popu	lation data							
<u>Density (</u>	no/100 m² su Cutthroat	urface area)		Bull tr	out		Mounta White	
Age 0 /	Age I Age 3.6 3.			Age I O	Age II	Age III+		
		surface are		U	0	0	pres	sent absent
	Cutthroat		- -	Bull tro	out			
		97 97	11+ Age 0 0	Age I	Age II	Age III+		

Table 25. Stream habitat and fish population data for Anaconda Creek Reach 2.

Stream Name	Reach number	Serial number	Reach Tri Length	Upper butary reach of bound	t .	Upper elev.	Lower reach (m) boundary	Lower elev.(m)
Anacono Creek	da 002	DB4		orth Anac ork Lake	c onda e	2112	Falls 1 from mo	9 km up uth 1399
Stream order 2	Habitat dat Drainage area(km²) — —	Ave. wetted width(m) 5.4	.16) width(m) 9 age Flow	-	Valley- channel <u>ratio</u> 2 Average eak water		Flow haracteristics roken rolling Maximum pool
Confine- ment	Pattern	chann <u>occuren</u>				temp(C)	Turbidity	depth(m)
X <u>≈ pool</u> 0	P <u>% run</u> 5	modera <u>% riffle</u> 90	% pock <u>wate</u> 5		ss % cl	001s 111 0 1	<u>pools IV</u> .7 8	0.7 % class y pools 0.3 0
fines	%gravel	% bed mat % rubbl		der %bedroo	D-90 ck (cm)	gradient	Stability <u>rating</u>	Bank form
10	40	30	19	1	44	11.7	95	repose
Bank Process	-	ank etic rial	Flood plain debris	Channel debris	chai	table nnel "co bris can		
failing	ı flu	ıvial	l ow	1 ow	30	3	3	20
Water che	mistry data							
Cond. (umohs/ cm)	A1k. (mg/1)	Total carbo (mg/l		No ₃	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K ⁺ SO ₊ (mg/1)
man desir			سر سند					
Spawning	data							
Number of bull trou redds in reach		ty	Number of bull tro redds in reach	out Redo n densit	ty	Number of bull trou redds in reach		Year
Fish popu	lation data							
Density (no/100 m² s Cutthroat				trout		Mount White	
				g <u>e O Age I</u>	Age II	Age III+	aha-	nde abassa
O Biomass (0 0 grams/100 m			0 0		0	abse	nt absent
	Cutthroat			8u11	trout			
Age 0		e II Ag	e III+ A	ge O Age I	Age II	Age III+		

81 0

LOGGING CREEK DRAINAGE

LOGGING CREEK REACH I

Channel Characteristics: Date surveyed: 8-21-80 (Figure 12)

Reach I of Logging Creek is a third order tributary to the North Fork. Average wetted width was 10.3 m with an average depth of 33.5 cm. This reach contained 32% run, 61% riffle and 7% pocketwater. Channel debris was low with 50% being stable. Very little bank cover was present and instream cover was low to moderate. Channel gradient was 1.6% and the D-90 was 34.9 cm. Logging Creek originated from Logging Lake located 7.5 km above the mouth.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 10:1. The average valley width was 175 m. The channel was entrenched and had an irregular pattern.

Fish Populations: (Figure 13)

Cutthroat trout, mountain whitefish, largescale suckers, longnose suckers, redside shiners, sculpins, squawfish and bull trout were observed in this reach. Cutthroat (2.6 per 100 m²) and suckers were the most abundant species. Suckers are known to spawn in this reach. Numerous juvenile cutthroat trout were trapped moving downstream indicating this creek may be used by migratory cutthroat stocks. Only one juvenile bull trout was trapped moving downstream and none were seen in snorkeling transects.

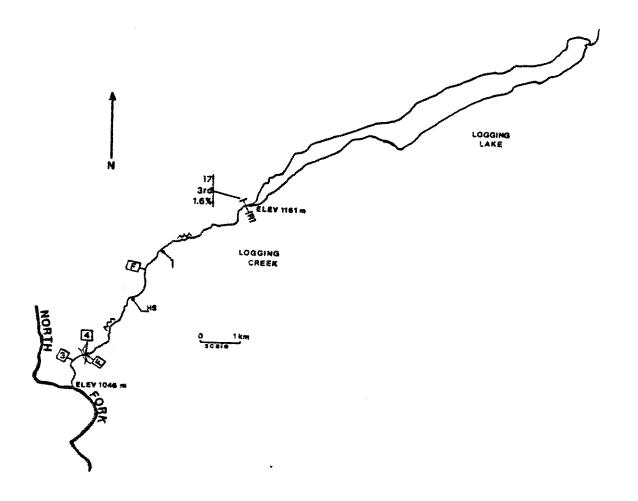


Figure 12. Location of physical habitat parameters by reach for Logging Creek.

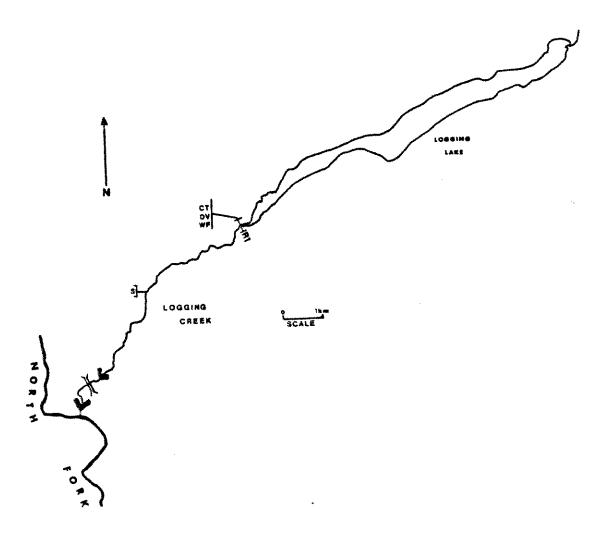


Figure 13. Fish population information by reach for Logging Creek.

Table 26. Stream habitat and fish population data for Logging Creek Reach 1.

Stream Name	Reach <u>number</u>	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Logging Creek	001	DEC	7.2	North Fork	Logging Lake	1161.0	mouth	1046.0

							•		
Ohveica!	Habitat data	a							
Stream	Drainage	Ave. wetted	Ave. depth for	Ave. channel	Valley	Valley- channel		Flow	~
order	area(km²)	width(m)	reach(m)	width(m)	width(m)	<u>ratio</u>	-	haracteris	
3	4.5	11.0	. 34	17	175	10	b	roken/r	olling
Confine- ment	Pattern	Side channel occurence	Average low flow	Flow dur survey (m³/sec	pea	verage ik water emp(C)	<u>Turbidity</u>	Maximum pool depth(m)	•
E	P	modera	te -82	1.7		22	low	1.0	
% pool	<u>% run</u>	% riffle	% pocket- water	% class I pools	% clas II pod				% class V pools
0	30	63	7	. 0	0	25		5	0
% fines	%gravel	<pre>% bed mater % rubble</pre>	ial % boulder	%bedrock	D-90 (cm)	gradient	Stability rating	Bai fo	
20	30	30	19	1	35	1.6	105	re	epose
20							****		over-
Bank Process		ank etic rial	Flood plain debris	Channel debris	% sta chann debr	iel % cove		er snot	rkel tion
failin			noderate	low	50	10	10	13	3
	emistry data								
Cond.		Total	Total						
(umohs/ cm)	Alk. (<u>mg/l)</u>	carbon (mg/l)	phos. (mg/1)	No 3 (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO. (mg/l)
25	23	1.04	.008	0.00	6.4	1.7	1.0	0.17	0.6
Spawning	data								
					•				
Number of bull tro	ut Red		Number of bull trout	Redd		Number of bull trout redds in	. Redd density		
redds in reach	densi (no/k		redds in <u>reach</u>	density (no/km)	Year	reach	(no/km)	Year	
						440 VED	784 SAII	KINS 1000	
Fish pop	ulation data	1		-					
Density	(no/100 m² s	urface area)					Mount	Other spec ain	ies Eastern
	Cutthroat			Bull tr	out	Age III+	<u>White</u>	fish	Brk trout
Age 0			III+ Age C	<u>Age I</u>	Age II	Mge 113*	280	cont	absent
3.2 Biomass		.0 .7 surface ar			****		hu.e:	sent	anselle
	Cutthroat			Bull tr	out				
Age 0	Age I Ag	e II Age	III+ Age C		Age II	Age III+			
3.5	6.2 1	2.2 21.	8		· · · · · · · · · · · · · · · · · · ·				

COAL CREEK DRAINAGE

COAL CREEK REACH I

Channel Characteristics: Date surveyed: 9-4-79 (Figure 14)

Coal Creek Reach I is a fourth order tributary to the North Fork. Average wetted width was 15 m and the average depth was 29 cm. This reach was composed of 60% riffle, 30% run, 6% pocketwater and 4% pool. Channel debris was low, with only a trace being stable. Overhanging vegetation provided low bank cover and instream cover was low. Stream gradient was 1.2% and the D-90 was 46 cm.

<u>Valley Characteristics</u>:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 20:1. The average valley width was 200 m. Reach I was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 15)

Bull trout, westslope cutthroat, mountain whitefish, shorthead sculpins and slimy sculpins were observed in this reach. Migratory cutthroat and bull trout utilized Reach I as a migration corridor to upstream spawning areas and the upper reach break was located just below a high density bull trout spawning area. Low density populations of juvenile bull trout and resident cutthroat were noted.

COAL CREEK REACH II

Channel Characteristics: Date surveyed: 9-14-79 (Figure 14)

Coal Creek Reach II is a fourth order tributary in the North Fork drainage. Average wetted width was 11.5 m and the average depth was 31 cm. Reach II was composed of 50% run, 20% riffle, 10% pool and 10% pocketwater. Channel debris was moderate with 20% being stable. Overhanging vegetation provided low bank cover and instream cover was low. Stream gradient was 1.0% and the D-90 was 33 cm. Some beaver activity was noted below the Dead Horse Creek Bridge.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 10:1. The average valley width was 200 m. This reach was occasionally confined and had an irregular pattern.

Bull trout, westslope cutthroat and sculpins were observed. This reach was extremely important for bull trout spawning and contained two high density spawning areas. In 1979, a density of 6.6 redds per kilometer was found in the high use area. An average of 46 bull trout redds were enumerated annually during four years of survey.

COAL CREEK REACH III

Channel Characteristics: Date surveyed: 9-11-79 (Figure 14)

Coal Creek Reach III is a third order tributary in the North Fork drainage. Average wetted width was 7.5 m and the average depth was 18 cm. This reach was composed of 60% run, 30% riffle, 7% pocketwater and 3% pool. Channel debris was moderate with 30% being stable. Instream cover was moderate to high and overhanging vegetation provided low bank cover. Stream gradient was 2.2% and the D-90 was 40 cm.

Valley Characteristics:

The upper bank slope was 30-40% and the valley to channel ratio was 12:1. The average valley width was 100 m. The reach was unconfined to occasionally confined and had an irregular pattern.

Fish Populations: (Figure 15)

Bull trout, westslope cutthroat and sculpins were observed in this reach. Density estimates showed Reach III to be an important rearing area for juvenile bull trout with 1.6 age I or older fish per $100~\text{m}^2$ surface area.

COAL CREEK REACH IV

Channel Characteristics: Date surveyed: 9-12-79 (Figure 14)

Coal Creek Reach IV is a second order tributary in the North Fork drainage. Average wetted width was 4 m and the average depth was 8 cm. This reach consisted of 50% run, 40% riffle, 8% pocketwater and 2% pool. Channel debris was low with 30% being stable. Instream cover and bank cover were low. Stream gradient was 7.5% and the D-90 was 40 cm. Many chutes and cascades were created by imbedded logs and boulders.

<u>Valley Characteristics:</u>

The upper bank slope gradient was 30-40% and the valley to channel ratio was 3:1. The average valley width was 20 m. This reach was occasionally confined and had an irregular pattern.

Bull trout, westslope cutthroat, and sculpins were observed. It was possible both migratory cutthroat and bull trout utilized the lower portion of this reach for spawning. A considerable number of resident cutthroat were also found in this reach.

Cyclone Creek Reach I

Channel Characteristics: Date surveyed: 9-5-79 (Figure 14)

Cyclone Creek Reach I is a third order tributary in the Coal Creek drainage. Average wetted width was 1.2 m and the average depth was 10 cm. Reach I was composed of 60% run, 30% riffle, 8% pocketwater and 2% pool. Channel debris was low with 40% being stable. Overhanging stream vegetation provided moderate bank cover and instream cover was moderate. Gradient was 1.5% and the D-90 was 20 cm.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 140:1. The average valley width was 500 m. Cyclone Creek was generally unconfined, but was confined for short distances. The stream pattern was sinuous.

Fish Populations: (Figure 15)

Bull trout, westslope cutthroat, mountain whitefish, and shorthead sculpins were observed. Migratory and resident cutthroat utilized Reach I for spawning and rearing. Density estimates of 12.9 age I or older cutthroat indicated an important rearing area.

Cyclone Creek Reach II

<u>Channel Characteristics</u>: Date surveyed: 9-20-79 (Figure 14)

Cyclone Creek Reach II is a third order tributary in the Coal Creek drainage. Average wetted width was 3 m and the average depth was 20 cm. This reach consisted of 60% run, 30% riffle, 7% pocketwater and 3% pool. Channel debris was low with 100% being stable. Overhanging vegetation provided abundant bank cover and instream cover was low. Stream gradient was 3% and the D-90 was 35 cm. A major slump zone occurred near the midway point of the reach.

Valley Characteristics:

The upper bank slope gradient was 30-40%, and the valley to channel ratio was 6:1. The average valley width was 40 m. This reach was frequently confined and had a sinuous pattern.

<u>Fish Populations</u>: (Figure 15)

Westslope cutthroat and sculpins were found in Reach II. Migratory and resident cutthroat utilized Reach II for spawning and rearing. Density estimates of 36.3 \pm I or older cutthroat per 100 m² surface area indicate an extremely important rearing area.

Dead Horse Creek Reach I

Channel Characteristics: Date surveyed: 9-18-79 (Figure 14)

Dead Horse Creek Reach I is a third order tributary in the Coal Creek drainage. Average wetted width was 3.5 m and the average depth was 17 cm. This reach was composed of 60% riffle, 30% run, 8% pocketwater and 2% pool. Channel debris was moderate with 20% being stable. A large area of blowdown increased debris levels in the stream for about 2 km in the upstream portion. Overhanging vegetation and instream cover were moderate. Stream gradient was 3.8% and the D-90 was 37 cm.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 3:1. The average valley width was 32 m. This reach was frequently confined and had an irregular pattern.

Fish Populations: (Figure 15)

Westslope cutthroat were observed in this reach. A good population of small, resident cutthroat was present.

Dead Horse Creek Reach II

<u>Channel Characteristics</u>: Date surveyed: 9-17-79 (Figure 14)

Dead Horse Creek Reach II is a second order tributary in the Coal Creek drainage. Average wetted width was 2 m and the average depth was 13 cm. This reach was composed of 40% riffle, 40% run, 19% pocketwater and 2% pool. Channel debris was low with 20% being stable. Overhanging vegetation provided very low cover, while instream cover was high. Stream gradient was 7.9% and the D-90 was 65 cm. Log jams and small cascade areas were common in the upstream portion.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 3:1. The average valley width was 24 m. Dead Horse Creek was occasionally confined and had an irregular pattern.

Westslope cutthroat were observed in this reach. A moderate population of small, resident cutthroat was present.

South Fork Coal Creek Reach I

Channel Characteristics: Date surveyed: 9-11-79 (Figure 14)

South Fork Coal Creek Reach I is a third order tributary in the Coal Creek drainage. Average wetted width was 6 m, and the average depth was 22 cm. This reach was composed of 50% riffle, 40% run, 7% pocketwater and 3% pool. Channel debris was moderate to low with 20% being stable. Overhanging vegetation and instream cover were moderate. Stream gradient was 3.0% and the D-90 was 38 cm.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 4:1. The average valley width was 58 m. The South Fork was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 15)

Westslope cutthroat and bull trout were observed in Reach I. Spawning by migratory bull trout was documented with an average of 10 redds enumerated annually during four years of survey. Density estimates of 1.5 age I or older bull trout indicated an important rearing area. Migratory cutthroat may be present and a resident population also existed.

South Fork Coal Creek Reach II

Channel Characteristics: Date surveyed: 9-1-79 (Figure 14)

The South Fork of Coal Creek Reach II is a second order tributary in the Coal Creek drainage. Average wetted width was 3.5 m with an average depth of 12 cm. Reach II consisted of 50% riffle, 30% run, 12% pocketwater and 8% pool. Channel debris was low with 30% stable material. Instream cover and bank cover were both low. Stream gradient was 11.1% and the D-90 was 50 cm.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 3:1. The average valley width was 50 m. Reach II was occasionally confined and had an irregular pattern. Flood plain debris was moderate to high.

Bull and westslope cutthroat trout were found in Reach II. Resident cutthroat were present. Migration is blocked by a 20 m high and 25 m long cascade at the lower end of the reach; however, bull trout spawning was observed below this barrier.

Mathias Creek Reach I

Channel Characteristics: Date surveyed: 9-11-79 (Figure 14)

Mathias Creek Reach I is a second order tributary in the Coal Creek drainage. Average wetted width was 4.5 m and the average depth was 19 cm. Reach I was composed of 40% run, 30% riffle, 21% pocketwater and 9% pool. Channel debris was high with 25% being stable. Overhanging vegetation was abundant and instream cover was high. Stream gradient was 2.4% and the D-90 was 30 cm. Many side channels and a series of beaver dams were found.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 22:1. The average valley width was was 200 m. Reach I was unconfined and had an irregular pattern.

Fish Populations: (Figure 15)

Westslope cutthroat and bull trout were observed in Reach I. Spawning by migratory bull trout was documented with an average of 10 redds enumerated annually during four years of survey. Density estimates of 1.9 age I or older bull trout indicated an important rearing area.

Mathias Creek Reach II

<u>Channel Characteristics</u>: Date surveyed: 9-11-79 (Figure 14)

Mathias Creek Reach II is a second order tributary in the Coal Creek drainage. Average wetted width was 3.5 m and the average depth was 22 cm. Reach II was composed of 40% run, 40% pocketwater, 10% riffle and 10% pool. Channel debris was moderate and 20% was stable. Bank cover was moderate and instream cover was low. Stream gradient was 8% and the D-90 was 100 cm.

<u>Valley Characteristics:</u>

The upper bank slope gradient was 30-40% and the valley to channel ratio was 9:1. The average valley width was 65 m. Reach II was occasionally confined and had a sinuous pattern.

Mathias Creek Reach II has been shocked and snorkeled during the 1979 and 1980 field season. No fish were observed or captured during these times. A series of beaver dams at the upper end of Reach I may impede movement of trout into Reach II.

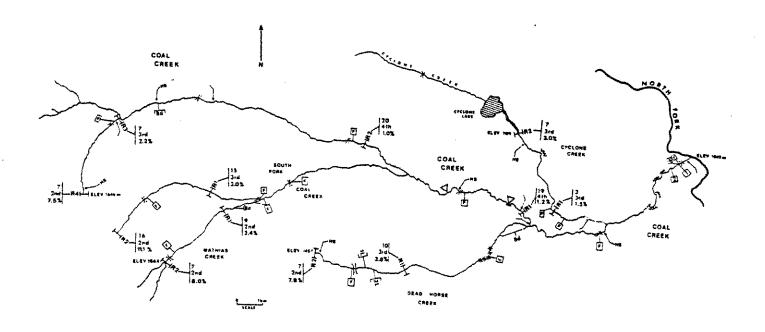


Figure 14. Location of physical habitat parameters by reach for the Coal Creek drainage.

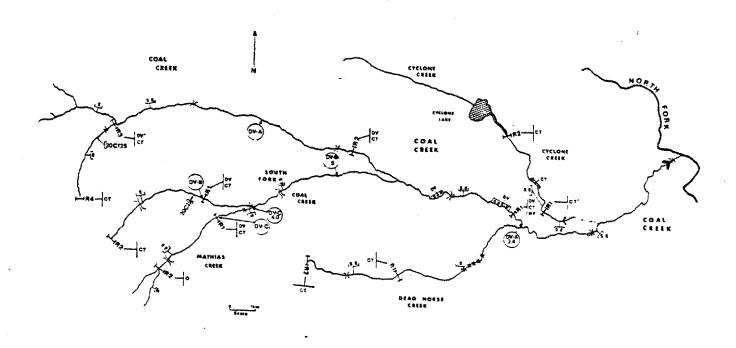


Figure 15. Fish population information by reach for the Coal Creek drainage.

Table 27. Stream habitat and fish population data for Coal Creek Reach 1.

Stream Name	Reach number		Reach Length	Tributa of	Upper ry reach bounda	ry		Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Coal Creek	001	DAM	10.1	North Fork		m above I Horse	:	1146.0) mouth	1	1026.0
Physical	Habitat data	<u>ı</u> Ave.	Ave		Ave.		Va [*]	lley-			
Stream order	Drainage <u>area(km²)</u>	wetted width(m)	depth reac	for	channel width(m)	Valley width(m)	cha	annel atio		Flow characteri	stics
4	211.5	15.0	.29		7	20		21	•		ng/rolling
Confine- ment	<u>Pattern</u>	Side channe occurenc	21	verage low flow	Flow di surve (m³/se	ey P	Average eak wai temp(C)	ter	Turbidity	Maximum pool depth(m	
Χ	Р	1ow				. a . 1		% c1	low	0.4	% class
% pool	% run	% riffle		ocket- ater	% class I pools			III p	ools I	V pools	V pools
4	50	40 % bed mate	, misl	5	23	D-90		7	Stability	50 R	11 ank
% fines	%gravel	% rubble		oulder	%bedrock			<u>jient</u>	rating	_	orm
0	0	0		0 -	0	40	1	.2	89	}	repose
Bank Process	8a gene <u>mater</u>		Flood plain debri		Channel debris	cha	table nnel oris	% cove		ver sn	cover- orkel ction
failin	g flu	uvial	lov	1	low	3		1	1]	LO
Water che	mistry data										
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbor (mg/l)	1	Total phos. mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/l)	,	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/l)</u>	SO ₄ (mg/1)
82	73	0.65	-	007	0.02	20.	5	.068	1.2		1.1
Spawning	data										
Number of bull trou redds in reach		У	bull redd	er of trout s in ach	Redd density (no/km)		bull redd	er of trout is in each	Redd density (no/km)	Year	
1	1.6	80	0		0.0	79	0		0.0	81	*
<u>Fish popu</u>	lation data									Other sp	ocine
Density (no/100 m² su	rface area	<u>i</u>)		Bull t	· not				other spi itain cefish	Eastern 8rk trout
Age 0			III+	Age 0	Age I	Age II	Age	111+	******	<u> </u>	U1 K \$1 424
O Riomass (0 0. grams/100 m²		O rea)	0	0	0		0	pr	esent	absent
7 10mm 33 /	Cutthroat				Bull t	rout					
Age 0		II Age	111+	Age 0	Age I	Age II	Age	111+			
0	0 1	1	0	0	0	0	0	İ			

Table 28. Stream habitat and fish population data for Coal Creek Reach 2.

lable 2	28. Stre	eam nab	itat and	risn pop	ulation	uata	tor u	oai tre	ek keac	n Z.
Stream Name	Reach number	Serial number		Uppe utary reac of boun		***************************************	Upper elev.(m)	Lower reach boundar	<u>y</u>	Lower elev.(m)
Coal Creek	002	DAL	8.4 Nor For		km abo th fork 1		1224.0		above Horse	1146.0
Physical	Habitat data	Ave.	Ave.	Ave.		V.	alley-			
Stream order	Drainage area(km²)	wetted width(m)	depth for	channel	Valle) <u>width(</u>	у с	hannel ratio		Flow character	
4		11.5	.31	19	400		10			ng/placid
Confine- ment	<u>Pattern</u>	Sid chann occuren	el low	su	during rvey /sec)	Avera peak w temp(ater	Curbidity	Maximu poo depth	
С	Р	moder				16	% cla	low	2.0 g class	% class
% pool	% run	% riffle	% pocket water	t- % cla I po		class pools	III po		IV pools	V pools
10	60	20 % bed mat	10 erial	2	D-9		3	Stability	•	O Bank
% fines	%gravel	% rubbl					adient	rating	-	form
20	10	- 30	20	2	0 46	•	1.0	103		repose
Bank Process		ank etic <u>ria</u> l	Flood plain debris	Channe debri	1 с	stable hannel debris	% cover canopy		over s	cover- snorkel section
failing	fl <u>u</u>	vial	moderat	e mode	rate	20	2		2	0
Water che	mistry data									
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbo (mg/l	n phos	No ₃	Ca ⁺) (mg/		Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1	K ⁺) (mg/]	SO. (mg/1)
-										
Spawning	data									
Number of bull trou redds in reach		ty	Number o bull tro redds in reach	ut Re		bu re	mber of 11 trout dds in reach	Redd density (no/km)	Year	
47	6.	2 80	40	5.3	3 79	9	29	3.9	81	
Fish popu	ulation data								0.1	
Density	(no/100 m² s	urface are	<u>ea</u>)						untain	Eastern
Age 0	Cutthroat Age I Ag	e II A	ge III+ Ag	Bul e O Age	l trout I Age I	I Ag	e III+	<u>Wh</u>	itefish	Brk trout
0	0	0	0	0 0	0		0	al	osent	absent
Biomass	(grams/100 m	² surface	area)							
Age 0	Cutthroat Age I Ag		ge III+ Ag	Bul e O Age	l trout I Age I	<u>pA</u>	e III+			

0 -

Table 29. Stream habitat and fish population data for Coal Creek Reach 3.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Vpper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Coal Creek	003	DAK	10.5	North Fork	junction with north head- waters	1620.0	2.2 km above south fork Coal	1224.0

Physical	Habitat dat		8	ā		Walley			
Stream <u>order</u>	Drainage <u>area(km²)</u>	Ave. wetted width(m)	Ave. depth for <u>reach(m)</u>	Ave. channel <u>width(m</u>)	Valley width(m)	Valley- channel <u>ratio</u>		Flow character	
3	***	4.0	.18	7	100	13		swirli	ng
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low flow	Flow du surve (m³/se	y pe	verage ak water emp(C)	<u>Turbidity</u>	Maximu pool depth(
U	Р	low					low	1.3	
% pool	% run	% riffle	% pocket- water	% class I pools				class / pools	% class V pools
3	60	30 % bed mater	7 ia l	3	D-90	₃ 20) Stability	34	38 Bank
% fines	%gravel	% rubble	% boulder	%bedrock	<u>(cm)</u>	gradient	rating	<u>.</u>	<u>form</u>
20	35	25	19	1	40	2.2	98	r	epose :
Bank Process		ank etic <u>ria</u> l	Flood plain debris	Channel debris	% sta chana deb	nel % cov		er si	cover- norkel ection
stable	flu	ıvial ı	moderate	moderat	te 30	2	10		26
Water che	mistry data		•						
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/1)	Total phos. (mg/l)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/l)</u>	SO. (mg/1)
				***		and 1000			***
Spawning	data								
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of buil trout redds in reach	Redd density (no/km)	Year	
0	0	80	4	0.4	79	1	0.1	81	
Fish popu	lation data								
Density (no/100 m² su	urface area)					Moun	<u>Other sp</u> tain	<u>ecies</u> Eastern
Age 0	Cutthroat Age I Age	e II Age	III+ Age 0	Bull tr Age I	out Age II	Age III+		<u>efish</u>	3rk trout
0.7	$\overline{1.2}$ $\overline{2.}$	4 3.	4 0.0	1.2	0.4	0.0	abse	ent	absent
Biomass (grams/100 m ²	surface are	<u>:a</u>)						
Age 0	<u>Cutthroat</u> Age I Age	e II Age		Bull tr Age I	out Age II	Age III+			

Table 30. Stream habitat and fish population data for Coal Creek Reach 4.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	reach boundary	Upper elev.(m)	reach boundary	Lower elev.(m)	
Coal Creek	004	DAJ	2.2	North Fork	headwaters	1646	junction with north head- water	1478	

Physical	Habitat data	3							
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel <u>ratio</u>	<u>9</u>	Flow haracteris	tics
2	-	4.0	.08	20	200	3	1	tumbling	/rolling
Confine-	****	Side channel	Average lo w	Flow dur survey		verage ak water		Maximum pool	
ment	Pattern	occurence		(m³/sec		emp(C)	<u>Turbidity</u>	depth(m)	*
Χ	Р	nil		0.3	or1		Tow lass % c	1.5	ov _1
<u>% pool</u>	% run	% riffle	% pocket- water	% class I pools	% clas				% class V pools
13	60	20	7	0	7	17	'	26	43
% fines	%gravel	<pre>5 bed mater 5 rubble</pre>	ial % boulder	%bedrock	D-90 (cm)	% gradient	Stability rating	Ba fo	
<u>* 110e3</u>	40	10	8	2	33	7.5	89		ose
70				_				·	
Bank	gene		Flood plain	Channel	% sta chann	nel % cove		r sno	over- rkel
Process	mater	<u>·ia</u> l	debris	debris	debi				tion
stable	e bed	lrock	moderate	low	30	2	:)10		0
Water che	mistry data								
Cond. (umohs/	Alk.	Total carbon	Total phos.	No ₃ *	Ca ⁺⁺	Mg ⁺⁺	Na ⁺	K ⁺	S0 ₄
<u>cm)</u>	$(\underline{mg/1})$	<u>(mg/1)</u>	<u>(mg/1)</u>	(mg/1)	(mg/1)	(mg/1)	<u>(mg/1)</u>	(mg/1)	<u>(mg/l)</u>
					***	***			
Spawning	data								
Number of			Number of			Number of			
bull trou redds in			bull trout redds in	Redd density		bull trout redds in	Redd density		
reach	(no/km		<u>reach</u>	(no/km)	Year	reach	(no/km)	Year	
					-	***			
Fish popu	lation data								
Density (no/100 m² su	rface area)					Mount	Other spec ain	ies Eastern
Age 0	<u>Cutthroat</u> Age I Age	II Age	III+ Age 0	Bull tro	out Age II	Age III+	White	<u>fish</u>	3rk trout
0	0	-	0 0	0	0	0	abse	ent	absent
Biomass (grams/100 m²	surface are	<u>ea</u>)						
	Cutthroat		· · · · · · · · · · · · · · · · · · ·	Bull tro				•	
-		II Age		Age I	Age II	Age III+			
0	0	0 0	0	0	0	0			

Table 31. Stream habitat and fish population data for Cyclone Creek Reach 1.

Stream Name	Reach number		Reach Tribut Length of		У	Upper elev.(m)	Lower reach boundary	·	Lower elev.(m)
Cyclone Creek	001	DAU	2.5 Nort Fork		ı end one Park	1164.0	juncti Coal C	on with reek	1092.0
			·	·					
Physical	Habitat data	a Ave.	Ave.	Ave.		Valley-			
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio	<u> </u>	Flow haracteris	tics
3	34.9	1.2	.10	3	500	99		•	swirling
Confine- ment U	Pattern N	Side channe occurence lov	el low ce flow	Flow dur survey (m³/sec 0.05	/ pea <u>te</u>	erage k water mp(C) T	urbidity low	Maximum pool depth(m) 0.6	
% pool	% run	% riffle	% pocket- water	% class I pools	% clas II poo				% class V pools
3	60	30	7	0	0	22		78	0
% fines	%gravel	% bed mate % rubble		%bedrock	D-90 (cm)	gradient	Stability rating	Ba <u>fo</u>	
20	60	10	9	1	20	1.5	81	re	ose
Bank Process	Ba gene mater		Flood plain <u>debris</u>	Channel debris	% sta chann debr	el % cover		r sno	over- rkel tion
stable	flu	vial	low	low	10	2	20	17	7
	nistry data								
Cond. (umohs/ cm)	Alk. (mg/1)	Total carbor (mg/l)		No ₃ * (mg/l)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/l)
			an an		anne sega	***		446 446	
Spawning	data								
Number of bull trou redds in reach	t Redo densit (no/kn	ty	Number of bull trout redds in reach	Redd density (no/km)	Year		Redd density (no/km)	<u>Year</u>	
***									\-
Fish popu	lation data							A	
Density (no/100 m² su	urface area	<u>i</u>)				Mount		Eastern
Age 0	Cutthroat Age I Age	e II Age	III+ Age	Bull tr O Age I	Age II	Age III+	White:	<u>r i s n</u>	<u>9rk trout</u>
34.9			.9 0	0	0	0	abse	ent	absent
<u>Biomass (</u>	grams/100 m²	surface a	irea)						
Age 0	Cutthroat Age I Age	Age	e III+ Age (Bull tr <u>Age I</u>	Age II	Age III+			

0

38

20

153

62

0

Table 32. Stream habitat and fish population data for Cyclone Creek Reach 2.

Upper

Density (no/100 m² surface area)

Cutthroat

Age I

Λ

Age II

Δ

Age 0

 $^{\circ}$

Lower

Other species

Eastern

Brk trout

absent

Mountain

Whitefish

absent

Stream Name	Reach number		each Tributa ength of	Upper iry reach boundary	F	Upper elev.(m)	reach boundary		Lower elev.(m)
Cyclone Creek	002	DAT	4.0 North Fork	ı Cyclo	ne Lake	1296.0	north Cyclon	end e Park	1164.0
Physical) Stream	Habitat dat Drainage area(km²)	a Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	9	Flow characteris	itics
3 Confine- ment	Pattern	3.0 Side channe occurence		7 Flow dur survey (m³/sec	peal	6 erage c water mp(C) I	S urbidity	Wirling Maximum pool depth(m)	
F	N	Tow		0.04			ow	0.9	
<u>% pool</u> 3	<u>% run</u> 60	<u>z riffle</u> 30	% pocket- water 7	% class I pools O	% class II pool			lass pools 4	% class V pools O
		% bed mater		%bedrock	D-90 (cm)	% gradient	Stability rating		nk rm
<u>% fines</u>	<u>%gravel</u> 60	<u>% rubble</u> 15	<u>% boulder</u> 14	1	35	3.0	89		pose
Bank Process	В	ank etic	Flood plain debris	Channel debris	% stat channe debri	ole el % cover	- % coγε	% c er sno	over- rkel tion
W	bedi	rock	low	low	10	2	30	0	
Water cher	mistry data								
Cond. (umohs/ cm)	A1k. (<u>mg/1)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
***				-					
Spawning	da ta								
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year	
Fish popu	lation data							Othon sno	rier

U	U	U	U	U	U	U	U
Biomass	(grams/1	00 m² surf	ace area)				
	Cutth			-	- Bull t	rout	
Age 0	Age I	Age II	Age III+	Age 0	Age I	Age II	Age III+
0	0	0	0	0	0	0	0

Age 0

Age III+

Bull trout

Age I

Age II

Age III+

 \circ

Table 33. Stream habitat and fish population data for Dead Horse Creek Reach 1.

Stream Name	Reach number		each Tribut ength of	- .	· Y	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Dead Horse Creek	001	DAO	6.1 Nor		ge acros Horse	s 1374.0	junction Coal Cree	
Obvedest	Uskibsk dat							
Stream	<u>Habitat data</u> Drainage	Ave. wetted	Ave. depth for	Ave. channel	Valley	Valley- channel		Flow
order	area(km²)	width(m)	reach(m)	width(m)	width(m)	ratio	chara	acteristics ·
3	25.2	3.5	.17	10	32	3		ken
Confine- ment	<u>Pattern</u>	Side channe occurence		Flow dui survey (m³/sec	/ pea	erage k water mp(C)		pool .
F	Р	low	% pocket-	0.1 % class	9 % clas	s % cla		.9 % class
% pool	% run	% riffle	water	<u>I pools</u>	II poo			
3	30	60 % bed mater	7 rial	1	D-90 1	3 20) 78 Stability	O Bank
% fines	%grave1	% rubble	% boulder	%bedrock	<u>(cm)</u>	gradient	rating	form
10	50	20	10	10	37	3.8	102	repose
Bank Process		ank etic <u>ria</u> l	Flood plain <u>debris</u>	Channel debris	% sta chann debr	el % cover		% cover- snorkel section
stable	flu	ıvial	moderate	moderate	e 20	10	20	25
Water che	mistry data	·				·		
Cond. (umohs/	Alk.	Total carbon	Total phos.	No 3 T	Ca ⁺⁺	Mg ++	Na ⁺	κ ⁺ 504
cm)	$(\underline{mg/1})$	(mg/1)	(mg/1)	(mg/1)	(mg/1)	(mg/1)	$\frac{(mg/1)}{(mg/1)}$	mg/1) (mg/1)
****		-	गाउ गाउँ	***	****			
Spawning	data							
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km) Yea	<u>r</u>
		***			***			· ••••.
	lation data						()+h	er species
Density (no/100 m² su)	Bull tr	rout		Mountain Whitefish	Eastern
		e II Age	III+ Age C	Age I	Age II	Age III+	**************************************	The second secon
1.7	O grams/100 m	0.6 0. ² surface as		0	0	0	absent	absent
n ining 22 (Cutthroat	Jul 1465 41		Bull tr	out			
Age 0	Age I Age	e II Age	III+ Age C		Age II	Age III+		
2	0	7	9 0	0	0	0		

Table 34. Stream habitat and fish population data for Dead Horse Creek Reach 2.

Dead Horse	Stream Name	Reach number	Serial number	Reach Tribu Length o		<u>-y</u>	Upper elev.(m)	Lower reach boundary	-	Lower elev.(m)
Stream Drainage Condition Water	Horse	002	DAN			vaters	1464.0			1374.0
Stream Drainage Condition Water			•							
Stream order area(km²) width(m) reach(m) width(m) valley channel characteristics cha	Physical	Habitat data		A	8		Val Fau	•		
Confine-ment			wetted	depth for	channe1		channel	C		
Condition	2		2.0	.13	7	24	3	_	tumbli	ng
Special State St	ment		channe occurenc	wo[is	surve (m³/se	y pea c) te	ık water emp(C) T		pool depth(m)	
2		% run		• •						
Spawning data		40			0	0			95	
Bank genetic plain Channel debris Channel debris Cover- snorkel debris Canopy Stable Channel debris Channel debris Canopy Cover- snorkel debris Canopy Canopy Canopy Canopy Canopy Canopy Canopy Canopy Canopy Caropy	% fines	%gravel			%bedrock					
Spawning data	10	30	30	20	10	65	7.9	77	rep	ose
Cond. Total Total (umohs/ cm) (mg/1)	Process	gene <u>mater</u>	tic ial	plain <u>debris</u>	debris	chann <u>debr</u>	el % cover is canopy	overha	r sno ng sec	rkel tion
Number of Number of Spawning data	Water cher	mistry data								
Number of bull trout Redd bull trout Redd bull trout redds in density reach (no/km) Year	(umohs/		carbon	phos.		Ca ⁺⁺ (mg/l)				
Number of bull trout Redd bull trout Redd bull trout redds in density reach (no/km) Year										WE. 1014
bull trout redds in density Redd density bull trout redds in density Redd density bull trout redds in density Redd density Fish population data Density (no/100 m² surface area) Bull trout Mountain Whitefish Brk trout Age 0 Age I Age II Age III+ Age 0 Age I Age II Age III+ O 0 0 0 absent absent Cutthroat Bull trout Biomass (grams/100 m² surface area) Cutthroat Bull trout Age II Age III Age III+ Age III Age III Age III+	Spawning (data								
Other species Mountain Eastern	bull trout redds in	densit	ý	bull trout redds in	density	<u>Year</u>	bull trout redds in	density	Year	
Cutthroat Bull trout Mountain Eastern Whitefish Brk trout	 Fish popu	 lation data								
Age 0 Age 1 Age IIII+ Age 0 Age I Age IIII+ 0 0.6 0 1.2 0 0 0 0 absent Biomass (grams/100 m² surface area) Cutthroat Bull trout Age 0 Age I Age III Age III+ Age III Age III+	Density (r		rface area)					in	Eastern
Biomass (grams/100 m² surface area) Cutthroat Age O Age I Age II Age III+ Age O Age I Age II Age III+	Age 0		II Age		Age I	Age II		White	<u> 15h</u>	8rk trout
Cutthroat Bull trout Age O Age I Age II Age III+ Age O Age I Age III Age III+					0	0	0	abse	nt	absent
We will be a second of the sec		Cutthroat								
0 4 0 37 0 0 0 0		<u>, 2</u>			_ 					

Table 35. Stream habitat and fish population data for South Fork Coal Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributa of	Upper ry reach boundar	<u> </u>	Upper elev.(m)	Lower reach boundary	***************************************	Lower elev.(m)
South Fork Coal Creek	001	DAS	9.0	North Fork	2nd bi South Coal (-	1472	junctic Coal Cr	on with reek	1201
Physical	Habitat data	a								
Stream order	Drainage area(km²)	Ave. wetted width(m)		e. h for ch(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio		Flow characteri	<u>stics</u>
3 Confine-	34.4	6.0 Sic		2 Average low	15 Flow du surve		4 erage k water		rolli Maximum pool	ng
<u>ment</u>	<u>Pattern</u>	occurer		flow	<u>(m³/se</u>			Turbidity	depth(m	<u>)</u>
Х	₽	low	oy 1	 oocket-	0.12 % class	% clas	- s %cla	low	0.8	% class
<u>% pool</u> 3	<u>% run</u> 40	½ riffle 50		water 7	I pools	11 poo 8	111 pc 22	ools <u>IV</u>	9001s 39	<u>V pools</u> 30
% fines	%grave1	% bed mai % rubbl		ooulder	%bedrock	D-90 (cm)	gradient	Stability rating		ink orm
20	30	20		20	10	38	3.0	94	re	pose
Bank Process		ank etic <u>ria</u> l	Floor plair debr	3	Channel debris	% sta chann debr	el % cover		% (er sno	cover- orkel ction
stable	fluv	/ial	low	1	low	20	10	20	16	
Water che	mistry data									
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbo (mg/l	on	Total phos. (mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/l)</u>	SO ₄ (mg/1)
	and desire					•••	400 444		***	
Spawning	<u>data</u>									
Number of buil trou redds in reach		ty	bul red	per of l trout ds in each	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
2	0.2	80		4	0.5	79	24	3.0	81	
Fish popu	lation data								0.1	_
Density (no/100 m² s	urface are	<u>ea</u>)					Mount		Eastern
Age 0	<u>Cutthroat</u> Age I Age		ge III+	Age 0	Bull to Age I	rout Age II	Age III+	White	etish	Brk trout
0		0.2	0.2	0.2	0.2	0.3	0.2	abse	ent	absent
Biomass (grams/100 m		area)							
Age 0	Cutthroat Age I Age	e II Ag	ne III+	Age 0	Bull to Age I	Age II	Age III+			
0	0	2	6	1	1	6	9			

Table 36. Stream habitat and fish population data for South Fork Coal Creek Reach 2.

Stream Name	Reach <u>number</u>		Reach Length	Tributar of	Upper y reach boundar	y	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
South Fork Coal Creek	002	DAR	2.0	North Fork	headwa	iters	1695	2nd bri South F Coal Cr	ork `	1472
Physical	Habitat data						W= 7.7			
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave depth reac	for (Ave. :hannel vidth(m)	Valley width(m)	Valley- channel ratio	<u>c</u>	Flow haracteris	<u>stics</u>
2	***	3.5	. 12	2	16	50	3	1	rolling	
Confine- ment	Pattern	Side channe occurenc	1	lverage low flow	Flow dur survey (m³/sec	pea pea	erage k water mp(C) <u>T</u>	urbidity	Maximum pool depth(m)	
X	Р	low			0.05	•		low	0.6	
<u>% pool</u>	<u>% run</u>	% riffle		ocket- ater	% class I pools	% clas II poo		- "	lass pools	% class V pools
8	30	50 % bed mate	12	2	1	0-90	₃ 36	Stability 2	23	36
% fines	%gravel	% rubble		oulder	%bedrock	(cm)	gradient	rating		<u>rm</u>
30	20	10	1	lO	30	50	11.1	88	re	pose
Bank Process	Ba gene <u>mater</u>		Flood plain debri		Channel debris	% stal channe debr	el % cover		r sno	over- rkel tion
stable	bedr	rock	mode	erate	low	30	2	10	0	
	mistry data								_	
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)		Total phos. mg/1)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO. (mg/l)
			-	. ***						
Spawning	data			-						
Number of buil trou redds in reach		.y	bull redd	er of trout s in ach	Redd density (no/km)	<u>Year</u>		Redd density (no/km)	Year	
			_	_						
Fish popu	lation data									
Density (no/100 m² su	rface area)					Moun ta		Eastern
			111+	Age 0	Bull tr Age I	Age II	Age III+	Whitef		Brk trout
O Biomass (0 grams/100 m²	O surface a	O rea)	0	0	0	0 .	abse	ΠŢ	absent
210	Cutthroat		<u></u> ,		Bull tr	out				
	Age I Age		111+	Age 0	Age I	Age II	Age III+			
0	0	0	0	0	0	0	0			

Table 37. Stream habitat and fish population data for Mathias Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary <u>of</u>	Upper reach boundar	·y		Upper elev.(m)	Lower reach boundar	у	Lower elev.(m)
Mathia	s 001	DAQ		North Fork Cr. sou	culven from (uth fon		km	1398.	•	cion with n fork Cr.	1356.0
Physical I	Habitat data		4								
Stream <u>order</u>	Orainage area(km²)	Ave. wetted width(m)	Ave. depth <u>reach</u>		Ave. mannel idth(m)	Valley width(m)	cha	lley- innel itio		Flow characteri	stics
2	13.2	4.5	.19	9		200	22	2		rolling/	swirling
Confine- ment	Pattern	Side channe occurenc	e 1	erage low low	Flow dur survey (m³/sec	/ T p	Average eak wat temp(C)	er	urbidity	Maximum pool depth(m)	_
U	Р	low	° 200	• •• • • • • • • • • • • • • • • • • •	0.08 % class	or _1			low	1.1	w -t
% pool	% run	% riffle	wa	ket- ter	I pools		ools	% cla:		class V pools	% class V pools
10	40	30 ″ bad =====	20)	3	4	~	22		71	0
% fines	%gravel	% bed mate % rubble		ılder	%bedrock	D-90 (cm)	grad	ient	Stability rating	Ba <u>fo</u>	nk m
30	30	20	19)	1	30	2	2.4	91	rep	ose
Bank Process	Ba gene mater	tic	Flood plain debris		hannel debris	cha	table nnel <u>bris</u>	% cover- canopy	- % cov	er sno	over- rkel tion
stable	fluv	/ial	modera	ite h	nigh	25	i	2	40	30	
Water chem	istry data										
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/l)	ph		No ₃ * mg/1)	Ca ⁺⁺ (mg/l)		Mg ⁺⁺ mg/1)	Na ⁺ (mg/1)	κ [†] (<u>mg/l)</u>	50 ₄ (mg/l)
		1999 4899	***			***		-			***
Spawning d	<u>ata</u>					*					
Number of bull trout redds in reach	Redd density (no/km		Number bull t redds reac	rout in	Redd density (no/km)	<u>Year</u>	bull redds		Redd ensity no/km)	Year	
10	6.6	80	2		1.3	79	1	0	6.7	81	
Fish popula	ation data										
Density (no	o/100 m² sur	face area)						Moun	Other spec tain	ies Eastern
Age 0 Ag	<u>Cutthroat</u> ge I Age	II Age	111+	Age 0	Bull tro	out Age II	Age I	TI+	White	<u>efish</u>	3rk trout
0	0 1. rams/100 m²	5 0		0	0	0.5	0.2		abse	ent .	absent
Age 0 Ag	Cutthroat ge I Age	II Ace	111+	Age 0	Bull tro	out Age II	Age I	114			
							****	<u> </u>			
0	0 1	8 0		0	0	11	9				

Table 38. Stream habitat and fish population data for Mathias Creek Reach 2.

Stream Name	Reach number		Reach Tribut Length of		ry	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Mathia	s 002	DAP	2.8 Nort		aters	1644.0		rt 1.5 om Coal outh	1398.0
Physical	Habitat dat	<u>a</u> Ave.	Ave.	Ave.		Valley-			
Stream order	Drainage area(km²)	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio	· <u>c</u>	Flow haracteri	stics
2		3.5	.22	7	65	9	t	umbling	J
Confine- ment	Pattern	Sid channo occuren	el low	Flow du surve (m³/se	ey pea	erage k water mp(C)	[urbidity	Maximum pool depth(m	
X	N	1ow		0.05		-	low ~	0.9	a -1
% pool	% run	% riffle	% pocket- water	% class I pools				lass pools	% class V pools
10	40	10	40	0	1	1	0 8 Stability	9	O ank
% fines	%gravel	% bed mate % rubble		%bedrock	0-90 (cm)	gradient	rating		orm Orm
20	30	20	10	20	100	8.0	52	re	pose
Bank Process		ank etic <u>ria</u> l	Flood plain debris	Channel debris	% sta chann debr	el % cover		r sno	cover- orkel ction
stable	bed	rock	moderate	modera	te 20	10	20	0	
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l		No ₃ " (mg/l)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	50. (mg/1)
***		nin edo	400 504	-101 200	** ==	** =			
Spawning	da ta		·						
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd densit (no/km		Number of bull trout redds in reach	Redd density (no/km)	Year	
	lation data	•	_					Other sp	ecies
	no/100 m² s Cutthroat Age I Ag	,	a) e III+ Age	Bull 1	trout Age II	Age III+	Mount White		Eastern Brk trout
0	0 grams/100 m	0	0 (0	0	0	abse	ent	absent
Dining 22 /	Cutthroat			Eull 1	trout				
Age 0			e III+ Age		Age II	Age III+			
0	0	0 0	0	0	0	0	e.		

QUARTZ CREEK DRAINAGE

QUARTZ CREEK REACH I

Channel Characteristics: Date surveyed: 8-22-80 (Figure 16)

Reach I of Quartz Creek is a fourth order tributary to the North Fork. Average wetted width was 13.8 m and the average depth was 40.2 cm. This reach contained 57% run and 43% riffle. Low amounts of debris were present with 60% stability. Bank cover was low and instream cover was moderate. The channel gradient was 2.0% and the D-90 was 40 cm. The creek originated at Quartz Lake, 12.7 km above the mouth.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 4:1. The average valley width was 150 m. The channel was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 17)

Cutthroat trout, mountain whitefish and suckers were present. Juvenile and adult fish of each species were observed. All age classes of cutthroat were observed with a total density of 4.5 cutthroat per $100~\text{m}^2$. Suckers apparently used this stream for spawning.

Cummings Creek Reach I

Channel Characteristics: Date surveyed: 8-24-80 (Figure 16)

This is a second order tributary to Quartz Creek. Average wetted width was $5.2\,\mathrm{m}$ with an average depth of $18.8\,\mathrm{cm}$. This reach contained 54% run, 42% riffle and 4% pocketwater. There was a low to moderate amount of debris and low amounts of bank cover. Instream cover was low. The channel gradient was 6.6% and the D-90 was $60.6\,\mathrm{cm}$. The headwater area was flat and swampy.

Valley Characteristics:

The upper bank slope gradient was 40-60%. The reach had a valley to channel ratio of 4:1 with an average valley width of 40 m.

Fish Populations: (Figure 17)

Cutthroat trout and sculpins were present in this reach. Mature resident cutthroat trout were observed while snorkeling.

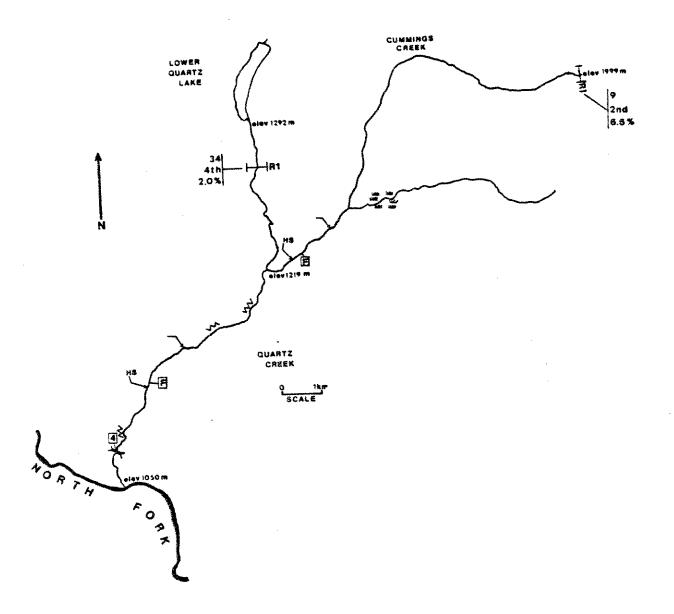


Figure 16. Location of physical habitat parameters for Quartz Creek and Cummings Creek.

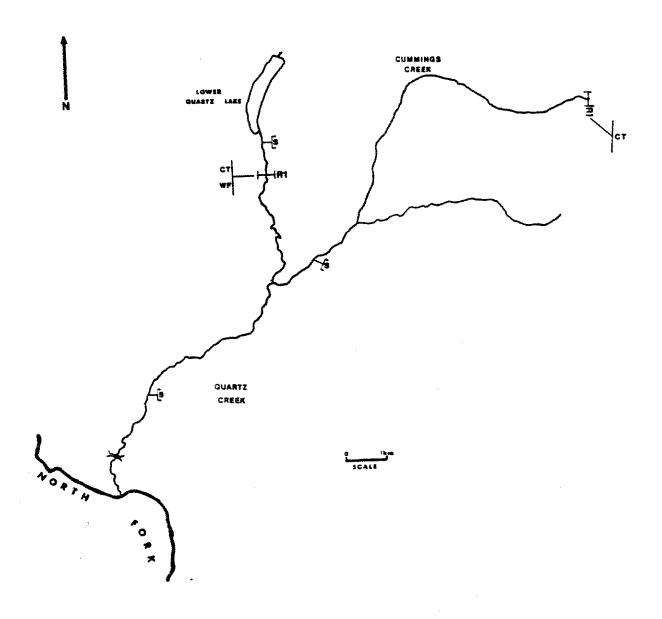


Figure 17. Fish population information by reach for Quartz Creek and Cummings Creek.

Table 39. Stream habitat and fish population data for Quartz Creek Reach 1.

Stream Name	Reach number		each Tributa ength of	Upper ary reach bounda	y	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Quartz Creek	001	DB6 10).1 North Fork	lower Lake	Quartz;	1257.	0 mouth	1050
Stream order	Habitat dat Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	:	Flow characteristics
4	135.9	13.8	.40	34	150	4	1	broken/rolling
Confine- ment	<u>Pattern</u>	Side channel occurence		Flow du surve (m³/se	y pea	erage k water mp(C)	Turbidity	Maximum pool depth(m)
Х	Р	modera	te	2.2			oderate	1.5
% pool	% run	% riffle	% pocket- water	% class I pools			ools IV	class % class pools V pools
1	55	43	. 1	25	25	_ 0	Fact 33.15	50 0
% fines	%gravel	<pre>3 bed mater</pre>	% boulder	%bedrock	D-90 <u>(ст)</u>	gradient	Stability rating	Bank <u>form</u>
20	40	30	10	0	40	2.0	92	repose
Bank <u>Process</u>	Ba gene mater		Flood plain debris	Channel debris	% stal chann debr	el % cover		
failing	fluy	ial	Tow	low	60.	10	3	18
Water che	mistry data							
Cond. (umohs/ cm)	Alk. (mg/1)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	$\begin{pmatrix} K^{\dagger} & SO_{\bullet} \\ (mg/1) & (mg/1) \end{pmatrix}$
		1.66	.006	0.01	8.9	.025		2.0
Spawning	data							
Number of bull trou redds in reach		:y	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	Year
-							40.44	-
Fish popu	lation data							Othon gazzin-
Density (no/100 m² su	rface area)		M 73 -			Mount	
Age 0	<u>Cutthroat</u> Age I Age	II Age	III+ Age O	Bull to		Age III+	White	fish Brk trout
	.9 1. grams/100 m²			0	0	0	pres	ent absent
Age 0	<u>Cutthroat</u> Age I Age	: II Age	III+ Age 0	Bull tr Age I		Age III+		
0	13 1	3 4	7 0	0	0	0		

Table 40. Stream habitat and fish population data for Cummings Creek Reach 1.

Stream Name	Reach <u>number</u>	Serial <u>number</u>	Reach Length	Tributary of	Upper reach boundary	Upp er elev.(m)	Lower reach boundary	Lower elev.(m)	, 8
Cummings Creek	001	DBX	11.8	North Fork	headwaters	1999	mouth	1219	

Physical	Habitat dat	а							
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio		Flow characteri	<u>stics</u>
2		5.2	.19	9	40	4		broken	- ,
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low flow	Flow du surve (m³/sec	y pe	verage ak water emp(C)	Turbidity	Maximum pool depth(m	
Χ	P	moderat	e	0,15		***	low	. 1.1	
% pool	% run	% riffle	% pocket- water	% class I pools	% cla II po			class <u>pools</u>	% class V pools
3	56	39	2	0	12	2	5 6	3	0
% fines	%grave1	% bed mater % rubble	ial % boulder	%bedrock	D-90 (cm)	% gradient	Stability rating		ank orm
30	30	30	10	0	61	6.6	91	rep	
Bank Process		ank etic rial	Flood plain debris	Channel debris	% st chan deb	nel % cov		% (er sno	cover- orkel ction
failing	g fluv	/ial	Tow	moderat	e 3	0 20	10	1	0
Water che	mistry data								
Cond. (umohs/ _cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	Mo ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	κ ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
Spawning	<u>da ta</u>								
Number of bull trou redds in reach		у	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
Fish popu	lation data								
Density (no/100 m² su	ırface area)					Mount	Other spe	cies Eastern
Age 0 0.5	Cutthroat Age I Age 0.7 1	<u>II Age 1</u>	11+ Age 0 .7 0	Bull tr Age I O	out Age II O	Age 111+ 0	White abs	efish	8rk trout absent
		surface are	<u>a</u>)						
	Cutthroat			Bull tr	out				
Age 0	Age I Age	II Age I	II+ Age O	Age I	Age II	Age III+			

18

HAY CREEK DRAINAGE

HAY CREEK REACH I

Channel Characteristics: Date surveyed: 8-11-80 (Figure 18)

Hay Creek Reach I is a third order tributary in the North Fork drainage. Average wetted width was 8.5 m and the average depth was 33 cm. Reach I consisted of 42% run, 40% riffle, 16% pocketwater and 2% pool. Channel debris was low with 40% being stable. Debris accumulation occurred near the upper end of this reach. Bank cover was moderate and instream cover was high. Stream gradient was 1.5% and the D-90 was 66 cm. Beaver activity and cattle grazing occurred on the lower bank. A major slump zone was present two kilometers below the upper reach break.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 4:1. The average valley width was 90 m. Hay Creek was frequently confined and had a sinuous stream pattern.

Fish Populations: (Figure 19)

Bull trout, westslope cutthroat trout and sculpins were observed in this reach. A resident bull trout population may exist and the presence of a migratory cutthroat population was not determined.

HAY CREEK REACH II

Channel Characteristics: Date surveyed: 8-11-80 (Figure 18)

Hay Creek Reach II is a third order tributary in the North Fork drainage. Average wetted width was 9 m and the average depth was 33 cm. Reach II was comprised of 46% run, 30% riffle, 19% pool and 5% pocketwater. Channel debris was low to moderate and 40% was stable. Bank and instream cover were both moderate. Stream gradient was 1.5% and the D-90 was 24 cm. Some beaver activity was noted in the middle of this reach.

Valley Characteristics:

The upper bank slope gradient was less than 30% and the valley to channel ratio was 10:1. The average valley width was 150 m. Reach II was unconfined and had an irregular stream pattern.

Fish Populations: (Figure 19)

Bull trout, westslope cutthroat trout, sculpins and yellowstone cutthroat

trout were observed in this reach. This reach may also contain a resident population of bull trout. Migratory cutthroat use of this reach was not confirmed. Cutthroat were present in higher densities than bull trout.

HAY CREEK REACH III

Channel Characteristics: Date surveyed: 8-11-80 (Figure 18)

Hay Creek Reach III is a third order tributary in the North Fork drainage. Average wetted width was 7.2 m and the average depth was 33 cm. Reach III was composed of 50% run, 35% riffle, 12.5% pool and 2.5% pocketwater. Channel debris was moderate with 60% stability. Vegetation provided only slight bank cover while instream cover was low-moderate. Stream gradient was moderate (3.4%) and the D-90 was 30 cm.

Valley Characteristics:

The upper bank slope gradient was less than 30% and the valley to channel ratio was 17:1. The average valley width was 200 m. Reach III was unconfined and had an irregular pattern.

Fish Populations: (Figure 19)

Bull trout and westslope cutthroat were observed in this reach. Both species are suspected to maintain resident populations. Use by migratory cutthroat was unknown.

HAY CREEK REACH IV

Channel Characteristics: Date surveyed: 8-11-80 (Figure 18)

Hay Creek Reach IV is a second order tributary in the North Fork drainage. Average wetted width was 3.7 m and the average depth was 16 cm. Reach IV consisted of 51% riffle, 34% pocketwater, 10% nun and 5% pool. Five percent of the total 34% pocketwater consisted of cascades. Channel debris was moderate and 30% was stable. Bank and instream cover were both moderate. Stream gradient was 10% and the D-90 was 62 cm.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 26:1. The average valley width was 200 m. Reach IV was unconfined and had an irregular stream pattern.

Fish Populations: (Figure 19)

Westslope cutthroat trout were observed in this reach. Cascades at

least 2 m high created a partial fish migration barrier in the middle of the reach.

Moran Creek Reach I

Channel Characteristics: Date surveyed: 7-25-80 (Figure 18)

Moran Creek Reach I is a third order tributary in the Hay Creek drainage. Average wetted width was 4.4 m and the average depth was 20 cm. Reach I consisted of 60% riffle, 38% run and 2% pool. Channel debris was low with 20% stability. Vegetation provided high bank cover and instream cover was low-moderate. Stream gradient was 3.9% and the D-90 was 24.5 cm.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 7:1. The average valley width was 70 m. Reach I was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 19)

Bull trout, westslope cutthroat trout, mountain whitefish and sculpins were observed in this reach. The presence of juvenile bulls suggested that bull trout may use the area for spawning. This was an important reach for cutthroat trout rearing with a density of 20 trout per $100~\text{m}^2$ surface area.

Moran Creek Reach II

Channel Characteristics: Date surveyed: 7-25-80 (Figure 18)

Moran Creek Reach II is a third order tributary in the Hay Creek drainage. Average wetted width was 4.9 m and the average depth was 23 cm. Reach II was comprised of 60% riffle, 20% run, 15% pocketwater and 5% pool. Ten percent of the total 15% pocketwater was made up of cascades. Channel debris was moderate with 60% being stable. Vegetation provided high bank cover and instream cover was moderate. Stream gradient was 7.6% and the D-90 was 32 cm.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 2:1. The average valley width was 20 m. Reach II was frequently confined and had an irregular pattern.

Westslope cutthroat were observed in this reach. A partial fish migration barrier, consisting of a 2 m high log jam, was located near the upper end of this reach when the survey was conducted.

Moran Creek Reach III

Channel Characteristics: Date surveyed: 7-25-80 (Figure 18)

Moran Creek Reach III is a third order tributary in the Hay Creek drainage. Average wetted width was 4.5 m and the average depth was 20 cm. Reach III was composed of 60% run, 27% riffle, 7% pool and 6% pocketwater. Channel debris was moderate and 60% was stable. Vegetation provided abundant bank cover and instream cover was moderate. Stream gradient was 5.5% and the D-90 was 26 cm.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 10:1. The average valley width was 100 m. Reach III was unconfined to occasionally confined and had an irregular pattern.

Fish Populations: (Figure 19)

Westslope cutthroat were observed in this reach and were probably resident fish.

Moran Creek Reach IV

Channel Characteristics: Date surveyed: 7-25-80 (Figure 18)

Moran Creek Reach IV is a second order tributary in the Hay Creek drainage. Average wetted width was 4.2 m and the average depth was 13 cm. Reach IV was composed of 68% riffle, 17% pocketwater and 5% pool. Channel debris was low and 70% was stable. Both bank and channel cover were low. Stream gradient was 8.5 and the D-90 was 40 cm.

<u>Valley Characteristics:</u>

The upper bank slope gradient was greater than 60% and the valley to channel ratio was 10:1. The average valley width was 70 m. Moran Creek was frequently confined and had an irregular stream pattern.

Fish Populations: (Figure 19)

Very little spawning habitat was available in Reach IV. Resident westslope cutthroat trout were observed during the survey.

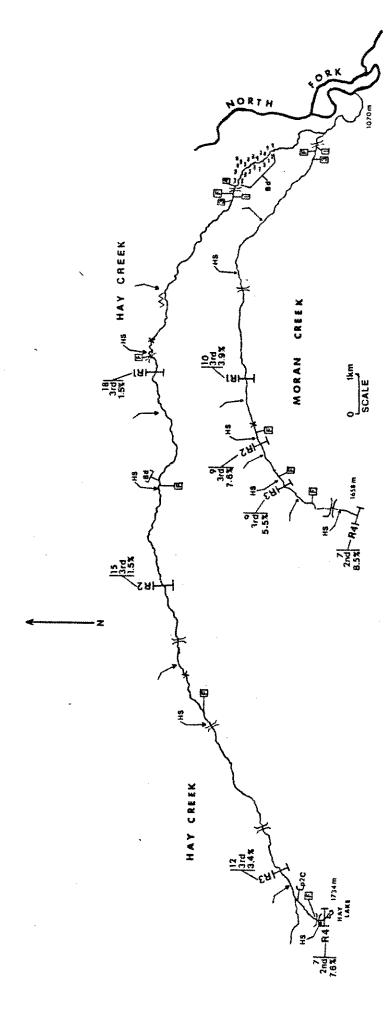


Figure 18. Location of physical habitat parameters by reach for Hay Creek and Moran Creek.

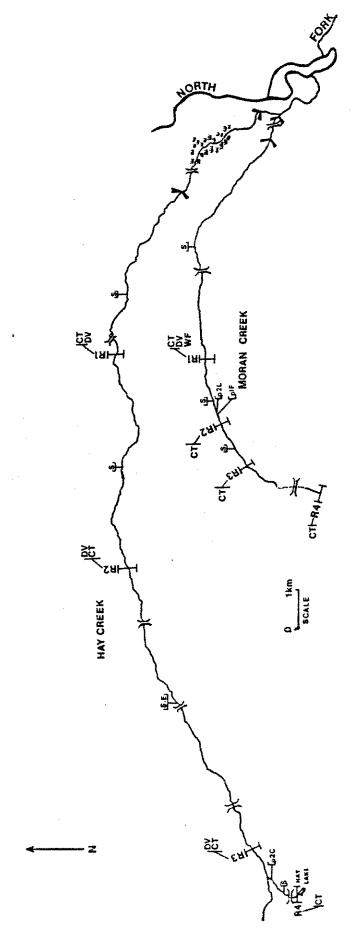


Figure 19. Fish population information by reach for Hay Creek and Moran Creek.

Table 41. Stream habitat and fish population data for Hay Creek Reach 1.

Stream <u>Name</u>	Reach number	Serial number	Reach Length	Tributary of	Upper reach bounda	ry	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Hay Creek	001	DAX	10.7	North Fork	7 mil from	es mouth	1228	mouth	1064
Physical Stream	Habitat data	a Ave. wetted	Ave denti		Ave.	Valley	Valley- channel	Flo	w
order order	area(km²)	width(m)			idth(m)	width(m)	ratio	characte	ristics

Physical	maditat dete		Aven	A		Valley-			
Stream <u>order</u>	Drainage area(km²)	Ave. weited width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	channel ratio		Flow characteri	stics
3	111.6	8.5	.33	18	80	5		broken/	rolling
Confine- ment	<u>Pattern</u>	Side channel occurence		Flow dur surve) <u>(m³/sec</u>	pe () t	verage ak water emp(C)	Turbidity	Maximum pool depth(m	
F	N	modera	te	0.60	1		moderate	1.2	
<u> 2 pool</u>	% run	% riffle	% pocket- water	% class I pools	% cla II po	ols III	pools IV	class pools	% class V pools
2	42	40	16	4	10			54	0
% fines	%gravel	% bed mater % rubble	ial % boulder	%bedrock	D-90 (cm)	gradient	Stability <u>rating</u>		ank orm
30	40	20	10	0	66	1.5	100	re	pose
Bank Process	Ba gene <u>mater</u>		Flood plain debris	Channel debris	% st chan deb	nel % cove		er sno	cover- orkel ction
failin	g fluy	ial	moderate	low	40	20	20	2	8
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (mg/1)	Total carbon (mg/1)	Total phos. (mg/l)	No ₃ " (mg/l)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
148	100	0.10	.004	below solel	26.6	.095	1.1		1.0
Spawning	data					·			
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	Year	
100 200									
<u>Fish popu</u>	lation data								
Density (no/100 m² su	urface area)					Moun	Other spe tain	Eastern
w.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				011				of ich	3rk trout

	pulation							Other s	pecies
Density	no/100 <u>(no/100</u> Cutth	m² surface roat	area)		Bull t	rout		Mountain Whitefish	Eastern Brk trout
Age 0	Age I	Age II	Age III+	Age 0	Age I	Age II	Age III+		
1.2	0	0.5	2.9	0	0	0	0	present	absent
Biomass	(grams/l	00 m² surf	ace area)						
	Cutth	roat			Bull t	rout			
Age 0	Age I	Age II	Age III+	Age 0	Age I	Age II	Age III+		

0

Table 42. Stream habitat and fish population data for Hay Creek Reach 2.

Stream Name	Reach number		each Tributa ength of	Upper ry reach bounda	ry	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Hay Creek	002	DAY 7.	2 North Fork		miles mouth	1338	7 miles from mou	1228 ith
	Habitat data	Ave.	Ave.	Ave.	V-11	Valley-		F1-
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depth for reach(m)	<pre>channel width(m)</pre>	Valley width(m)	channel <u>ratio</u>	cha	Flow racteristics
3	*****	9.1	.33	15	150	10	ro	olling
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low <u>flow</u>	Flow du surve (m³/se	y pea	verage ik water emp(C)		Maximum pool depth(m)
U	Р	Wo [% pocket-	0.40 % class	% clas	 ss %cla	low ass % cla	1.2 ss % class
% pool	<u>% run</u>	% riffle	<u>water</u>	I pools	II poc	ols III po	ools IV po	ols V pools
19	46	30	5	14	18	_~ 39	29	
% fines	%gravel	<pre>% bed mater % rubble</pre>	% boulder	%bedrock	D-90 <u>(cm)</u>	gradient	Stability rating	Bank <u>form</u>
40	40	18	2	0	24	1.5	86	flat
Bank Process	Ba gene mater		Flood plain debris	Channel debris	% sta chann debr	el % cover		<pre>% cover- snorkel section</pre>
aggradir	ng fluv	/ial	low	low	40	20	20	23
Water cher	mistry data							•
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K ⁺ SO ₄ (mg/1)
	****	-				· *** ***		
<u>Spawning</u>	<u>data</u>							
Number of bull trou redds in reach	t Redd densit (no/km	У	Number of bull trout redds in reach	Redd density (no/km)	Year		Redd density (no/km) Ye	ear .
	هنت جنيب					***		The sine
Fish popu	lation data						.	
	Cutthroat		Tit Age ()	Bull tr		Ago TIVE	Ot Mountain Whitefis	
	Age I Age).2 0.4			Age I O	Age II O	Age 111+ 0.1	presen	t absent
		surface are			~	# T ##	- www.wiii	

Age I

0

Bull trout

Age II

0

Age III+

5

Cutthroat Age I Age II

5

Age 0

1

Age III+

218

Age 0

Table 43. Stream habitat and fish population data for Hay Creek Reach 3.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Hay Creek	003	DAV	7.5		bridge 2 km below Hay Lake	1591	11.5 miles from mouth	1338.

Physical	Habitat data			0	•	Valla.			
Stream <u>order</u>	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel <u>ratio</u>		Flow <u>characteri</u>	stics
3		7.2	.33	12	200	16		rolling	J
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low flow	Flow dur survey (m³/sec	, pea	erage k water mp(C)	Turbidity	Maximum pool depth(m	
U	Р	1 ow	% pocket-	0.24 % class	% clas	 s % c	low lass *	1.1 class	% class
% pool	% run	% riffle	water	I pools	II poo			pools	V pools
13	35	50	2	13	- 16 D-90	51 %	O 2 Stability	21	O ank
% fines	%gravel	<pre>% bed mater % rubble</pre>	% boulder	%bedrock	(cw)	gradient	rating		211K 211II
10	50	20	20	0	30	3.4	86	re	pose
Bank <u>Process</u>	Ba gene mater		Flood plain debris	Channel debris	% sta chann debr	ble el % covi	er- % cov	ž (er sno	cover- orkel ction
stable	fluv	/ial	1 ow	moderat	e 60	10	10	1	5
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
***		wink miles	Notes white					***	***
Spawning	data								
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	Year	
***	***			** **					
Fish popu	lation data								_
Density ((no/100 m² si	urface area)					Mount		Eastern
Age 0	Cutthroat Age I Age	e II Age	III+ Age 0	Bull tr Age I	out Age II	Age III+	<u>White</u>	erish	Brk trout
0.1	0.2).6 3.5 surface are	0	0	0	0.3		ent	absent
	Cutthroat			Bull tr	out				
Age 0	Age I Age	<u>e II Age</u>		Age I	Age II	Age III+			
1	1	7 10	9 0	0	0	14			

Table 44. Stream habitat and fish population data for Hay Creek Reach 4.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Hay Creek	004	DAW	1.9	North Fork	Hay Lake	1734	bridge 2 km below Hay Lake	1591

Physical	Habitat data					V-77		
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	<u>c</u> l	Flow haracteristics
2		3.7	.16	7	200	30	tı	umbling/broken
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low <u>flow</u>	Flow dur survey (m³/sec	peak	erage water up(C)	Turbidity	Maximum pool depth(m)
U	Р	1 ow		0.03			low	9.5
% pool	% run	% riffle	% pocket- water	% class I pools	% class II pool		lass % cl	lass % class pools <u>V pools</u>
5	10	56	29	0	14	86		
.,	Ø	% bed mater	ial % boulder	%bedrock	D-90	gradient	Stability rating	Bank form
% fines	%gravel	% rubble		***************************************				
15	30	15	20	20	62	7.6	77	steep
Bank Process	Ba gene mater		Flood plain debris	Channel debris	% stab channe debri	1 % cove		
stable	bed	rock	moderate	moderat	e 30	5	20	16
Water cher	nistry data							
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ SO ₊ (mg/1)
* **	-			Marke Markey			***	

Spawning data

Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year

Fish population data

	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		,					Other	species
Density	<u>(no/100 </u>	m² surface iroat	e area)		Bull t	rout	Mountain Whitefish	Eastern Brk trout	
Age 0	Age I	Age II	Age III+	Age 0	Age I	Age II	Age III+		, ,
1.7 Biomass	0.6 (grams/1	1.1 00 m² surf	2.3 Face area)	0	0	0	0	absent	absent
	Cutth	roat			Bull t	rout		*	
Age 0	Age I	Age II	Age III+	Age 0	Age I	Age II	Age III+		
2	Л	13	72	n	O	n	0		

Table 45. Stream habitat and fish population data for Moran Creek Reach 1.

Stream Name	Reach number	Serial number	Reach <u>Length</u>	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Moran Creek	001	DAZ	7.1	North Fork	7.1 km above junction with Hay	1353	junction with Hay Creek	1070

Observation	المحالف خاصف الماسات	_						
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel <u>width(m</u>)	Valley width(m)	Valley- channel <u>ratio</u>	:	Flow characteristics
3	23.6	4.3	.10	10	70	7		broken/rolling
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low flow	Flow dur survey (m³/sec	/ pe <u>:) t</u>	verage ak water emp(C)	Turbidity	Maximum pool depth(m)
Χ	Р	low	.14	0,19	1		low	1.1
% pcol	% run	% riffle	% pocket- water	% class I pools	% cla II po			class % class pools V pools
2	38	60	0	10	37	5		
% fines	%gravel	<pre>% bed mater % rubble</pre>	ial % boulder	%bedrock	D-90 (cm)	gradient	Stability rating	Bank <u>form</u>
13	50	19	18	0	24	3.9	106	steep
Bank <u>Process</u>	Ba gene <u>mater</u>		Flood plain debris	Channel debris	% st chan deb	nel % cove		
failir	ng flu	vial	low	1 ow	21	0 34	32	14
Water che	mistry data							
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos (mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/l)	Na ⁺ (mg/1)	K ⁺ 50 ₄ (mg/1)
***			volv max	. 100		49.20		think white the same of the sa
Spawning	data							
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>
	***					order steem		
Fish popu	lation data							
Density (no/100 m² su	urface area)					Mount	
Age 0	Cutthroat Age I Age	II Age	II+ Age 0	Bull tr Age I	out Age II	Age III+	<u>White</u>	fish Brk trout
0.6	4.2 grams/100 m ²	9.8 6. 9	0.2	0	0.2	0.6	pres	ent absent
	Cutthroat			Bull tr	out	·		
Age 0	Age I Age	il Age	11+ Age 0	Age I	Age II	Age 111+		
7	28 1	19 21	5 1	0	4	28		

Table 46. Stream habitat and fish population data for Moran Creek Reach 2.

Stream Name	Reach number	Serial number	Reach Length	Tributar of	Upper y reach boundar	<u>Y</u>		Upper elev.(Low rea m) bou			Lower elev.(m)
Moran Creek	002	DA1	1.4	North Fork	8 km junct Hay C	ion	with	1463 1	ju		on with	1353
<u>Physical</u>	Habitat dat	<u>a</u> Ave.	Ave		Ave.			Valley-				
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	dept	for	channel width(m)	Vall width		channel ratio		:	Flow characteri	stics
3		4.9	.2	3	9	2	0	2		tı	umbling,	/swirling
Confine- ment	Pattern	Sid chann occuren	e1	lverage low flow	Flow du surve (m³/sec	,	pea	erage k water mp(C)	Turbic	lity	Maximum pool depth(m	<u>,</u>
С	Р	1 ow	e/		0.08 % class	a,	- clas		low	* ,	1.0	% class
<u>% pool</u>	<u>% run</u>	% riffle		ocket- ater	1 pools		I poo		pools		pools	V pools
5	19	66 % bed mat	Tetan	10	0	n_	90	10 %)() Stabi	1i+u	0	0 ank
% fines	%grave1	% rubbl		oulder	%bedrock		<u>m)</u>	gradient		ing	_	orm
35	40	12		12	1	32	2	7.6	74	ļ	rep	ose
Bank Process		ank etic rial	Flood plain debri	l	Channel debris		% sta chann debr	el % cov		% coverna	er sno	cover- orkel ction
stable Water chem	flu mistry data	vial	low		moderat	e	60	33		27	1	.8
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbo (mg/l	n .	Total phos. mg/l)	No ₃ - (mg/1)	Ca (mg)		Mg ⁺⁺ (mg/1)	N. <u>(m</u>	a ⁺ 9/1 }	κ ⁺ (<u>mg/1)</u>	50 ₄ (mg/1)
					-		•					
Spawning	<u>da ta</u>											
Number of bull trou redds in reach		ty	bull redd	er of trout is in each	Redd density (no/km)	<u>Ye</u>	ar	Number of bull trout redds in reach	Red densi (no/k	ty	Year	
									-	_		
	lation data										Other spa	ries
Density (no/100 m² s		<u>a</u>)		Bull tr	out				Mount White	ain	Eastern Brk trout
Age 0		e II Ag	e III+	Age 0	Age I	Age	11	Age III+		75.77 QC		
O Biomass (0 0 grams/100 m		.6 area)	0	. 0	0		0		abse	nt	absent
Age 0	Cutthroat Age I Ag		e III+	Age 0	Bull tr Age I	out Age	<u> </u>	Age III+				
0	0	6	112	0	0	0		0				

Table 47. Stream habitat and fish population data for Moran Creek Reach 3.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Moran Creek	003	DA2	1.8	North Fork	dry area below cascade	1561	8 km above junction with Hay Creek	1463

Physical	Habitat dat	<u>a</u>							
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel <u>ratio</u>		Flow character	<u>istics</u>
3		4.6	.22	9	100	11	į	broken/	rolling
Confine-		Side channel	Average low	Flow du surve		verage ak water		Maximum pool	n
ment	<u>Pattern</u>	occurence		(m³/se	<u>c) t</u>	emp(C)	Turbidity	depth(r	<u>n)</u>
U	Р	low		0.05			low	0.9	
% pool	% run	% riffle	% pocket- water	% class I pools	% cla 11 po			class / pools	% class V pools
7	60	27	6	0	8	26	5 (56	0
% fines	%grave!	% bed mater % rubble	ial % boulder	%bedrock	D-90 (cm)	gradient	Stability rating		lank 'orm
27	43	20	10	0	26	5.5	97	unc	 lercut
	8a	ink	Flood		% sta	able		ay o	cover-
Bank Process	gene mater		plain debris	Channel debris	cham debi			er sn	orkel ction
failing	***************************************	,,,,,	low	moderat			27 27		17
•									
	mistry data	·							
Cond. (umohs/	Alk.	Total carbon	Total phos.	No ₃ "	Ca ⁺⁺	Mg ⁺⁺	Na ⁺	κ+	SO ₄
cm)	(<u>mg/1)</u>	(mg/1)	<u>(mg/1)</u>	(mg/1)	(mg/1)	(mg/1)	<u>(mg/l)</u>	(<u>mg/1)</u>	<u>(mg/1)</u>
			-	***	***			***	
Spawning	<u>data</u>								
Number of			Number of			Number of			
bull trou			bull trout redds in	Redd		bull trout	Redd		
redds in reach	densit (no/km		reach	density (no/km)	Year	redds inreach_	density (no/km)	Year	
	HOTEL APPEAL					***			
Fish popu	lation data								
Density (no/100 m² su	rface area)					Mount	Other spe	ecies Eastern
Aco A	Cutthroat	II Age	III+ Age 0	Bull tr		Age III+	White	fish	8rk trout
Age 0 /	<u>Age I Age</u> O O.			Age I O	Age II O	0	abs	ent	absent
	grams/100 m²			-					
	Cutthroat			Bull tr					
Age 0 /	Age I Age	II Age	11+ <u>Age 0</u>	Age I	Age II	Age III+			

Table 48. Stream habitat and fish population data for Moran Creek Reach 4.

Stream Name	Reach number	Serial number	Reach <u>Length</u>	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach Lower boundary elev.(m)
Moran Creek	004	DA3	1.0	North Fork	upper falls	1658	dry area below 1561 upper cascade

Physical Stream order	Habitat dat. Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio		Flow characteri	stics
2		4.2	.13	7	70	. 9		broken/1	tumbling
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low flow	Flow dur survey (m³/sec	/ pe	verage ak water emp(C)	Turbidity	Maximum pool depth(m	<u> </u>
F	Р	7 ow	1	0.09			low	0.3	
<u>% pool</u>	% run	% riffle	% pocket- water	% class I pools	% cla II po			class pools	% class V pools
5	0,	68 % bed mater	27	0	0 D-90	1C)	0
% fines	%grave1	% rubble	% boulder	%bedrock	(cm)	gradient	Stability rating		nk rm
10	30	30	30	0	40	8.5	63	st	еер
Bank Process	Ba gene mater		Flood plain debris	Channel debris	% sta chana deba	nel % cov		er sno	over- rkel tion
R	flu	vial	low	Tow	70) 10	0		0
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/1)	Total phos. (mg/l)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	κ ⁺ (<u>mg/l)</u>	SO. (mg/1)
	***	·	interior enterior	*** ****	***			200 400	
Spawning	da ta								
Number of bull trou redds in reach		y	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
								** ***	
Fish popu	lation data								
Density (no/100 m² su	rface area)					Mount	Other spec ain	<u> Eastern</u>
Age 0	<u>Cutthroat</u> Age I Age	II Age	II+ Age O	Bull tro	out Age II	Age III+	<u>White</u>	fish	Brk trout
0	0 (0	0	0	0	abse	nt	absent
Biomass (grams/100 m²	surface are	<u>a</u>)						
Age 0	<u>Cutthroat</u> Age I Age	II Age I	II+ Age 0	Bull tro	out Age II	Age III+			
0	0 (0	0	0	0	0			

BOWMAN CREEK DRAINAGE

BOWMAN CREEK REACH I

Channel Characteristics: Date surveyed: 8-12-80 (Figure 20)

This reach is a third order tributary to the North Fork. Average wetted width was 13.9 m and the average depth was 39.3 cm. The reach contained 50% run and 50% riffle. There was a low to moderate amount of debris with 40% stability and very little bank cover. Instream cover was moderate. The channel gradient was 1.7% and the D-90 was 49 cm. The creek originated from Bowman Lake 9.7 km above the mouth.

Valley Characteristics:

The upper bank slope gradient was 30-40% with a valley to channel ratio of 3:1. The average valley width was 75 m. The channel was occasionally confined and had a sinuous pattern.

Fish Populations: (Figure 21)

Cutthroat trout and mountain whitefish were present in this reach. Juvenile and adult fish of both species were observed. A density of 11.2 cutthroat per 100 m² indicated an important rearing area.

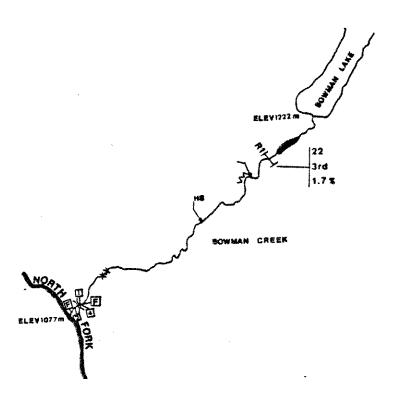


Figure 20. Location of physical habitat parameters by reach for Bowman Creek.

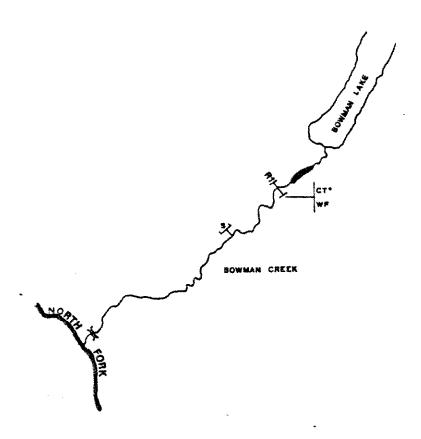


Figure 21. Fish population information by reach for Bowman Creek.

Table 49. Stream habitat and fish population data for Bowman Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach bounda <i>ry</i>	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Bowman Creek	001	DB3	8.2	North Fork	Bowman Lake	1222	mouth	1077

	·								
Physical	Habitat dat	a							
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel <u>width(m</u>)	Valley width(m)	Valley- channel <u>ratio</u>		Flo characte	
3	177.9	13.0	.39	22	75	3		broken	rolling
Confine- ment	Pattern	Side channel occurence	Average low <u>flow</u>	Flow du surve (m³/se	y pe	iverage ak water emp(C)	Turbidity	Maxim poo depth	1 .
Χ	N	modera		1.89		21	Tow	1.3	
% pool	% run	% riffle	% pocket- water	% class I pools	% cla II po			% class (V pools	% class V pools
0	57	43	0	0	0	0		0	100
% fines	%gravel	% bed mater % rubble	ial % boulder	%bedrock	D-90 (cm)	% gradient	Stability rating		Bank form
20	30	30	20	0	49	1.7	96	-	repose
	R	ank	Flood		% c+	able			cover-
Bank Process		etic	plain debris	Channel debris	chan deb	nel % cov		ver s	norkel ection
failin	g flu	vial r	noderate	low	40	3	;	3	24
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	**g ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1</u>	SO. (mg/l)
122	68	0.89	.004	0.02	21.0	.057	0.8		0.8
Spawning	<u>da ta</u>								
Number of bull trou redds in <u>reach</u>		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
							**	***	
Fish popu	lation data								
Density (no/100 m² su	urface area)					Mour	Other s ntain	pecies Eastern
Age 0	<u>Cutthroat</u> Age I Age	e II Age	III+ Age 0	Bull tr Age I	out Age II	Age III+		tefish	3rk trout
		.1 11.		0	0	0	pre	sent	absent
<u>Biomass (</u>	grams/100 m²	surface are	<u>:a</u>)	100	-				
Age 0	<u>Cutthroat</u> Age I Age	e II Age I	II+ Age 0	Bull tr Age I	out Age II	Age III+			
0				***************************************		***************************************			
U	1	1 34	13 0	0	0	0			

AKOKALA CREEK DRAINAGE

AKOKALA CREEK REACH I

<u>Channel Characteristics</u>: Date surveyed: 8-19-80 (Figure 22)

Akokala Creek Reach I is a fourth order tributary in the North Fork drainage. Average wetted width was 10.5 m and the average depth was 33 cm. Reach I consisted of 70% run, 25% riffle, 3% pocketwater and 2% pool. Channel debris was low and 40% was stable. Vegetation provided only slight bank cover while instream cover was moderate. Stream gradient was 1.4% and the D-90 was 25 cm. A marsh area partially created by beaver dams occurred 1 km below the upper end of this reach and extended 2 km downstream. The creek divided into two separate channels in this area. A major slump zone was present in the middle of this reach.

Valley Characteristics:

The upper bank slope gradient was less than 30% and the valley to channel ratio was 5:1. The average valley width was 100 m. Reach I was occasionally confined and had an irregular meandering pattern.

Fish Populations: (Figure 23)

Westslope cutthroat, mountain whitefish and sculpins were observed in this reach. Migratory and resident westslope cutthroat trout were present. The presence of whitefish fry indicated this area was used for spawning.

AKOKALA CREEK REACH II

Channel Characteristics: Date surveyed: 8-19-80 (Figure 22)

Akokala Creek Reach II is a second order tributary in the North Fork drainage. Average wetted width was 10 m and the average depth was 33 cm. Reach II consisted of 56% run, 43% riffle and 1% pocketwater. Channel debris was low and 20% was stable. Bank cover was low and instream cover was moderate. Stream gradient was 2.9% and the D-90 was 35 cm. A major slump zone was present 1 km above the lower end of this reach.

Valley Characteristics:

The upper bank slope was less than 30% and the valley to channel ratio was 6:1. The average valley width was 100 m. Reach II was occasionally confined and had a sinuous pattern.

<u>Fish Populations</u>: (Figure 23)

Westslope cutthroat trout, mountain whitefish and sculpins were observed in Reach II. Migratory and resident westslope cutthroat trout were present.

Parke Creek Reach I

<u>Channel Characteristics</u>: Date surveyed: 8-20-80 (Figure 22)

Parke Creek Reach I is a third order tributary in the Akokala Creek drainage. Average wetted width was 5.7 m, and the average depth was 14 cm. Reach I was comprised of 52% riffle, 33% run, 15% pocketwater, and a trace of pools. Channel debris was moderate with 40% stable material. Vegetation provided only slight bank cover while instream cover was moderate. Stream gradient was 4.9% and the D-90 was 57 cm. A major slump zone was present one kilometer below the head of this reach and two areas of debris accumulation appeared just below the slump zone.

Valley Characteristics:

The upper bank slope gradient was 30% and the valley to channel ratio was 6:1. The average valley width was 80 m. Reach I was occasionally confined and had a sinuous pattern.

Fish Populations: (Figure 23)

Westslope cutthroat trout and sculpins were observed in this reach.

Parke Creek Reach II

Channel Characteristics: Date surveyed: 8-20-80 (Figure 22)

Parke Creek Reach II is a third order tributary in the Akokala Creek drainage. Average wetted width was 5.6 m and the average depth was 31 cm. Reach II was composed of 50% riffle, 40% run, and 10% pocketwater. Channel debris was moderate and 30% was stable. Bank cover was high and instream cover was moderate. Stream gradient was 4.9% and the D-90 was 12 cm. The lower 1-2 km of Reach II was a marsh area.

Valley Characteristics:

The upper bank slope gradient was 30% and the valley to channel ratio was 12:1. The average valley width was 120 m. Reach II was occasionally confined and had an irregular meandering pattern.

<u>Fish Populations:</u> (Figure 23)

Westslope cutthroat trout and sculpins were observed in this reach.

Longbow Creek Reach I

Channel Characteristics: Date surveyed: 8-20-80 (Figure 22)

Reach I of Longbow Creek is a second order tributary in the Akokala Creek

drainage with an average wetted width of $5.1\,\mathrm{m}$ and an average depth of $23.5\,\mathrm{cm}$. This reach contained 44% run, 50% riffle, 6% pocketwater and no pools. There was a low to moderate amount of debris with 30% being stable. Low amounts of instream cover and moderate amounts of bank cover were present. The channel gradient was steep (12.3%) and the D-90 was $70.5\,\mathrm{cm}$.

Valley Characteristics:

The upper bank slope gradient was less than 30% and the valley to channel ratio was 15:1. The average valley width was 100 m.

Fish Populations: (Figure 23)

Adult and juvenile cutthroat trout were observed in this reach in moderate densities.

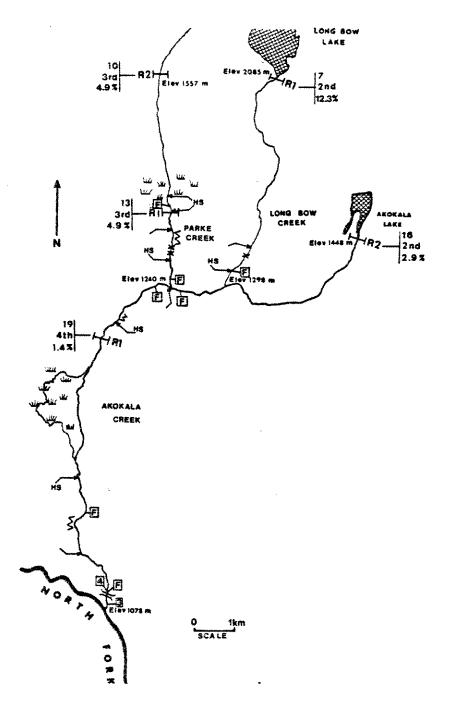


Figure 22. Location of physical habitat parameters by reach for the Akokala Creek drainage.

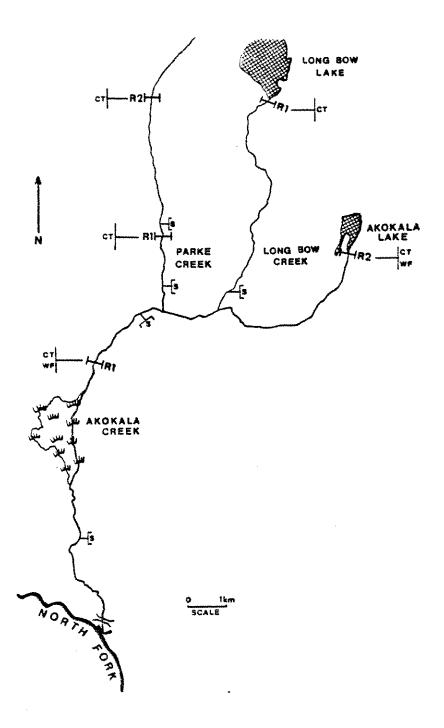


Figure 23. Fish population information by reach for the Akokala Creek drainage.

Table 50. Stream habitat and fish population data for Akokala Creek Reach 1.

lable (. Ju	cam nap	icue c	ina er.	an babai	acion a	iaca (oj A	κοκαια τ	A CCK IN	each 1.
Stream Name	Reach number	Serial number	Reach Length	Tributar of	Upper y reach boundar	1	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Akokala Creek	001	DBG	8.0	North Fork	2.6 km mouth Creek	ı below Parke	1193	mouth		1078
Physical I	Habitat data	<u>a</u>								
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave depth <u>reac</u>	for	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	<u> </u>	Flow haracteri	<u>stics</u>
4	120.1	10.4	. 3	3	19	100	5		rolli	ina
Confine- ment	<u>Pattern</u>	Sid chann <u>occuren</u>	el	verage low flow	Flow dur survey (m³/sec	pea	rerage ik water ump(C) I	urbidity	Maximum pool depth(m	J
X	С	moder	ate 0	.28 ocket-	1.30 g class	% clas		oderate	1.3	% class
% pool	% run	% riffle	W	ater	<u>I pools</u>	II poo			pools	<u>V pools</u>
2	70	25	3		20	20 D-90	0 ۶	6 Stability		0 ank
% fines	%gravel	<pre>% bed mat % rubbl</pre>		oulder	%bedrock	(cm)	gradient	rating		orm
30	30	30	1	0	0	25	1.4	97	re	pose
Bank Process		ank etic rial	Flood plain debri		Channel debris	% sta chann debr	el % cover		r sno	cover- orkel ction
failing	ı flı	uvial	moder	ate	1ow	40	10	10		21
•	nistry data									
Cond.		Total		Total		++	++	+	K ⁺	
(umohs/ cm)	Alk. (mg/l)	carbo (mg/l		phos. mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/l)	Na ⁺ (mg/l)	K (<u>mg/1)</u>	SO. (mg/1)
65	47	1.0	2.	010		13.8	.037	1.2	***	0.7
Spawning	data		,							0.,
Number of bull trou redds in reach		ty	bull redd	er of trout s in ach	Redd density (no/km)	Year	Number of bull trout redds in <u>reach</u>	Redd density (no/km)	Year	
7072 AVE			***				***	~ **	~ ~	
Fish popu	lation data									
Density (no/100 m² s	urface are	<u>a</u>)					Mount		<u>Eastern</u>
Age 0	<u>Cutthroat</u> Age I Ag		e III+	Age 0	Bull tr Age I	out Age II	Age III+	White	fish	Brk trout
0.6		0.1	1.3	0	0	0	0	pres	ent	absent
Age 0	-Cutthroat Age I Ag	e II Ad	e III+	Age 0	Bull tr Age I	out Age II	Age III+			

Table 51. Stream habitat and fish population data for Akokala Creek Reach 2.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Akokala Creek	002	DBH	8.8	North Fork	Akokala Lake	1448	2.6 km below mouth Parke Creek	1193

Physical Stream order	Habitat dat Drainage <u>area(km²)</u>	a Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio		Flow characteri	stics
2		9.8	.33	16	100	7		braken _a i	colling
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low flow	Flow dur survey (m³/sec	/ pea	verage ak water emp(C)	Turbidity	Maximum pool depth(m	
Χ	N	high		1.06			low	1.3	w 1
% pool	% run	% riffle	% pocket- water	% class I pools	% clas	ss 3c ols III		class / pools	% class V pools
0	56	43	1	7	36	-	0	7	0
% fines	%gravel	% bed mater % rubble	ial % boulder	%bedrock	D-90 (cm)	% gradient	Stability rating		ank orm
20	40	30	10	0	35	2.9	90	****	the desired and the second and the s
Bank Process	Ba	ank etic	Flood plain debris	Channel <u>debris</u>	% sta chanr <u>debr</u>	able nel % cov	er- % cov	er sn	pose cover- orkel ction
failing	fluv	rial	low	low	20	3	3	1	7
Water che	mistry data						•	•	•
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/1)	Total phos. (mg/l)	No 3 - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	κ ⁺ (<u>mg/l)</u>	\$0 ₄ (mg/1)
	- -					-100 May	***		
Spawning	data							/	
Number of bull trou redds in reach	t Redi densi (no/kr	ty	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
** ***						400. 445			
Fish popu	lation data								
Density (no/100 m² si	urface area)					Moun	Other spe tain	Eastern
Age 0	<u>Cutthroat</u> Age I Age	≘II Age	III+ Age O	Bull tr Age I	out Age II	Age III+	Whit	<u>efish</u>	Brk trout
	0.7 1.			0	0	0	pre:	sent	absent
Biomass (surface are		···	-	•	•		_
Age 0	Cutthroat Age I Age	e II Age	III+ Age 0	Bull tr Age I	out Age II	Age III+			
· · · · · · · · · · · · · · · · · · ·					,,,q-	: (-d/* TTT.			

Table 52. Stream habitat and fish population data for Parke Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Tribut Length of	*	<u> </u>	Upper elev.(m	Lower reach boundary	Lower elev.(m)
Parke Creek	001	DBJ	1.8 North Fork	n 2 km u from m		1329	mouth	1240
				•				
Stream order	Habitat dat Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	<u>c</u>	Flow haracteristics
3		5.7	.14	13	80	6	ric	lling/broken
Confine- ment	Pattern	Sid channo occuren	el low	Flow dur survey (m³/sec	/ pe	verage ak water emp(C)	Turbidity	Maximum pool depth(m)
Х	N	low	26	0.21		1 =	low	0.8
% pocl	% run	% riffle	<pre># pocket- water</pre>	% class <u>I pools</u>	% cla Ii po			lass % class pools V pools
1	33	-51	15	0	11	. 33	5	6 0
% fines	%grave1	% bed mate % rubble		%bedrock	D-90 (cm)	g gradient	Stability rating	Bank form
20	40	30	10	0	57	4.9	98	repose
Bank Process	Ba gene mater		Flood plain debris	Channel debris	% st chan deb	nel % cover		
failing	flu\	/ial	moderate	moderate	e 40	10	10	19
Water chem	nistry data							
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbor (mg/l)		No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K ⁺ SO ₄ (<u>mg/1)</u> (<u>mg/1)</u>
						 -		
Spawning e	<u>da ta</u>							
Number of bull trout redds in reach	t Redo densii (no/kn	ty	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year
*** ****	***		***					
Fish popu	lation data							
	no/100 m² su Cutthroat Age I Age		1) : III+ Age O	Bull tr	out Age II	Age III+	Mounta Whitef	
	.9 2.			0	0	0	abser	ıt absent
Biomass (grams/100 m²	surface a	rea)					
Age 0 /	<u>Cutthroat</u> Age I Age	e II Age	III+ Age O	Bull tro	out Age II	Age III+		
<u> </u>	·z· · nge			1.9E 1	-134- 11	-35-111		

0

0

13

26

100

Table 53. Stream habitat and fish population data for Parke Creek Reach 2.

Stream Name	Reach number	Serial number	Reach Length	Tributar of	Upper y reach boundar	у	Upper elev.(Lower reach m) boundary		Lower elev.(m)
Parke Creek	002	DBY	4.6	North Fork	7 km mouth	up from	1557	2 km up mouth) from	1329
<u>Physical</u>	Habitat dat				4		V=3.2 == .			
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth reach	for o	Ave. channel <u>vidth(m</u>)	Valley width(m)	Valley- channel ratio	<u> </u>	Flow haracteri	stics
3		5.6	.31		10	120	12	F	lacid/r	rolling
Confine- ment	Pattern	Side channe occurence	: 1	erage low low	Flow dun survey (m³/sec	y pea	rerage k water mp(C)	Turbidity	Maximum pool depth(m)	
X	С	low			0.29		· · · ·	low	0.8	av
<u>% pool</u>	% run	% riffle		cket- iter	% class I pools	% clas			lass pools	% class V pools
0	40	50		0	0	0	*	0	100	0
% fines	%grave1	% bed mate % rubble		oulder	%bedrock	D-90 (cm)	% gradient	Stability <u>rating</u>		ink orm
40	40	19	1		0	12	4.9	82	rep	ose
Bank Process		ank etic rial	Flood plain debris	L.	Channel debris	% sta chann debr	el % cov		r sno	over- orkel otion
failing	fluv	ial	moder	ate	moderat	te 30	30	20	2	:0
Water chem	nistry data									
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbor (mg/l)	ı p	otal hos. g/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (ng/1)	Na ⁺ (mg/1)	K ⁺ (mg/1)	SO ₄ (mg/1)
			_	-						
Spawning o	data									
Number of bull trout redds in reach	Redo densi (no/kr	ty	Numbe bull redds rea	trout in	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year	
भीर सम्ब								200 -444		
Fish popu	lation data								Other spe	ciec
Density (r	no/100 m² su	urface area	_)		Bull tr	ant.		Mount White	ain	Eastern Brk trout
2.1	Cutthroat Age I Age 1.2 2. Orams/100 m ²	$\overline{1}$ $\overline{1}$.7 rea)	Age 0 O	Age I	Age II O	Age III+ O	abse		absent
Age 0 /	Cutthroat Age I Age		3	Age 0	Bull tr Age I	Age II	Age III+			

Table 54. Stream habitat and fish population data for Long Bow Creek Reach 1.

Stream <u>Name</u>	Reach <u>number</u>		Reach Tribut Length of	•	<u>ry</u>	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Long Bow Creek	001	DBI	6.4 Nor		Bow Lak	e 2085	mouth	1298
Physical	Habitat dat		_					
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	cha	Flow Taracteristics
2	· Marie	5.1	.24	7	100	15	rol	ling/broken
Confine- ment	Pattern	Side channe occurenc	I low	Flow du surve <u>(m³/se</u>	y pea	verage ik water emp(C) <u>T</u>	urbidity	Maximum pool depth(m)
Χ	N	1ow	z pocket-	0.21 % class			1 🗸 11	1.0
<u>% pool</u> 0	<u>% run</u> 48	% riffle 48	water 4	i pools				ools V pools
% fines	%gravel	% bed mate % rubble	rial	%bedrock	0-90		Stability rating	Bank form
20	40	30	10	0	71	12.3	105	repose
Bank Process	Ba gene mater		Flood plain debris	Channel _debris	% sta chann _debr	el % cover-	- % cover overhang	% cover- snorkel section
failing	fluv	ial .	moderate	moderat	e 30	20	10	10
Water che	mistry data							
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)		No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ SO ₄ (mg/1)
			446.			***	***	man san
Spawning	data							
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	Year		Redd Hensity no/km Ye	ear_
			-					
Fish popu	lation data						Λ-	they encoing
Density (no/100 m² su Cutthroat	ırface area)	Bull tr			Mountair Whitefis	
	Age I Age		111+ Age 0	Age I	Age II	Age III+		
	.3 2. grams/100 m²			0	0	0	absent	absent
	Cutthroat		TYT. 8	Bull tr		A 777		
			111+ Age 0		Age II	Age III+		
0	2	31 1	.18 0	0	0	0		

RED MEADOW CREEK DRAINAGE

RED MEADOW CREEK REACH I

Channel Characteristics: Date surveyed: 8-8-79 (Figure 24)

Red Meadow Creek Reach I is a third order tributary in the North Fork drainage. Average wetted width was 7.5 m and the average depth was 29 cm. Reach I was composed of 60% riffle, 30% run, 8% pocketwater and 2% pool. Channel debris was moderate and 43% was stable. Vegetation provided abundant bank cover and instream cover was moderate. Stream gradient was 2.2% and the D-90 was 47 cm. Two major slump zones occurred below the mouth of the south fork of Red Meadow Creek.

Valley Characteristics:

The upper bank slope gradient was less than 30% and the valley to channel ratio was 10:1. The average valley width was 100 m. Reach I was occasionally confined and had an irregular to sinuous pattern.

Fish Populations: (Figure 25)

A great variety of game fish species were present in Reach I including westslope cutthroat, yellowstone cutthroat, bull trout, arctic grayling, mountain whitefish and sculpins. Density estimates of 11.2 age I or older westslope cutthroat per $100~\text{m}^2$ surface area indicated an important rearing area. Juvenile bull trout also utilized the area for rearing and migratory adults of both species annually migrate through to upstream spawning areas.

RED MEADOW CREEK REACH II

Channel Characteristics: Date surveyed: 8-8-79 (Figure 24)

Red Meadow Creek Reach II is a third order tributary in the North Fork drainage. Average wetted width was 6 m and the average depth was 22 cm. Reach II consisted of 60% run, 20% riffle, 12% pocketwater and 8% pool. Channel debris was moderate with 20% stability. Bank cover and instream cover were both moderate. Stream gradient was 0.9% and the D-90 was 41 cm.

Valley Characteristics:

The upper bank slope gradient was less than 30% and the valley to channel ratio was 8:1. The average valley width was 75 m. Reach II was occasionally to frequently confined and its pattern was irregular.

Fish Populations: (Figure 25)

Species observed included bull trout, westslope cutthroat, yellowstone cutthroat, arctic grayling, mountain whitefish and sculpins. Density estimates indicated an important rearing area for both migratory and resident westslope cutthroat and bull trout with 14.8 and 6.1 age I or older fish per 100 m² surface area, respectively. Spawning by migratory bull trout was documented with an average of nine redds enumerated annually during three years of survey.

RED MEADOW CREEK REACH III

Channel Characteristics: Date surveyed: 8-8-79 (Figure 24)

Red Meadow Creek Reach III is a second order tributary in the North Fork drainage. Average wetted width was 3.5 m and the average depth was 16 cm. Reach III was comprised of 50% pocketwater, 20% run, 15% riffle and 15% pool. Channel debris was low and 20% was stable. Bank and instream cover were both moderate. Stream gradient was 7.6% and the D-90 was 50 cm. Areas of chutes and cascades were observed.

Valley Characteristics:

The upper bank slope gradient was 30-50% and the valley to channel ratio was 2:1. The average valley width was 15 m. Reach III was frequently confined and had an irregular pattern.

Fish Populations: (Figure 25)

A variety of game fish species were present in Reach III including bull trout, westslope cutthroat trout, yellowstone cutthroat trout, arctic grayling and mountain whitefish. The arctic grayling and yellowstone cutthroat trout observed resulted from downstream movement out of Red Meadow Lake. The lower third was an important rearing area for bull trout, with densities of 4.2 age I or older fish per 100 m² surface area. Cascades 15 m high and 10 m long created a partial fish migration barrier just above the mid-point of this reach.

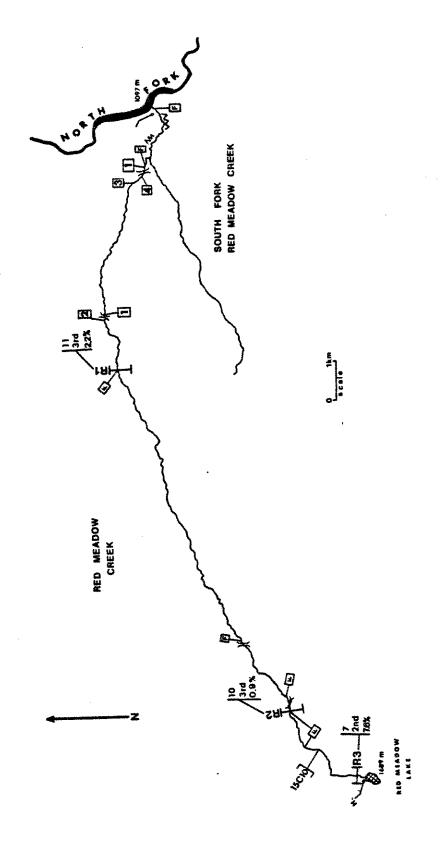


Figure 24. Location of physical habitat parameters by reach for Red Meadow Creek.

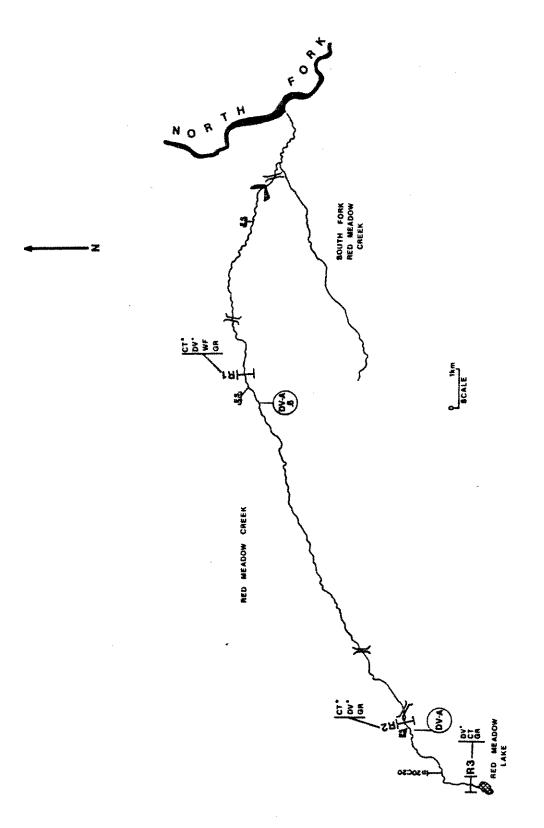


Figure 25. Fish population information by reach for Red Meadow Creek.

Table 55. Stream habitat and fish population data for Red Meadow Creek Reach 1.

Stream Name	Reach <u>number</u>	Serial number	Reach Length	Tributar of	y reach boundar	<u>y</u>	Upper elev.(m)	reach boundary	······································	Lower elev.(m)
Red Meadow Creek	001	DCJ	7.7	North Fork		above 2n e across		mouth		1097
<u>Physical</u>	Habitat dat	<u>a</u> Ave.	Av	2,	Ave.		Valley-			
Stream <u>order</u>	Drainage area(km²)	wetted width(m)			channel vidth(m)	Valley width(m)	channel ratio	<u>.</u>	Flow characteris	stics
3	76.8	7.5	.29	1	1	108	10	t	roken/r	olling
Confine- ment	Pattern	Sid chann occuren	e i	Average low flow	Flow dur survey (m³/sec	, pea	erage k water mp(C)	Turbidity	Maximum pool depth(m)	
Х	P	low	9 /2 1	.47 pocket-	0.47 % class	′ 1! % clas		low ass % o	1.2	% class
% pool	% run	% riffle		water_	<u>I pools</u>	II poo	ls III p	ools IV	pools	V pools
10	30	60 % bed mat		0 ooulder	1 %bedrock	D-90 /cm)	14 gradient	Stability rating		nk rm
<u>% fines</u> 20	<u>%gravel</u> 30	<u>% rubbl</u> 25		25	0	<u>(cm)</u> 47	2.2	85		 epose
Bank Process		ank etic <u>ria</u> l	Floo plai debr	T .	Channel debris	% stal channe debr	el % cove	r- % cove	% c er sno	over- rkel tion
failing	fluy	ial	1 ow	mo	derate	43	20	30	20	כ
Water che	mistry data									
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbo (mg/l	n	Total phos. (mg/1)	No, - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	κ ⁺ (<u>mg/l)</u>	SO. (mg/l)
132	79	0.98		005	0.01	23.5	.061	0.9	***** *****	0.9
Spawning	data						·			
Number of bull trou redds in reach		ty	bul red	per of l trout ds in each	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
0	0	80	(כ	0	78	·			
Fish popu	ulation data								Other spe	rior
<u>Density</u>	(no/100 m ² s		<u>a</u>)		D11 +m	out.		Mount White	ain	Eastern Brk trout
Age 0 4.5		e II Ac	<u>e 111+</u> .5	Age 0 O	Bull tr Age I O	Age II 0.4	Age III+ O			absent
Biomass	(grams/100 m	² surface	area)		<u>.</u>	•				
Age 0	Cutthroat Age I Ag		e III+	Age 0	Bull tr Age I	Age II	Age III+			•
5	54	34	16	0	0	9	0			

Table 56. Stream habitat and fish population data for Red Meadow Creek Reach 2.

Stream Name	Reach number	Serial number		Upper outary reach of bounda	ry	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Red Meadow Creek	002	DCL	19.0 Not	rth .6 km rk Link L	below .ake fork		1 km abov 2nd bridg across RM	ge
Physical	Habitat dat	<u>a</u> Ave.	Ave.	Ave.		Valley-		
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio	cha	Flow racteristics
3	****	6.0	.22	10	73	7	•	cid/swirling
Confine- ment	Pattern	Sid channo occuren	el low	ge Flow di surve <u>(m³/se</u>	ey pea	erage k water mp(C)		Maximum pool depth(m)
Χ	Р	modera	te	 t- % class	s % clas	_ s %cla	low iss % cla:	1.4
% pool	% run	% riffle	water	I pools	s II poo	ls III po	ools IV poo	ols V pools
10	60	20 % bed mate	10 erial	4	10 p-90	23	63 Stability	O Bank
% fines	%gravel	% rubble			· ·	gradient	rating	form
30	40	15	14	1	41		92	steep
Bank Process	Ba gene <u>mater</u>		Flood plain <u>debris</u>	Channel debris	% sta chann debr	el % cover	and the second s	% cover- snorkel section
failing	fluv	ial	moderate	modera	te 20	10	20	20
Water che	mistry data		•					
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbor (mg/l)		No ₃ "	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K [†] SO ₄ (<u>mg/l) (mg/l)</u>

Spawning	data							
Number of bull trou redds in reach	t Redo densit (no/km	ty	Number of bull trou redds in reach			Number of bull trout redds in reach	Redd density (no/km) Ye	ar
	lation data	00	tus.	0.4	. 3	23		
	no/100 m² su	ırface area	<u>.</u>)					her species
***	Cutthroat			Bull t	rout Age II	Age III+	Mountain Whitefis	
			.7 Age		4.4	1.6	presen	t absent
Biomass (grams/100 m²	' surface a	<u>irea</u>)					
Age 0	<u>Cutthroat</u> Age I Age	e II Age	: 111+ Age	Bull t	rout Age II	Age III+		•
0	7	4 3	02 0	10	96	74		

Table 57. Stream habitat and fish population data for Red Meadow Creek Reach 3.

Stream Name	Reach number		Reach Length	Tributar of	Upper ry reach boundar	<u>y</u>	Upper elev.(Lower reach m) bounda	iry	Lower elev.(m)
Red Meadow Creek	003	DCI :	3.2	North Fork	Red Me Lake	adow	1689		km below k Lake for	1450.8 rk
Physical Stream order	Habitat data Drainage area(km²)	Ave. wetted width(m)	Ave depth _reac	for	Ave. channel width(m)	Valley width(m)	Valley- channel ratio		Flow characteri	<u>stics</u>
2		3.5	.16		7	15	2		tumblin	ng
Confine- ment	Pattern	Side channe occurenc	1	verage low flow	Flow dur survey (m³/sec	, pe	verage ak water emp(C)	Turbidit	Maximum pool y depth(m	
F	Р	1 ow	% n:	 ocket-	0U26 % class	_ % c1a	 ss %c	l OW	1.3 % class	% class
% pool	% run	🕉 riffle	W	ater	I pools	II po	ols III	pools	IV pools	V pools
10	20	20	5	0	0	0	10		90	0
% fines	%gravel	% bed mate % rubble		oulder	%bedrock	D-90 (cm)	gradient	Stabili ratin		ank orm
10	20	20	2	0	30	50	7.6	74	rep	ose
Bank <u>Process</u>	Ba gene mater		Flood plain debri	<u>s</u>	Channel debris	% st chan deb			cover sn	cover- orkel ction
stable	bedi	rock	nil		low	20	30	2	0 2	0
Water che	mistry data									
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)		Total phos. ng/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1	κ ⁺ <u>(mg/l)</u>	SO ₄ (mg/l)
***			-	-				-	*** ***	***
Spawning	da ta									
Number of bull trou redds in reach		ty	bull redd:	er of trout in ich	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	Year	
			-							
Fish popu	lation data									
Density (no/100 m² si	ırface area)					Мо	Other spe	<u>cies</u> Eastern
Age 0	<u>Cutthroat</u> Age I Age	e II Age	111+	Age 0	Bull tr Age I	out Age II	Age III+	Wh	itefish	Brk trout
0	O grams/100 m		.4 rea)	0	0	3.4	0.8	al	bsent	absent
Age 0	<u>Cutthroat</u> Age I Âge	e II Age	111+	Age 0	Bull tr Age I	out Age II	Age III+			
0	0 1	14 10	6	0	0	74	37			

MOOSE CREEK DRAINAGE

MOOSE CREEK REACH I

Channel Characteristics: Date surveyed: 7-26-80 (Figure 26)

Moose Creek Reach I is a third order tributary in the North Fork drainage. Average wetted width was 4.8 m and the average depth was 24 cm. Reach I consisted of 50% run, 43% riffle, 5% pool and 2% pocketwater. Channel debris was low with 30% being stable. Vegetation provided high bank cover and instream cover was moderate. Stream gradient was 2.7%. and the D-90 was 32 cm. A major slump zone occurred in the middle of the reach and beaver activity was observed near the lower end.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 7:1. The average valley width was 75 cm. Reach I was occasionally confined and had an irregular meandering pattern.

Fish Populations: (Figure 27)

Bull trout, westslope cutthroat trout and sculpins were observed. Juvenile bull trout were present although no bull trout spawning has been documented here. Beaver dams near the mouth may impede bull trout migration during low summer flows. Migratory and resident populations of cutthroat were present and densities of 10.8 Age I or older fish per $100~\text{m}^2$ surface area indicated an important rearing area.

MOOSE CREEK REACH II

Channel Characteristics: Date surveyed: 7-26-80 (Figure 26)

Moose Creek Reach II is a second order tributary in the North Fork drainage. Averaged wetted width was 5.8 m and the average depth was 27 cm. Reach II was comprised of 60% riffle, 37% run and 3% pool. Channel debris was low with 70% being stable. Bank cover and instream cover were both moderate. Stream gradient was 3.5 % and the D-90 was 26 cm. A major slump zone occurred in the middle of this reach.

Valley Characteristics:

The upper bank slope gradient was less than 30% and the valley to channel ratio was 40:1. The average valley width was 400 m. Reach II was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 27)

Westslope cutthroat trout were observed in this reach. This area provided important cutthroat trout rearing habitat with densities of 27.4 age I or older fish per 100 m^2 surface area.

MOOSE CREEK REACH III

Channel Characteristics: Date surveyed: 7-27-80 (Figure 26)

Moose Creek Reach III is a second order tributary in the North Fork drainage. Average wetted width was 1.7 m and the average depth was 27 cm. Reach III consisted of 64% run, 24% riffle and 12% pool. Channel debris was low with 40% being stable. Bank cover and instream cover were moderate. Stream gradient was 2.8% and the D-90 was 25 cm. Some beaver activity was noted in the middle of this reach.

Valley Characteristics:

The upper bank slope gradient was less than 30% and the valley to channel ratio was 25:1. The average valley width was 400 m. Reach III was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 27)

Westslope cutthroat were observed in this reach. Density estimates showed this to be a very important rearing area with 62.0 ${\rm age}$ I or older cutthroat per 100 ${\rm m}^2$ surface area.

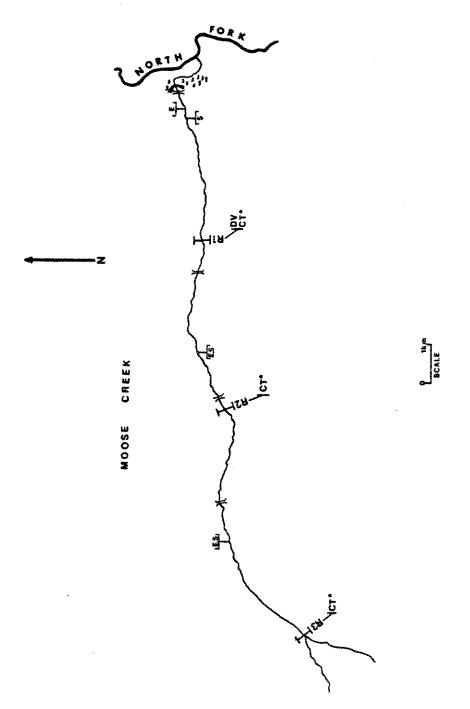


Figure 27. Fish population information by reach for Moose Creek.

Table 58. Stream habitat and fish population data for Moose Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Moose Creek	001	DD9	5.2	Fork	1 km below Whale Buttes bridge	1253	mouth	1109

Physical	Habitat data		8	Arra		Valley-		
Stream <u>order</u>	Drainage <u>area(km²)</u>	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel <u>width(m</u>)	Valley width(m)	channel ratio		Flow characteristics
3	48.0	4.8	.24	11	75	8		rolling
Confine-		Side channel	Average low	Flow dur survey	-	verage ak water		Maximum Pooq
ment_	Pattern	occurence		(m³/sec		emp(C)	Turbidity	depth(m)
Χ	С	low	0.17	0.31		5	low	1.0
% pool	% run	% riffle	% pocket- water	% class I pools	% clas			lass % class pools V pools
5	50	43	2	5	14		^	59 3
% fines	%gravel	<pre>% bed mater % rubble</pre>	ial % boulder	%bedrock	D-90 (cm)	% gradient	Stability rating	Bank form
27	30	33	10	0	32	2.6	105	repose
_,		ınk	Flood	•	% sta			% cover-
Bank	gene	etic	plain	Channel	chanr	nel % cov		er snorkel
Process	mater		debris	debris	debi			
aggrad	ing flu	uvial m	oderate	low	30	22	26	25
Water che	emistry data							
Cond. (umohs/	Alk.	Total carbon	Total phos.	No 3	Ca ⁺⁺	Mg ⁺⁺	Na ⁺	K ⁺ SO.
cm)	(<u>mg/1)</u>	(mg/1)	<u>(mg/1)</u>	(mg/1)	(mg/1)	(mg/1)	<u>(mg/1)</u>	(mg/1) $(mg/1)$
90	78	1.02	.004		20.6	0.84	1.0	1.0
Spawning	data				•			
Number of		4	Number of bull trout	Redd		Number of bull trout	Redd	
bull trou redds in	densit	:y	redds in	density	V	redds in	density	Voor
reach	(no/ka	n) Year	reach	(no/km)	Year	reach	(no/km)	Year
		***	-		-			
Fish popu	lation data							Other species
Density (no/100 m² su	irface area)					Mount	ain Eastern
Age 0	Cutthroat Age I Age	II Age	III+ Age 0	Bull tr Age I	out Age II	Age III+	<u>White</u>	fish Brk trout
	$\frac{1}{2.4}$ 5.		1 0	0	0	0	abse	ent absent
Biomass (grams/100 m²	surface an	<u>ea</u>)					
	Cutthroat	37 8	1114 800 0	Bull tr		Age III+		
Age 0	Age I Age	II Age	111+ Age 0	<u>Age I</u>	Age II	MAE III.		
4	16 6	4 97	0	0	0	0		

Table 59. Stream habitat and fish population data for Moose Creek Reach 2.

Stream Name	Reach number	Serial number	Reach Tr Length	Upper ibutary reach of bound	İ	Upper elev.(Lower reach m) boundary	·	Lower elev.(m)
Moose Creek	002	DEA 4	1.9 No Fo	rk abovē	ge 2 km e Whale es Bridge	1426		elow Buttes	1253
Physical	Habitat dat	<u>a</u>							
Stream <u>order</u>	Drainage area(km²)	Ave. wetted width(m)	Ave. depth fo <u>reach(</u> m		Valley width(m)	Valley- channel <u>ratio</u>		Flow characteris	tics
2		5.8	.21	10	400	10		rolling	g/broken
Confine- ment	Pattern	Side channe occurenc	1 10	w surv	rey pea	verage ak water emp(C)	Turbidity	Maximum pool depth(m)	
Χ	P	low	-	~				1.2	
% pool	% run	% riffle	% pock- wate						% class V pools
3	37	60	0	19	37		44	0	0
% fines	%gravel	<pre>% bed mate % rubble</pre>		der %bedroc	D-90 k (cm)	% gradient	Stability rating	Ba fo	
10	50	30	10	0	26	3.5	95	ur	_ idercut
Bank Process failing	gene <u>mater</u>	<u>ia</u> l	Flood plain debris low	Channel debris	% sta chann debr 70	el % cov		er sno	over- rkel tion
Water cher	nistry data								
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Tota phos (mg/1	No ₃ "	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO. (mg/l)
			==				****		eleci vens
Spawning	<u>da ta</u>								
Number of bull trou- redds in reach	t Redd densit (no/km	у	Number of bull tro redds in reach	ut Redd		Number of bull trout redds in reach	Redd density (no/km)	Year	
 Fish popu	 lation data								
Density (no/100 m² su	rface area)				Mount		<u>ies</u> Eastern
	Cutthroat Age I Age 3.4 12.		1111÷ Ag	Bull t e 0 Age I) 0	Age II	Age III+	White abser		8rk trout
Biomass (rams/100 m²	surface a	rea)	- :					
Age 0 A	Cutthroat ige I Age	II Age	III+ Ag	Bull t e O Age I	Age II	Age III+			
1	64 1	.50 17	5 0	0	0	0			

Table 60. Stream habitat and fish population data for Moose Creek Reach 3.

Stream Name	Reach number	Serial number	Reach <u>Length</u>	Tributary of	Upper reach boundar		Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Moose Creek	003	DEB	11.4	North Fork	3 km a		1743	bridge 2 above Wha Butte bri	ale
Physical	Habitat dat						Vallev-		
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave depth reac	for cl	Ave. hannel idth(m)	Valley width(m)	channel _ratio	<u>cha</u>	Flow racteristics
2		4.7	.24		39	150	10	Y	rolling
Confine- ment	Pattern	Sid chann occuren	e	verage low flow	Flow dur survey (m³/sec	y pea	erage k water mp(C) I		Maximum pool depth(m)
Χ	Р	NO			0.] % class	- 2 clas	- s % cla	 ss % cla	1.2
% pool	% run	% riffle		ocket- ater	I pools	II poo	-	ols IV po	ols V pools
6	64	24 % bed mat	6 erial		4	17 D-90	25 *	54 Stability	O Bank
% fines	%grave)	% rubb]		<u>oulder</u>	%bedrock	(cm)	gradient	<u>rating</u>	form
20	30	40	10)	0	20	2.8	93	repose
Bank Process		ank etic <u>ria</u> l	Flood plain debri	. (Channel debris	% sta chann debr	el % cover		% cover- snorkel section
aggrad	ing flu	ıvial	modera	ate	Tow	40	10	20	20
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbo (mg/l	n	Total phos. mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ SO ₄ (mg/1)
			•			-			
Spawning	<u>da ta</u>								
Number of bull trou redds in reach		ty	bull redd	er of trout Is in each	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach_	Redd density (no/km) Yo	ear
	***		•	··· ···					
Fish population data Other species									
Density (no/100 m ² s		<u>a</u>)		Bull ti	mau t		Mountai Whitefi	n Eastern
Age 0		e II Ad	e III+	Age 0	Age I	Age II	Age III+		
0	5.9 10 grams/100 m		i.0 area)	0	0	0	0	abser	nt absent
DIUMASS (Cutthroat		 /		Bull ti	rout			•
Age 0		e II Aç	e III+	Age 0	Age I	Age II	Age III+		
0	40 1	.22 14	35	0	0	0	0		

WHALE CREEK DRAINAGE

WHALE CREEK REACH I

Channel Characteristics: Date Surveyed: 8-28-79 (Figure 28)

Whale Creek Reach I is a fourth order tributary in the North Fork drainage. Average wetted width was 13 m, and the average depth was 34 cm. Reach I consisted of 50% run, 40% riffle, 7% pocketwater, and 3% pool. Channel debris was moderate with 20% being stable. Vegetation provided only slight bank cover while instream cover was moderate. Stream gradient was 1.1% and the D-90 was 48 cm. Three different areas of debris accumulation and a major slump zone occurred within a 5 km section of this reach.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 12:1. The average valley width was 220 m. Reach I was occasionally confined and has an irregular pattern.

Fish Populations: (Figure 29)

Westlope cutthroat, bull trout, mountain whitefish and sculpins were observed here. Spawning by adfluvial bull trout has been documented with an average of 23 redds enumerated annually during four years of survey. In 1982 a 4 km high use spawning area was noted near the upper reach break with redd densities of 13 per km. Migratory cutthroat were also observed here.

WHALE CREEK REACH II

<u>Channel Characteristics</u>: Date Surveyed: 8-28-79 (Figure 28)

Whale Creek Reach II is a fourth order tributary in the North Fork drainage. Average wetted width was 13 m, and the average depth was 34 cm. Reach II contained 50% run, 20% riffle, 19% pool, and 11% pocketwater. Channel debris was moderate to high and 25% was stable. Bank and instream cover were both low. Stream gradient was 0.7% and the D-90 was 27 cm. Three instream debris accumulations were noted and a major slump zone was present 2.5 km above the lower reach break.

<u>Valley Characteristics:</u>

The upper bank slope gradient was less than 30% and the valley to channel ratio was 10:1. The average valley width was 175 m. Reach II was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 29)

Westslope cutthroat, bull trout, mountain whitefish and sculpins were observed. Adfluvial bull trout spawning occurred with an average of 76 redds enumerated annually during four years of survey. Density estimates of 1.6 age I or older bull trout per $100~\text{m}^2$ surface area indicated an important rearing area.

Shorty Creek Reach I

<u>Channel Characteristics</u>: Date Surveyed: 8-18-79 (Figure 28)

Reach I of Shorty Creek is a fourth order tributary. It had a wetted width of 9 m and an average depth of 20 cm. This reach contained 20% run, 30% riffle and 50% pool. Channel debris was high with 30% being stable. A trace of bank cover was present. Instream cover varied by feature with deep pools providing the only instream cover observed. The channel gradient was 2% and the D-90 was 25 cm.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 5:1. The average valley width was 70 m. The channel was frequently confined and had an irregular pattern.

Fish Populations: (Figure 29)

Westslope cutthroat and bull trout were observed here. Spawning by adfluvial bull trout was documented with an average of 28 redds enumerated during four years of survey. Densities of 1.6 age I or older bull trout per $100\ \text{m}^2$ surface area indicated an important rearing area.

Shorty Creek Reach II

Channel Characteristics: Date Surveyed: 8-18-79 (Figure 28)

Reach II of Shorty Creek is a third order tributary. The wetted width was 5 m with an average depth of 20 cm. Reach II contained 30% runs, 50% riffle and 20% pool. Channel debris was moderate with 20% being stable. Bank cover and instream cover were very low. Channel gradient was 5% and the D-90 was 43 cm. Waterfalls and cascades created by large boulders created a barrier to upstream migration in the lower reach.

Valley Characteristics:

The upper bank slope gradient was 30-40%. There was a valley to channel

ratio of 8:1 and a valley width of 70 m. The channel was frequently confined with an irregular pattern.

Fish Populations: (Figure 29)

No fish were observed while surveying or snorkeling in this reach, probably due to the barriers mentioned above.

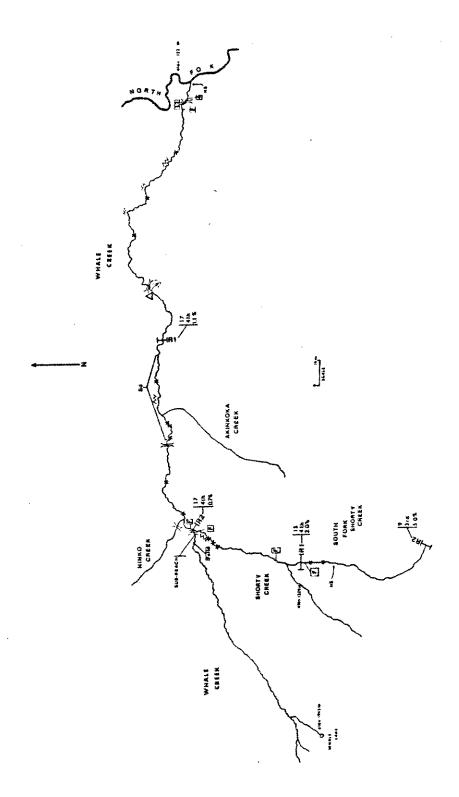
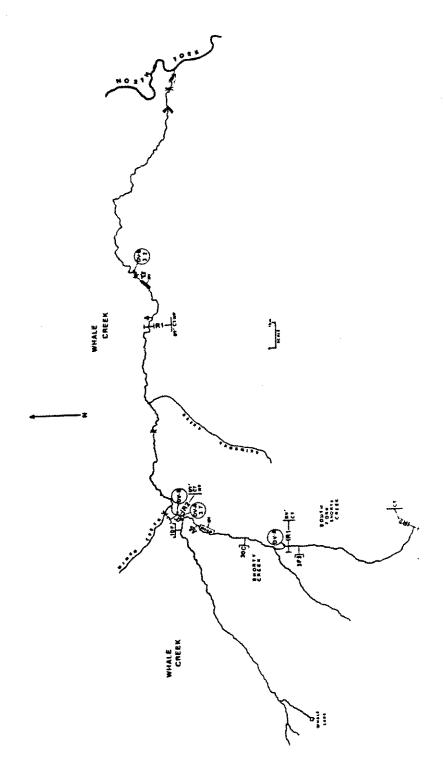


Figure 28. Location of physical habitat parameters by reach for the Whale Creek drainage.



Fish population information by reach for the Whale Creek drainage. Figure 29.

Table 61. Stream habitat and fish population data for Whale Creek Reach 1.

Stream Name	Reach number		each Tribu	•	гу	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Whale Creek	001	DA6 1:	3.9 Nort Fork		Buttes	1280	mouth	1122
Physical Physical	Habitat dat	<u>a</u> Ave.	Ave.	Ave.		Valley-		
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio	<u>.</u>	Flow characteristics
4	165.5	13.0	. 34	17	220	13	þ	roken/rolling
Confine- ment	Pattern	Side channel occurence	Average low <u>flow</u>	Flow du surve (m³/se	y pea	erage k water mp(C) T	urbidity	Maximum pool depth(m)
Χ	Р	moderate	1.57	1.64 % class		l5 s % c1a	low	1.8
% pool	% run	% riffle	water	I pools	II poo	ls III po	ols IV	pools V pools
10	50	40	0	5	10 D-90	15	35	35
% fines	%gravel	<pre>% bed mater % rubble</pre>	<u> </u>	%bedrock	(Ciii)	gradient	Stability rating	Bank <u>form</u>
20	40	20	19	1	48	1.1	89	repose
Bank Process	Ba gene <u>mate</u> r		Flood plain debris	Channel debris	% stal channe debr	el % cover		
failing	j flu	/ial	low	1 ow	20	5	5	25
Water chem	nistry data		•					
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ (mg/l)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ SO ₄ (mg/1)
ea		0.84	.003	0.14	35.5	.102		30.4
Spawning o	<u>lata</u>							
Number of bull trout redds in reach	: Redo densit (no/km	:y	Number of bull trout redds in reach	Redd density (no/km)	Year		Redd density (no/km)	<u>Year</u>
12	1.5	80	10	1.3	79	22	2.8	81
Fish popul	ation data							
Density (n	o/100 m² su	rface area)					Mounta	Other species ain Eastern
Age 0 A	Cutthroat ge I Age	II Age 1	III+ Age (Bull tr		Age III+	White	fish Brk trout
0	0	0 0 surface are	0.3	0	0.1	0.3	pres	ent absent
Age 0 A	<u>Cutthroat</u> ge I Age	II Age I	II+ Age C	Bull tr		Age []]+		
0	0 0	 1	1	0	1	9		

Table 62. Stream habitat and fish population data for Whale Creek Reach 2.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper y reach boundary	1	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Whale Creek	002	DA5	11.5	North Fork	Whale Falls	Creek	1365	2 km at Whale E Bridge		1280
Physical Stream	Habitat dat Drainage area(km²)	a Ave. wetted width(m	dept	for c	Ave. channel ridth(m)	Valley width(m)	Valley- channel ratio	<u>c</u>	Flow haracteri	<u>stics</u>
4	÷ _	13.0	. 34		17 Flow dur	175	22 erage	swi	irling/ Maximum	rolling
Confine- ment	Pattern	chan occure	ine1	low flow	survey (m³/sec) ter	k water	Turbidity	pool depth(m	<u>)</u>
X % pool	P % run	hig <u>% riffl</u>	- ~ ,	ocket- water	0.73 % class I pools	% class			2.7 lass pools	% class V pools
30	50	20 % bed ma	terial	0	17	20 D-90	27	Stability 3	36 8a	O ank
% fines	%gravel	% rubb	le %	ooulder	ಸಿbedrock	(cm)	gradient	<u>rating</u>	fe	<u>om</u>
40	40	10		9	1	27	0.7	87	rep	
Bank <u>Process</u>	gen	lank letic lrial	Floor plain <u>debr</u>	ו	Channel debris	% stal chann debr	el % cove		r sno	cover- orkel ction
failing	g fl	uvia1	low		low	20	5	10		4
Water che	mistry data	<u>L</u>								
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Tota carb (mg/	on	Total phos. (mg/l)	No; (mg/1)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO₄ <u>(mg/1)</u>
***				-					WW 168	
Spawning	<u>da ta</u>									
Number of bull trou redds in reach		ity	bul red	ber of l trout ds in each	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	Year	
35	3.	5 80	3 24	1	2.4	79	79	7.9	81	
Fish popu	ulation data	1							Other sp	arias
Density	(no/100 m ²		<u>rea</u>)		Bull tr	.m.; +#		Mount White	ain	Eastern 3rk trout
Age 0		ge II /	Age <u> </u>	Age 0	Age I	Age II	Age III+			
0	0 (grams/100 (0 n² surface	0.6 e area)	0.1	0.2	0.1	1.3	abse	ent	absent
BIOMASS	(grams/100) Cutthroa		uscu)		Bull tr	rout				
Age 0		ge II	Age III+	Age 0	Age I	Age II	Age III+			
0	0	0	19	1	2	2	60			

Table 63. Stream habitat and fish population data for Shorty Creek Reach 1.

Stream Name	Reach <u>number</u>	Serial number	Reach Length	Tributary of	Upper reach boundar	'Y	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Shorty Creek	001	DA4	4.5	North Fork	Falls above fork S		1405	junction Whale Co		1365
Physical Stream	Habitat data Drainage	Ave.	Ave depti		Ave. hannel	Valley	Valley- channel		Flow	**
order	area(km²)	width(m)	read	<u>:h(m)</u> <u>w</u>	idth(m)	width(m)	<u>ratio</u>	<u> </u>	haracteris	<u>tics</u>
4 Confine-	48.0	9.0 Sid chann	el	Average low	5 Flow du surve (m³/se	y pe	5 werage ak water emp(C)	SV Turbidity	virling Maximum pool depth(m)	
<u>ment</u> F	<u>Pattern</u> C	occuren modera		flow	1.49			low	1.4	
% pool	% run	% riffle	%	oocket- vater	% class I pools	% cla		ass % c	lass	% class V pools
30	20	30 % bed mat	erial 2	0	13	D-90	_% 31	Stability		nk 7
% fines	%gravel	% rubbl		ooulder	% <u>bedrock</u>	<u>(cm)</u>	gradient	<u>rating</u>	<u>fo</u>	<u>rm</u>
10	60	15	1	5	0	25	0.9	91	repo	
Bank <u>Process</u>		ank etic <u>ria</u> l	Floor plain <u>debr</u>	1	Channel debris	chan	able nel % cover ris canop		r sno	over- rkel tion
failing	fluvi	ial	mode	rateo	high	3	0 1	1	1	9
Water che	mistry data									
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbo (mg/l	n	Total phos. (mg/l)	No ₃ * (mg/l)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na [†] (mg/l)	K [†] (<u>mg/l)</u>	SO ₄ (mg/1)
							equit. Alanh	1996, npile,	Make, region,	
Spawning	data									
Number of bull trou redds in reach		ty	bul red	ber of l trout ds in each	Redd density (no/km)		Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
4	0.8	80)	33	6.6	79	17	3.4	81	
Fish popu	lation data					•			Other spe	cies
<u>Density</u>	no/100 m ² s		<u>ea</u>)		Bull t	raut		Mount White	ain	Eastern Brk trout
Age 0		e II A	ge III+	Age 0	Age I	Age II	Age III+			**************************************
	0.3 0 grams/100 m		0.4 <u>area</u>)	0.7	0.4	0.7	0.5	abse	nt	absent
	Cutthroat		777	300	Bull t	rout Age II	Age III+			
Age 0	Age I Ag	<u>le II Ad</u>	ge III+	Age 0	Age I	****				
0	2	5	12	1	4	15	23			

Table 64. Stream habitat and fish population data for Shorty Creek Reach 2.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	y reach boundar	y	Upper elev.(m)	reach boundar	<u> </u>	Lower elev.(m)
Shorty Creek	002	DCK	4.6	North Fork	headwa	iters	1640		1 km north Shorty	1405
Stream order	Habitat dat Drainage area(km²)	Ave. wetted width(m)	Ave depti reac	for c	Ave. channel cidth(m)	Valley width(m)	Valley- channel ratio		Flow character	istics
3	****	5.0	.3	4	9	70	8		rolling	/tumbling
Confine- ment	Pattern	Sic chann occurer	ne1	verage low flow	Flow dur survey (m³/sec	, pea	erage k water mp(C)	Turbidity	Maximum pool depth(m	
С	P	low	% n	ocket-	0.22 % class	- % clas	- s %cl	low	1.5 class	% class
<u>% pool</u>	% run	% riffle		ater	<u>I pools</u>	II poo	ls III po		V pools	V pools
6	30	50 % bed mat		14	1	8 D-90	20	Stability	50	21 lank
% fines	%grave1	% rubb		<u>oulder</u>	%bedrock	<u>(cm)</u>	gradient	rating		orm
10	20	5	;	5	60	43	5.0	76	re	pose
Bank <u>Process</u>		ank etic <u>ria</u> l	Flood plain debri		Channel debris	% sta chann debr	el % cove		ver sn	cover- orkel oction
stable	bed	irock	1 ow	•	moderat	e 20	1	10)	0
Water che	mistry data									
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbo (mg/l	on ,	Total phos. mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	κ ⁺ (<u>mg/1)</u>	\$0. (mg/1)
***		***		· ·			***	***		
<u>Spawning</u>	<u>data</u>									
Number of bull trou redds in reach	. 13	ty	bull redo	er of trout s in ach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
***	-			-		-	-	-	***	
Fish popu	lation data	_							0.4	
	no/100 m² s Cutthroat Age I Ag		ea) ge III+	Age 0	Bull tr Age I	out Age II	Age III+		Other sp ntain tefish	Eastern Srk trout
O Biomass (O grams/100 m	O ² surface	O area)	0		0	0	abs	ent	absent
Age 0	Cutthroat Age I Ag	e II A	ie III+	Age 0	Bull tr Age I	Out Age II	Age III+			

0

0 - 0

0,

0

FORD CREEK DRAINAGE

FORD CREEK REACH I

Channel Characteristics: Date surveyed: 8-20-80 (Figure 30)

Ford Creek Reach I is a third order tributary in the North Fork drainage. Average wetted width was 4 m and the average depth was 18 cm. Reach I was comprised of 47% riffle, 40% run, 7% pool and 6% pocketwater. Channel debris was moderate with 40% being stable. Stream gradient was 3.4% and the D-90 was 25 cm. A major slump area.occurred 1 km above the lower reach break and sediment from this slump solidly imbedded substrate immediately downstream.

Valley Characteristics:

The upper bank slope gradient was <30% and the valley to channel ratio was 17:1. The average valley width was 100 m. Reach I was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 31)

Westslope cutthroat and sculpins were observed in this reach. The westslope cutthroat were believed to be resident fish.

FORD CREEK REACH II

<u>Channel Characteristics</u>: Date surveyed: 8-23-80 (Figure 30)

Ford Creek Reach II is a third order tributary in the North Fork drainage. Average wetted width was 3 m and the average depth was 13 cm. Reach II consisted of 56% run, 37% riffle and 7% pocketwater. Channel debris was moderate to low with 20% being stable. Vegetation provided high bank cover while instream cover was moderate. Stream gradient was 2.9% and the D-90 was 9 cm. The lower kilometer of this reach was a marsh area.

Valley Characteristics:

The upper bank slope was less than 30% and the valley to channel ratio was 25:1. The average valley width was 100 m. Reach II was unconfined and had an irregular meandering pattern.

Fish Populations: (Figure 31)

Westslope cutthroat trout and sculpins were observed in this reach. The westslope cutthroat were thought to be resident fish.

FORD CREEK REACH III

Channel Characteristics: (Figure 30)

Ford Creek Reach III is a third order tributary in the North Fork drainage. Average wetted width was 3 m and the average depth was 11 cm. Reach III was comprised of 43% run, 43% riffle, 7% pool and 7% pocketwater. Channel debris was low with 20% being stable. Vegetation provided high bank cover while instream cover was moderate. Stream gradient was 15% and the D-90 was 32 cm.

Valley Characteristics:

The upper bank slope gradient was 40-60% and the valley to channel ratio was 17:1. The average valley width was 70 m. Reach III was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 31)

Westslope cutthroat trout and sculpins were observed in this reach. The westslope cutthroat were probably resident fish.

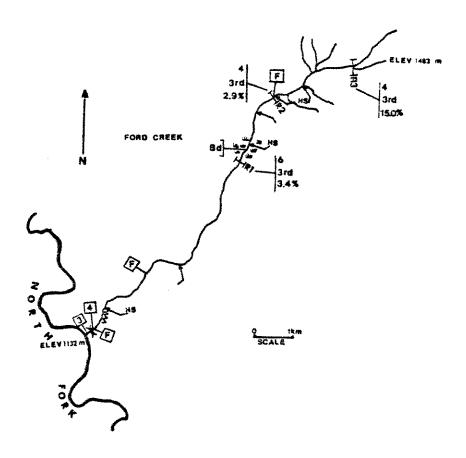


Figure 30. Location of physical habitat parameters by reach for Ford Creek.

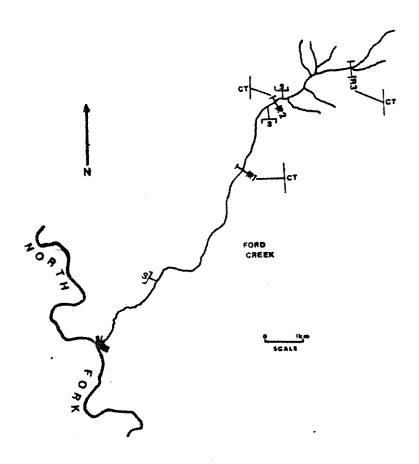


Figure 31. Fish population information by reach for Ford Creek.

Table 65. Stream habitat and fish population data for Ford Creek Reach 1.

Stream Name	Reach number	Serial number	Reach T Length	ributary of	Upper reach boundar	<u>y</u>	Upper elev.(Lower reach m) boundar	Y	Lower elev.(m)
Ford Creek	001	DBM		orth ork	7.2 k from	m up mouth	1364	mouth	ı	1132
	Habitat dat	<u>a</u> Ave. wetted	Ave.	fan ei	Ave. hannel	Valley	Valley- channel		Flow	
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depth (reach)		idth(m)	width(m)	ratio		characteri	<u>stics</u>
3	32.4	4.0	.18		6	100	25		rolling	•
Confine- ment	Pattern	Sic chanr occuren	el	erage ow ow	Flow dur survey (m³/sec	/ pe	verage ak water emp(C)	Turbidity	Maximum pool depth(m	<u>.</u>
X fooq 2	P % run	moder	% poc	:ket-	.09 % class I pools	% cla: II po			0.7 class V pools	% class V pools
7	40	47	6		0	40		0	30	0
% fines	%gravel	% bed mat % rubbl		ilder	%bedrock	D-90 (cm)	% gradient	Stability rating		ink orm
30	40	20	1		0	25	3.4	82	re	pose
8ank Process	Ba gene <u>mater</u>		Flood plain debris		Channel debris	% sta chan debi	nel % cov		ver sno	over- orkel tion
failing	j fluv	/ial	low	m	oderat	e 40	4	0 40	2	3
Water cher	mistry data									
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbo (mg/l	n ph	tal os. /1)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	κ ⁺ (<u>mg/l)</u>	SO ₄ (mg/1)
105	85	1.67	.01	14		24.7	.055	2.0		0.4
Spawning	data				÷					
Number of bull trou redds in reach	t Redo densit (no/kn	:y	Number bull t redds reac	rout in	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year	
										
	lation data								Other spe	cies
	<u>no/100 m² su</u> <u>Cutthroat</u> Age I Age			Age O	Bull tr Age I	out Age II	Age III+		itain cefish	Eastern Brk trout
5.0	3.9 5. grams/100 m²	0 0.	9	0	0	0	0	abs	ent	absent
Age 0 A	Cutthroat Age I Age	<u>II Ag</u>	e <u> </u>	Age 0	Bull tr Age I	out <u>Age II</u>	Age III+			
55	26 6	0 2	:8	0	0	0	0			

Table 66. Stream habitat and fish population data for Ford Creek Reach 2.

Stream Name	Reach number		each Tribut ength of	-	y	Upper elev.(m	Lower reach) boundary	-	Lower elev.(m)
Ford Creek	002	DBL 2	.1 Nor		m up mouth	1426	7.2 km from m		1364
Physical Physical	Habitat data	<u>a</u> Ave.	Ave.	Ave.		Valley-			
Stream order	Drainage area(km²)	wetted width(m)	depth for reach(m)	channe l	Valley width(m)	channel ratio	٥	Flow haracteris	tics
3		3.0	.13	4	100	26		rolling	3
Confine- ment	<u>Pattern</u>	Side channe occurenci		Flow dur survey (m³/sec	, pea	erage k water mp(C)	Turbidity	Maximum pool depth(m)	
U	С	low	% pocket-	0.05 % class	z clas				% class
% pool	% run	<u>% riffle</u> 37	water 7	I pools	11 poo 6	<u>lls III r</u> 31			V pools
0	56	% bed mate	•	0 %bedrock	D-90 (cm)	ر پر gradient	Stability rating	a Ba: fo	
% fines 40	%gravel 40	<u>% rubble</u> 19	1	0	9	2.9	73		epose
Bank <u>Process</u>		ank etic <u>ria</u> l	Flood plain debris	Channel debris	% sta chann <u>debr</u>	el % cove		% co r sno	over- rkel tion
failing	j fluv	/ial r	moderate	moderate	e 20	50	30	16	
	mistry data		.						
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	κ ⁺ (<u>mg/1)</u>	504 (mg/1)
				Ave. 446	***		****	 -	
Spawning	data								
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	Year	
				 .		***			
	lation data							Other spec	ies
Age 0		e II Age	III+ Age C		Age II	Age III+	Mount White	<u>fish</u>	Eastern Brk trout
O Biomass (O grams/100 m ³	0 4. ² surface as	-	0	0	0	abse	nt	absent
	Cutthroat			Bull tr	out Age II	Age III+			
<u>Age 0</u> 0			111+ Age 0 47 0	Age I O	0	0			

Table 67. Stream habitat and fish population data for Ford Creek Reach 3.

Stream <u>Kame</u>	Reach <u>number</u>		each Tributa ength of	Upper ry reach boundar	<u> </u>	Upper elev.(m)	Lower reach boundary	······································	Lower elev.(m)
Ford	003	DBK 3	3.8 North	12.8	km up	2073	9.5 km	up from	1426
Creek	340		Fork	from r			mouth		
<u>Physical</u>	Habitat data	<u>a</u> Ave.	Ave.	Ave.		Valley-			
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel <u>ratio</u>	<u>c</u> !	Flow haracteris	tics
3		3.0	.11	4 53 out du	70	17 erage	bı	roken/r Maximum	olling
Confine- ment	Pattern	Side channe occurence		Flow du survey (m³/sec	/ pea	k wäter	Turbidity	pool depth(m)	•
Х	Р	1 ow	 % pocket-	0.05 % class	; % clas		low ss %c	0.5 lass	% class
<u>% pool</u>	% run	% riffle	water	<u>I pools</u>	II poo	ls III po	ools IV	oools	V pools
7	43	43	7	0	0 D-90	43 2	Stability 5	57 Ba	O nk
% fines	%gravel	% bed mate	% boulder	%bedrock	(cm)	gradient	rating	fo	
10	30	40	19	1	32	17.0	99	rep	ose
Bank Process		ank etic rial	Flood plain debris	Channel debris	% sta chann debr	el % cover		- sno	over- rkel <u>tion</u>
failing	flu	vial	low	1.ow	20	50	40	14	
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (mg/1)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K [†] (<u>mg/1)</u>	SO ₄ (mg/l)
	***						₩	***	****
Spawning	data					_			
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
					** **				
Fish popu	lation data							۸،۱	
Density (no/100 m² si	urface area)				Mounta		Eastern
Age 0	Cutthroat Age I Age	e II Age	III+ Age O	Bull tr Age I	out Age II	Age III+	White	rish	<u>9rk trout</u>
0).7 2.	.7 0	0	0	0	abse	nt	absent
Blomass (:	Surrace di		 Bull tr	roist				
Age 0	<u>Cutthroat</u> <u>Age I Ag</u> e	e II Age	111+ Age 0	Age I	Age II	Age III+			

0 2

KINTLA CREEK DRAINAGE

KINTLA CREEK REACH I

Channel Characteristics: Date Surveyed: 8-7-80 (Figure 32)

Reach I is the only reach surveyed in Kintla Creek. It extends from lower Kintla Lake to the North Fork River. It is a second order tributary with an average wetted width of 15.4 m and an average depth of 49 cm. Reach I contained 59% run, 40% riffle and 1% pocketwater. Channel debris was low with 50% being stable. Bank vegetation was low and instream cover was moderate. Stream gradient was 1.7% and the D-90 was 61 cm. Two major slump zones appeared along Kintla Creek and an area of debris accumulation was present 1 km below the lake outlet.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 2:1. The average valley width was 40 m. Kintla Creek was frequently confined and had an irregular pattern.

Fish Populations: (Figure 33)

Westslope cutthroat trout and mountain whitefish were observed in this creek. The westslope cutthroat were believed to be resident fish.

STARVATION CREEK DRAINAGE

STARVATION CREEK REACH I

Channel Characteristics: Date Surveyed 7-29-80 (Figure 32)

Starvation Creek Reach I is a third order tributary in the North Fork drainage. Average wetted width was 7 m and the average depth was 27.5 cm. Reach I contained 56% riffle, 40% run, 3% pool and 1% pocketwater. Channel debris was low and 50% was stable. Bank cover was low and instream cover was low-moderate. Stream gradient was 3.1% and the D-90 was 38 cm.

Valley Characteristics:

The upper bank slope was 40-60% and the valley to channel ratio was 7:1. The average valley width was 200 m. Reach I was frequently confined and had an irregular meandering pattern. Numerous slumping clay banks were found, firmly imbedding substrate downstream. The upper endoof Starvation Creek lies in Canada and has been logged except near the creek banks.

Fish Populations: (Figure 33)

Bull trout, westslope cutthroat, mountain whitefish and sculpins were observed. Spawning by adult bull trout has been documented here.

STARVATION CREEK REACH II

Channel Characteristics: Date Surveyed: 8-5-80 (Figure 32)

Starvation Creek reach II is a second order tributary in the North Fork drainage. Average wetted width was 7.3 m and the average depth was 23 cm. Reach II consisted of 53% run, 40% riffle, 4% pocketwater and 3% pool. Channel debris was low and 70% was stable. Vegetation provided limited bank cover while instream cover was abundant. Stream gradient was 1.8% and the D-90 was 24 cm. An area of debris accumulation was present in the middle of this reach.

<u>Valley Characteristics</u>:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 4:1. The average valley width was 80 m. Reach II was occasionally confined and had a sinuous pattern.

Fish Populations: (Figure 33)

Bull trout, westslope cutthroat trout and sculpins were observed in this reach. Migratory as well as resident cutthroat were present and fish densities indicated an important rearing area for bull trout with 3.5 age I or older fish per $100~\text{m}^2$ surface area. Bull trout were more abundant than cutthroat trout.

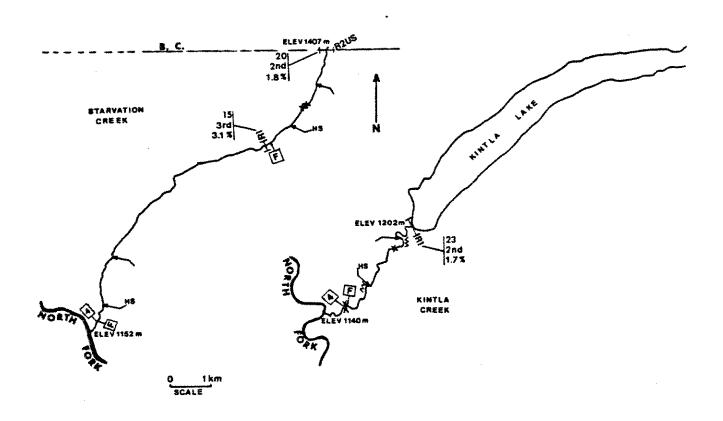


Figure 32. Location of physical habitat parameters by reach for Kintla Creek and Starvation Creek.

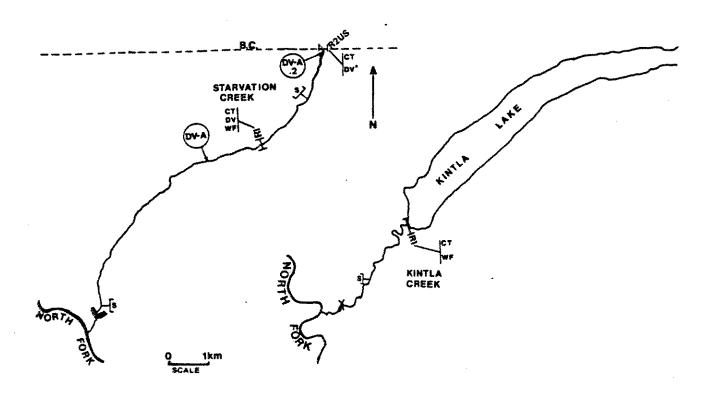


Figure 33. Fish population information by reach for Kintla Creek and Starvation Creek.

Table 68. Stream habitat and fish population data for Kintla Creek Reach 1.

Stream Name	Reach number	Serial number	. Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(用)
Kintla Creek	001	DBN	3.5	North Fork	Kintla Lake	1202.4	mouth	1140.0

					•				
<u>Physical</u>	Habitat data	<u>a</u> Ave.	Ave.	Ave.		Valley-			
Stream <u>order</u>	Drainage <u>area(km²)</u>	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio		Flow characteri	stics
2	138.1	15.4	.49	23	40	2	1	rolling	•
Confine-		Side channel	Average low	Flow dur survey	pea	verage ak water		Maximum pool	
ment	<u>Pattern</u>	occurence	flow	<u>(m³/sec</u>		emp(C)	Turbidity	depth(m)	<u>-</u>
F	P	Tow		3.55 % class	% clas		low lass %	1.2 class	% class
% pool	% run	% riffle	% pocket- water	I pools	II pod			pools	V pools
0	60	39	1	0	0	-		100	0
% fines	%gravel	<pre>% bed mater % rubble</pre>	ial % boulder	%bedrock	D-90 (cm)	gradient	Stability <u>rating</u>		nk <u>orm</u>
30	30	30	10	0	61	1.7	107	st	eep
Bank Process		ank etic <u>ria</u> l	Flood plain debris	Channel debris	% sta chanr debr	iel % cove		er sno	over- rkel tion
failin	g flu	vial	Wo	Wof	50	10	- 6	13	•
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
	÷.	0.76	.002	0.12	17.3	.043			2.5
Spawning	data								
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
Fish popu	lation data	•		•					
-	no/100 m² su	infano anos)					4-2	Other spe	
Density (7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	niace area/		D., 13 +w.	ab		Moun:		Eastern Brk trout

F	į	h	popu	lat	ion	data

1 1 12 22

								Other species		
Density	(no/100) Cutth	m² surface roat	area)		Bull t	rout		Mountain Whitefish	Eastern 3rk trout	
Age 0 0.1	Age 1	Age II 1.0	Age III+ 0.7	Age 0	Age I O	Age II O	<u>Age III+</u> O	present	absent	
	(grams/1	00 m² surf						·		
Age 0	Cutth Age I	roat Age II	Age III+	Age 0	Bull t Age I	rout Age II	Age III+			

0

Table 69. Stream habitat and fish population data for Starvation Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Starvation Creek	001	DBR	8.0	North Fork	8 km up from mouth	1392.0	mouth	1152.0

Physical	Habitat data	a. Ave.	Ave.	Ave.		Valley-			
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depth for reach(m)	channe l	Valley width(m)	channel ratio	***	Flow characteris	<u>tics</u>
3	21.8	7.0	.28	15	100	7		broken/r	rolling
Confine- ment	<u>Pattern</u>	Side channel occurence		Flow dur survey (m³/sec	, pe	verage ak water emp(C)	Turbidity	Maximum pool depth(m)	
F	С	low	0.25 % pocket-	0.48 % class	%_cla:	ss ãc′			% class
% pool	<u>% run</u>	<u>% riffle</u>	<u>water</u>	<u>I pools</u>	II po				V pools
3	40	56 % bed mater	l ial	0	43 D-90	43 %	Stability	4 Bai	
% fines	<u>%gravel</u>	<u>% rubble</u>	% boulder	%bedrock	(cm)	gradient	rating_	for	
23	34	27	16	0	38	3.1	100	rep	ose
Bank Process	Ba gene mater		Flood plain debris	Channel debris	% sta chanr debi	nel % cove		er sno	over- rkel tion
failing	flu\	/ial	moderate	low	50	10	3	1	.1
-	mistry data								
Cond.		Total	Total			•			
(umohs/ cm)	Alk. (mg/l)	carbon (mg/l)	phos. (mg/1)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K ⁺ (<u>mg/l)</u>	SO ₄ (mg/1)
100	83	0.54	.003	0.56	24.9	.065	1.3	the sale.	1.3
Spawning	<u>da ta</u>								
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
0	0.0	08 (**		sager Asset.	1	0.1	81	
Fish popu	lation data								
Density (no/100 m² si	urface area)					Mount	Other spec	ies Eastern
	Cutthroat		1771: 3A	Bull tr		Age III+		fish	3rk trout
3.2	0 0.	9 1.	1 0	<u>Age I</u> O	Age 11 0.7	0.6	pre	sent	absent
Biomass (surface ar	ea)		·				
Age 0	<u>Cutthroat</u> Age I Age	e II Age	III+ Age 0	Bull tr Age I	Age II	Age III+			
3	0 . 1	11 34	0	. 0	15	28			

Table 70. Stream habitat and fish population data for Starvation Creek Reach 2.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Starvation Creek	002	DBQ	3.2	North Fork	Canadian border	1446.0	8 km up from mouth	1392.0

Physical	Habitat dat	a							
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	•	Flow characteri	<u>stics</u>
2	-	7.3	.23	20	80	4		rolling	
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low <u>flow</u>	Flow du surve (m³/se	y pe	verage ak water emp(C)	Turbidity	Maximum pool depth(m	<u>.</u>
Χ	N	Tow	z- % pocket-	0.38 % class	% cla			class. 1	% class
2 pool	% run	% riffle	water	I pools	II po			/ pools	<u>V pools</u>
3	54	40	3.	15	29	•		28	0
% fines	%grave1	% bed mater % rubble	1al % boulder	%bedrock	D-90 (cm)	gradient	Stability rating		ink <u>erm</u>
20	49	30	1	0	24	1.8	102	r	epose
Bank Process	Ba gene mater		Flood plain debris	Channel debris	% st chan <u>deb</u>	nel % cove		er sno	cover- orkel ction
failing Water cher	flu flunistry data	ıvial	low	1 ow	70	10) 10) 2:	9
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	κ ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
									
Spawning (<u>da ta</u>								
Number of bull trou redds in reach	t Redo densit (no/km	ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	year	
1 Fish popul	0.3 Nation data	80				VII. 480		***	4
								Other spe	
Density (no/100 m² su Cutthroat	indue area)		Bull tr	out		Moun Whit	tain efish	Eastern Brk trout
Age 0		II Age			Age II	Age III+			
			.4 1.6	1.5	1.0	1.0	abs	ent	absent
Siomass (surface are	<u>(\$)</u>						
Age 0	Cutthroat Age I Age	e II Age l	II+ Age 0	Bull tr Age I	out Age II	Age III+			
0	2	4 12	2 2	14	22	46			

TRAIL/YAKINIKAK CREEK DRAINAGE

TRAIL CREEK REACH I

Channel Characteristics: Date Surveyed: 9-13-79 (Figure 34)

Trail Creek Reach I is a fifth order tributary in the North Fork drainage. Average wetted width was 15 m and the average depth was 30 cm. Reach I was composed of 60% run, 40% riffle and traces of pool and pocketwater. Channel debris was low with only a trace stable. Bank and instream cover were both low. Stream gradient was 2.0%, and the D-90 was 35 cm. The source of water for Reach I Trail Creek arises from springs which are fed by subterranian flows from Reach I of Yakinikak Creek. A 1 km long canyon was a feature at the upper end of Reach I. This canyon had 60% riffle, 40% run and traces of pool and pocketwater features. Two springs discharging an additional 27.2 cfs of water at 6.1°C were located immediately below the canyon, forming a 226 m long channel which enters Trial Creek from the north.

Valley Characteristics:

The upper bank slope was 40-60% and the valley to channel ratio was 6:1. The average valley width was 115 m. Reach I was occasionally confined and had a sinuous pattern.

<u>Fish Populations</u>: (Figure 35)

Westslope cutthroat, bull trout, mountain whitefish and sculpins were observed here. Migratory populations of cutthroat and bull trout were present. Spawning by adult bull trout was observed and four years of survey enumerated an average of 52 redds annually. Density estimates indicated an important rearing area for juvenile bull trout $(1.7 \text{ age I} + \text{fish per } 100 \text{ m}^2 \text{ surface area})$.

Ketchikan Creek Reach I

Channel Characteristics: Date Surveyed: 8-23-80 (Figure 34)

Ketchikan Creek Reach I is a third order tributary in the Trail Creek drainage. Average wetted width was 2.7 m and the average depth was 13 cm. Reach I contained 70% run, 19% pool, and 11% riffle. Channel debris was moderate with 20% being sable. Overhanging vegetation provided abundant bank cover in this reach and instream cover was also high. Stream gradient was 0.5% and the D-90 was 14 cm.

The upper bank slope gradient was 30% and the valley to channel ratio was 80:1. The average valley width was 400 m. Reach I was unconfined and had an irregular pattern. Most of this reach is located in private ownership.

Fish Populations: (Figure 35)

Westslope cutthroat were observed in this reach. It was a major rearing area for cutthroat trout supporting resident and migratory cutthroat populations at a density of 33.6 age I or older fish per $100~\text{m}^2$ surface area.

Ketchikan Creek Reach II

Channel Characteristics: Date Surveyed: 8-23-80 (Figure 34)

Ketchikan Creek Reach II is a third order tributary in the Trail Creek drainage. Average wetted width was 3 m, and the average depth was 12.6 cm. Reach II contained 67% riffle, 29% run, and 4% pocketwater. Channel debris was low with 10% being stable. Overhanging vegetation provided high cover while instream cover was moderate. Stream gradient was 4.9% and the D-90 was 23 cm.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 20:1. The average valley width was 50 m. Reach II was occasionally confined with an irregular pattern.

Fish Populations: (Figure 35)

Westslope cutthroat were observed in this reach. It was an important rearing area for cutthroat trout supporting resident and migratory cutthroat populations at a density of 17.1 age I or older fish per 100 m² surface area.

Ketchikan Creek Reach III

Channel Characteristics: Date Surveyed: 8-23-80 (Figure 34)

Ketchikan Creek Reach III is a third order tributary in the Trail Creek drainage. Average wetted width was 2.2 m, and the average depth was 12 cm. Reach III consisted of 50% run, 30% riffle, 10% pool, and 10% pocketwater. Channel debris was low with 10% being stable. Instream cover was low-moderate, while bank cover was low. Stream gradient was 3.1% and the D-90 was 8.5 cm. The lower 1-2 km of Reach III were a marsh area.

The upper bank slope gradient was 40-50% and the valley to channel ratio was 40:1. The average valley width was 100 m. Reach II was unconfined and had a regular meandering pattern.

Fish Populations: (Figure 35)

Westslope cutthroat were observed in this reach. This was a major rearing area for cutthroat trout supporting resident and migratory cutthroat populations at a density of 17.1 age I or older fish per 100 m² surface area.

YAKINIKAK CREEK REACH I

Channel Characteristics: Date Surveyed: 8-2-79 (Figure 34)

Reach I of Yakinikak Creek is a third order tributary to Trail Creek. Average wetted width was 6.0 m with an average depth of 27 cm. Reach I contained 56% run, 26.5% riffle and 17.5% pools. Channel debris was moderate with 55% being stable. Only small amounts of bank cover and instream cover were present. The channel gradient was 1.4% and the D-90 was 60 cm. Approximately 3 km of the lower reach flowed underground.

Valley Characteristics:

Reach I had a valley to channel ratio of 3:1 with a valley width of 50 m. The majority of the channel was entrenched with some being confined. The meandering pattern was irregular.

Fish Populations: (Figure 35)

The majority of the Reach I stream channel was dry most of the year. Fish were present in the upper .5 km of the reach; however, no fish population work was conducted in this area.

YAKINIKAK CREEK REACH II

Channel Characteristics: Date Surveyed: 8-11-79 (Figure 34)

Reach II of Yakinikak Creek is a fourth order tributary to Trail Creek. Average wetted width was 20 m with an average depth of 40 cm. This reach contained 40% run, 40% riffle and 20% pools. Channel debris was moderate and 30% stable. Only a trace of bank cover and instream cover were present. The channel gradient was 1.7% and the D-90 was 40 cm.

<u>Valley Characteristics:</u>

The upper bank slope gradient was 40-60% and the valley to channel ratio was 15:1. The average valley width was 150 m. The channel was occasionally confined and had an irregular pattern.

Fish Populations: (Figure 35)

Westslope cutthroat trout were the most abundant species in this reach. A few bull trout and whitefish were also observed. The dry channel below this area precluded adult bull trout spawning.

YAKINIKAK CREEK REACH III

<u>Channel Characteristics</u>: Date Surveyed 8-15-79 (Figure 34)

Reach III of Yakinikak Creek is a third order tributary. Average wetted width was 7 m and the average depth of 30 cm. There was 50% run, 30% riffle and 20% pools in this reach. Moderate debris was present with 20% being stable. Instream cover was very low and bank cover was moderate. Channel gradient was 1.5% and the D-90 was 20 cm. A large beaver dam area was present in the middle of this reach.

Valley Characteristics:

The reach had a valley to channel ratio of 20:1 with an average valley width of 200 m. The channel was occasionally confined with an irregular pattern.

Fish Populations: (Figure 35)

Westslope cutthroat trout were observed in this reach.

YAKINIKAK CREEK REACH IV

Channel Characteristics: Date Surveyed: 8-15-79 (Figure 34)

Reach IV of Yakinikak Creek is a third order tributary. Average wetted width was 8 m and the average depth was 24 cm. This reach had 50% run, 20% riffle and 30% pools. Moderate amounts of channel were present with 20% being stable. A major debris pile consisting of large logs was located near the lower reach break. Instream cover was moderate and bank cover was abundant. The channel gradient was 1.0% and the D-90 was 57 cm.

The upper bank slope gradient was 40-60%. The valley to channel ratio was 4:1 and the valley width was 63 m. The channel was occasionally confined with an irregular meandering pattern.

Fish Populations: (Figure 35)

Westslope cutthroat trout were present in Reach IV in moderate densities.

YAKINIKAK CREEK REACH V

Channel Characteristics: Date Surveyed: 8-15-79 (Figure 34)

Reach V of Yakinikak is a third order tributary. Average wetted width was 3.4 m and the average depth was 15 cm. This reach contained 20% run, 50% riffle and 30% pools. Abundant channel debris was present with 20% being stable. A moderate amount of bank cover was present and instream cover was high. The channel gradient was 10.7% and the D-90 was 33 cm.

Valley Characteristics:

The upper bank slope gradient was 30% and the valley to channel ratio was 7:1. Average valley width was 40 m. The channel was frequently confined and had a sinuous pattern.

Fish Populations: (Figure 35)

Westslope cutthroat trout were present in Reach V in low densities.

Tuchuck Creek Reach I

Channel Characteristics: (Figure 34)

Tuchuck Creek Reach I is a fourth order tributary in the Trail Creek drainage. Average wetted width was 4 m and the average depth was 29 cm. Reach I contained 50% riffle, 40% run, and 10% pool. Channel debris was moderate and 30% was stable. Bank cover was abundant and instream cover was moderate. Stream gradient was 1.6% and the D-90 was 36 cm. Two different areas of debris accumulation appeared 1 km above the lower reach break.

The upper bank slope was 30--40% and the valley to channel ratio was 7:1. The average valley width was 60~m. Reach I was occasionally confined and had a sinuous pattern.

Fish Populations: (Figure 35)

Westslope cutthroat trout were observed in this reach. Density estimates of 19.0 age I or older cutthroat per 100 $\rm m^2$ surface area indicated an important rearing area.

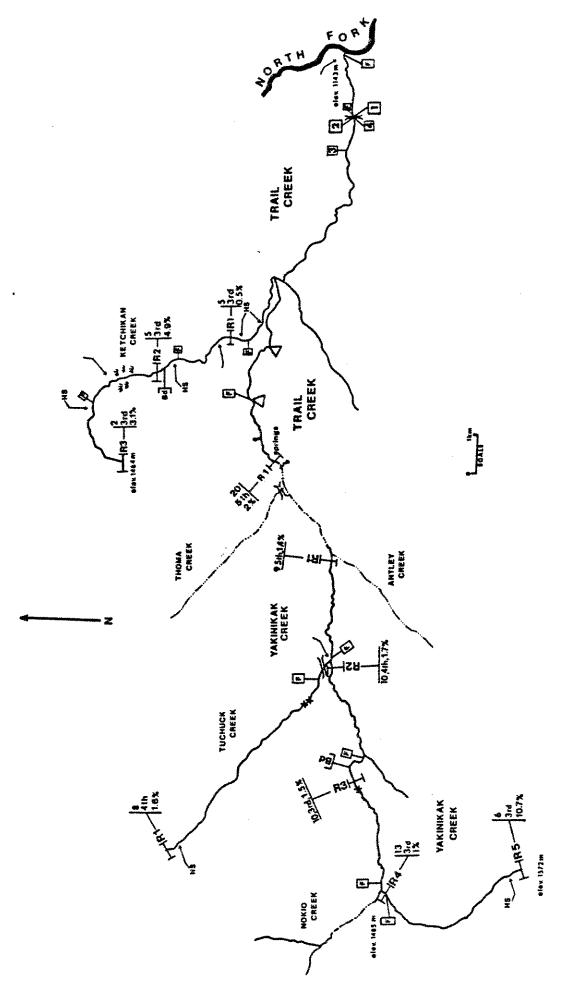
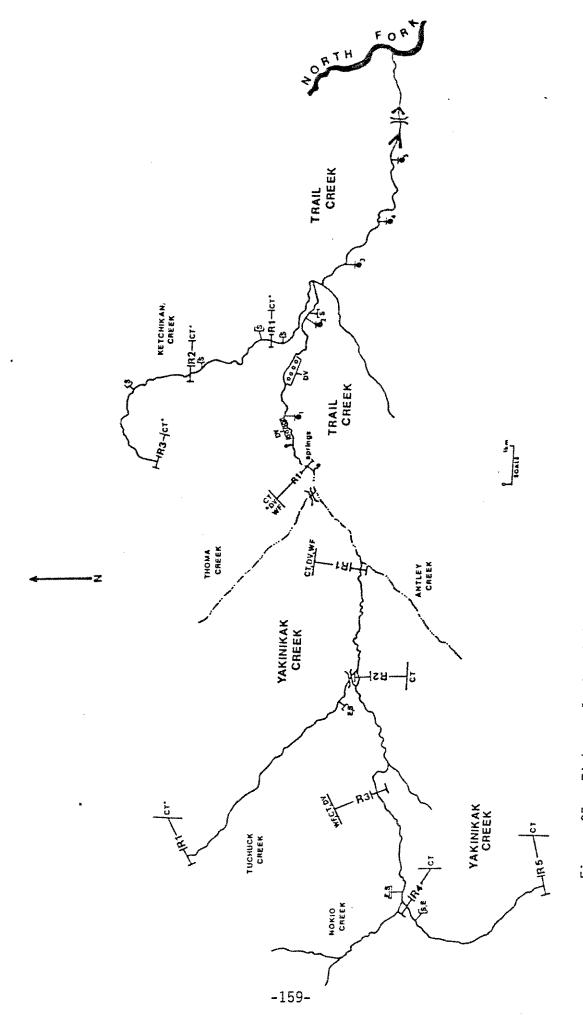


Figure 34. Location of physical habitat parameters by reach for the Trail Creek drainage.



Fish population information by reach for the Trail Creek drainage. Figure 35.

Table 71. Stream habitat and fish population data for Trail Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	reach boundary	Lower elev.(和)
Trail Creek	001	DB7	11.4	North Fork	bottom dry area	1311	mouth Trail Creek	1170

Physical_	Habitat dat			* -		Valley	,		
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	9	Flow haracteri	stics
5	186.1	15.0	.30	20	155	5	SI	wirling	/rolling
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low <u>flow</u>	Flow dur survey (m³/sec	/ p∈	lverage eak water temp(C)	Turbidity	Maximum pool depth(m	<u>.</u>
X % pool	N % run	moderate % riffle	% pocket- water	1.47 % class I pools	% cla II po			1.5 lass pools	% class V pools
2	<u>2 100</u> 55	38	5	2	2	18		78	0
		% bed mater	ial		D-90	Ny No	Stability	Ba	ank
% fines	%gravel	% rubble	<u>% boulder</u>	% <u>bedrock</u>	<u>(cm)</u>	gradient	<u>rating</u>		Orm
30	30	20	19	1	45	1.2	94	re	oose
Bank Process		ank etic <u>ria</u> l	Flood plain debris	Channel debris	chan	cable inel % cove iris canor		r sno	cover- orkel ction
failing	flu	uvial	low	low	1	1	10		10
Water cher	nistry data								
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/1)	Total phos. (mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
		0.76	.008	0.01	21.7	.062	<u></u>	one can	13.2
Spawning -	<u>da ta</u>								
Number of bull trou redds in reach	t Redo densi: (no/ki	ty	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year	
31	3.6		35	4.1	79	82	9.7	81	
	lation data	, 0	00	,			9 • •		
		inface area)						Other spe	
Density (Cutthroat	urface area)	•	Bull tr	out		Mount White		Eastern Brk trout
Age 0		e II Age l		Age I	Age II	Age III+		_	_
0	~	0 0.6	1.6	0.1	0.9	0.7	pres	ent	absent
Blomass (² surface are	<u>~</u> 1	 D, 11 A	out.				
Age 0	Cutthroat Age I Age	e II Age I	II+ Age 0	Bull tr Age I	Age II	Age III+			
0	0	0 19	2	1	11	22			

Table 72. Stream habitat and fish population data for Ketchikan Creek Reach 1.

Stream Name	Reach number	Serial number	Reach <u>Length</u>	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Ketchikan Creek	001	DCA	3.0	North Fork	2 km above junction with trail	1284.0	junction with trail	1236.0
Ohusias Wah	itat dat	3						

Physical Physical	Habitat dat	<u>a</u>	Ave	Ave.		Valley-			
Stream <u>order</u>	Drainage area(km²)	Ave. wetted width(m)	Ave. depth for reach(m)	channe1	Valley width(m)	channel ratio		Flow characteri	stics
3	13.8	2.7	.13	5	700	80		placid	•
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low <u>flow</u>	Flow dur survey (m³/sec	pe	verage ak water emp(C)	Turbidity	Maximum pool depth(m	
U	p	low		0.03			low	0.5	W
% pool	<u>% run</u>	% riffle	% pocket- water	% class I pools	% cla: II po			class pools	% class V pools
19	70	11	0	0	0	100		0	0
% fines	%grave1	<pre>% bed mater % rubble</pre>	ial % boulder	%bedrock	D-90 (cm)	gradient	Stability <u>rating</u>		ank orm
40	50	10	0	0	14	0.5	107	r	epose
Bank Process		ank etic rial	Flood plain debris	Channel debris	% sta chan debi	nel % cove		er sno	cover- orkel ction
aggradi	ng flu	vial	low	moderate	2	0 80	80	3	0
Water che	mistry data								
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/1)	Total phos. (mg/l)	No ₃ * (mg/1)	Ca^{++} (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	κ ⁺ (<u>mg/1)</u>	50 ₄ (mg/1)
	***			apb 4486					
Spawning	data								
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	Year	
	-	****			nan wie				
Fish popu	lation data	-					Þ	Other spe	orios
Density		urface area)		0.33.4			Moun		Eastern Brk trout
Age 0	Cutthroat Age I Ag	e II Age	III+ Age 0	Bull tr Age I	Age II	Age III+	WILL	<u> </u>	STR CTOUC
29.8	4.8 1	1.5 17 ² surface ar		0	0	0	abs	ent	absent
	Cutthroat			Bull tr	out	Ann III			
Age 0	Age I Ag	e II Age	III+ Age 0	Age I	Age II	Age III+			
33	33 13	39 54	0 0	0	0	0			•

Table 73. Stream habitat and fish population data for Ketchikan Creek Reach 2.

Stream Name	Reach <u>number</u>		Reach Tribut ength of		Υ	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Ketchil Creek	an 002	DCB	1.5 North Fork		below on Creek		2 km a juncti trail	bove on with	1284.0
-									
Physical	Habitat dat	<u>a</u> Ave.	Ave.	Ave.		Valley-			
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio		Flow characteri	stics
3	****	3.0	.13	5 Flow du	50 Au	10 erage		broken Maximum	
Confine- ment	Pattern	Side channe occurenc	l low	surve (m³/se	y pea	k water	urbidity	pool depth(m	<u>,</u>
Χ	Р	1 ow	" % pocket-	0.04 % class	 % clas	s % cla	low ss %	class 0.6	% class
% pool	<u>% run</u>	3 riffle	water	I pools		ls III po	ols IV	pools	<u>V pools</u>
0	29	67 % bed mate	4 rial	0	0 0-90	8	Stability	92 8a	ink 0
% fines	%grave1	% rubble	% boulder	%bedrock	(cm)	gradient	rating) T T T
20	40	30	10	0	23	4.9	66	r	epose
Bank Process	_	ank etic <u>ria</u> l	Flood plain debris	Channel debris	% stal channe debr	el % cover		er sno	over- orkel stion
failing	flu	vial	low	low	10	30	60) 2	0
Water che	mistry data					4			
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/l)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
			400 404		1000 1000	dedys models	**		
Spawning	data			÷					
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>		Redd density (no/km)	<u>Year</u>	
nia vir	1000 1000s		***	·			***	THE MAIN	
Fish popu	lation data							Oahaa	oios
Density (no/100 m² s)				Moun		Eastern
Age 0	<u>Cutthroat</u> <u>Age I Ag</u>		III+ Age 0	Bull tr Age I	out Age II	Age III+	<u>wni te</u>	<u>efish</u>	3rk trout
1.7			.6 0	0	0	0	abs	ent	absent
<u>Biomass (</u>	grams/100 m	' surtace a	r <u>ea</u>)						
	Cutthroat		•	Bull tr					

Table 74. Stream habitat and fish population data for Ketchikan Creek Reach 3.

Stream Name	Reach number	Serial number	Reach Length	Tributar of	Upper ry reach boundar	у	- Upper elev.(m	Lower reach) boundary		Lower elev.(m)
Ketchi Creek	kan 003	DB9	3.7	North Fork	headw	aters	1483	.2 km Johnso	below n Creek	1368
Physical Stream	Habitat data	Ave.	Ave dentl		Ave. channel	Valley	Valley- channel		F1ow	
order	area(km²)	width(m)			width(m)	width(m)	ratio		characteris	tics
3	*****	2.2	.1		2	100	41		rolling Maximum	
Confine- ment	<u>Pattern</u>	Side channe occuren	2)	Average low <u>flow</u>	Flow dur survey <u>(m³/sec</u>	/ pea	erage k water mp(C)	Turbidity	pool depth(m)	. •
U	R	modera		ocket-	.02 % class	− % clas	 s % c1	low	0.9 class	% class
<u>% pool</u>	% run	% riffle		vater	I pools	II poo				V pools
10	50	30 % bed mate		0	0	10 D-90	40 %	Stability	50 Ba	O nk
% fines	%gravel	% rubble		oulder	%bedrock	(cm)	gradient	rating	fo	
30	40	29		1	0	9	3.1	90	fl	at
Bank Process	Ba gene <u>mate</u> r		Flood plair debri	1	Channel debris	% sta chann debr	el % cove		er sno	over- rkel tion
stable	e flu	vial	moder	ate	low	10	30	10	1	3
Water che	emistry data									•
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	1 %	Total phos. [mg/l]	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/l)</u>	50 ₄ (mg/1)
***		'			***			₩ ₩,	1940, 1944	**
Spawning	data									
Number of bull trou redds in reach		ty	bull redo	er of trout is in each	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
								990, 990,	**************************************	
Fish popu	ulation data								Other spec	rine
Density Age 0	(no/100 m² su Cutthroat Age I Age		111+	Age 0	Bull tr	out Age II	Age III+	Moun1 White		Eastern Brk trout
8.1		4.1	8.9	0	0	0	0	abse	ent	absent
800 0	Cutthroat	11 000	<u> </u>	Age 0	Bull tr	out Age II	Age III+			
<u>Age 0</u> 9	Age I Age 28 49		78	0 Age 0	Age I O	0	0			
7	40 4	J 4	<i>i</i> 0	U	u	Ų	U			

Table 75. Stream habitat and fish population data for Yakinikak Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)	
Yakinikak Creek	001	DCG	3.0		.1 km above Antley Creek	1353	junction with Thoma	1311	

Physical	Habitat data	Ave.	Ave.	Ave.		Valley-			
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio		Flow <u>characteri</u>	stics
5	139.1	6.0	.27	. 9	50	3		rolling Maximum	/broken
Confine- ment	Pattern	Side channel occurence	Average low flow	Flow du surve (m³/se	y pea	verage ik water emp(C)	Turbidity	pool depth(m	<u>.</u>
E	Р	low	~- % pocket-	0.95 % class	z clas	_ ~	low lass %	1.4 class	% class
% pool	% run	% riffle	water_	I pools	II poo			/ pools	V pools
8	44	39 % bed mater		6	8 D-90	_% 2	Stability	61 88	O ink
% fines	%gravel	% rubble	% boulder	%bedrock	(<u>cm)</u>	gradient	rating	***************************************	<u>orm</u>
10	20	20	20	30	48	1.4	64	re	pose
Bank <u>Process</u>	Ba gene mater		Flood plain debris	Channel debris	% sta chann debr	el % cove		er sno	over- orkel tion
stable	flu	vial	Tow	moderat	e 55	10	10		0
Water cher	nistry data								
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbon (mg/l)	Total phos. (mg/1)	No ₃ " (mg/l)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/l)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
								***	***
Spawning o	<u>data</u>								
Number of bull trout redds in reach	t Redd densit (no/km	y	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year	
			-						
Fish popul	lation data								
Density (r	no/100 m² su	rface area)					Moun	Other spe	cies Eastern
Age O A	Cutthroat Age I Age	II Age I	II+ Age 0	Bull tr Age I	out Age II	Age III+		efish	3rk trout
0	0 0) () Surface are	0 <u>a</u>)	0	0	0	abs	ent :	absent
Age 0 A	Cutthroat ige I Age	II Age I	II+ Age 0	Bull tr Age I		Age III+			

Table 76. Stream habitat and fish population data for Yakinikak Creek Reach 2.

Stream Name	Reach number	Serial number	Reach Length	Tributa of	Upper ry reach boundar	-y	Upper elev.(m	Lower reach boundary		Lower elev.(m)
Yakinik Creek	ak 002	DCF	3.2	North Fork	.1 km Seemo		1408	1 km a Antley	bove Creek	1353
Physical Stream order 4 Confine- ment	Habitat dat. Drainage area(km²) Pattern	Ave. wetted width(m) 10.0 Sid chann occuren		h for ch(m)	Ave. channel width(m) 10 Flow du surve (m³/se	y pe	Valley- channel ratio 15 verage ak water emp(C)	•	Flow characteri broken/ Maximum pool depth(m	rolling
Χ	Р	low		 ocket-	0.67	% cla		low lass %	1.2	% class
<u>% pool</u>	% run	% riffle		<u>vater</u>	1 pools		***************************************		pools	<u>V pools</u>
12	40 .	40 % bed mat		8	5	25 0-90	× .	Stability	_	0 ank
% fines 20	<u>%grave1</u> 30	<u>% rubb1</u> 25	<u>e 3.1</u>	oulder 24	%bedrock 1	(cm) 4	gradient 1.7	<u>rating</u> 79		om epose
Bank Process	Ba	ank etic	Floor plair debr	j	Channel debris	% stackari chan debi	able nel % cove	er- % cove	er sn	cover- orkel ction
failing	fluv	<u>-</u>	low		moderat	e 31	0 1	1		0
•	mistry data									-
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbo (mg/l		Total phos. (mg/l)	No 3 (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ (<u>mg/1)</u>	SO. (mg/1)
	***							***	- -	
Spawning	<u>data</u>									
Number of bull trou redds in reach		ty	bul' red	er of I trout is in ∍ach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year	
******		-				™ •■			***	
	no/100 m ² s Cutthroat Age I Age		<u>a</u>) e <u>III+</u>	Age 0	Bull t Age I	rout Age II	Age III+	Mount White		ecies Eastern Brk trout
0	O grams/100 m	0 2 surface	O area)	0	0	0	0	abse	nt	absent
DIUMASS (Cutthroat				- Bull t					-
Age 0		<u>e II Aq</u>	e III+	Age 0	Age I	Age II	Age III+			
0	0	0	0	0	0	0	0			

Table 77. Stream habitat and fish population data for Yakinikak Creek Reach 3.

Stream Name	Reach number	Serial number	Reach <u>Length</u>	Tributar of	Upper y reach boundary	<u> </u>	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Yakinik Creek	ak 003	DCE	3.3	North Fork	top B Beave		1457	.1 km Seemo		1408
							·			
Physical	<u>Habitat dat</u>	<u>a</u> Ave.	Ave	,	Ave.		Valley-			
Stream <u>order</u>	Drainage area(km²)	wetted width(m	depti	for (channe1	Valley width(m)	channel ratio	<u>.</u>	Flow characteri	stics
3		7.0	1.3	30	10	200	20	r		swirling
Confine- ment	<u>Pattern</u>	Si chan occure	ne 1	lverage low <u>flow</u>	Flow dur survey (m³/sec	pea	verage ak water emp(C)	Turbidity	Maximum pool depth(m	<u>,</u>
Х	Р	low			0.42	w		low	1.7	% class
^ % pool	<u>% run</u>	% riffl	~ 1	ocket- ater	% class I pools	% clas			pools	V pools
8	50	30 % bed ma		12	5	5 D-90	_% 30	6 Stability	0 8	o ank
% fines	%gravel	% rubb	le % t	oulder	%bedrock	(cm)	gradient	rating	<u>f</u>	orm
30	60	5		5	0	20	1.5	95	rep	ose
Bank Process		ank etic <u>ria</u> l	Flood plair debri	1	Channel debris	% sta chanr <u>debr</u>	iel % cove		er sno	cover- orkel ction
failing fluvial moderat					moderate	e 21	0 10	20		0
Water chemistry data										
Cond. (umohs/ cm)	Alk. (mg/1)	Tota carb (mg/	on	Total phos. mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/l)	Na ⁺ (mg/1)	κ ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
-							. ***			
Spawning data										
Number of bull trou redds in reach		ty	bull red	per of trout is in each	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km)	Year	
477		-	-					***		
Fish population data Other species										
Density (no/100 m² surface area)								Mountain Eastern Whitefish Brk trout		
Cutthroat Bull tro Age 0 Age I Age II Age III+ Age 0 Age I							Age III+	MILL	. F [345	JIN COUR
0	0	0	0	0	0	0	0	abse	ent	absent
Biomass (grams/100 m² surface area)										
Cutthroat Bull trout Age 0 Age I Age II Age III+ Age 0 Age I Age III Age III+										
0	0	0	0	0	0	0	0			

Table 78. Stream habitat and fish population data for Yakinikak Creek Reach 4.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)	
Yakinikak Creek	004	DCD	3.6		junction with Nokio Creek	1506	top Big Beaver Dams	1457	

<u>Physical</u>	Habitat data					W. 3.3		
Stream	Draiñage	Ave. wetted	Ave. depth for	Ave. channel	Valley	Valley- channel		Flow
<u>order</u> 3	area(km²)	<u>width(m)</u> 8.0	reach(m)	<u>width(m)</u> 13	width(m) 63	<u>ratio</u>	-	characteristics olling/broken
J		Side	Average	Flow dur		verage	•	Maximum
Confine- ment	Pattern	channel occurence	low flow	survey (m³/sec	/ pea	nk water	Turbidity	pool depth(m)
Χ	С	1ow	***	0.46		_	low	1.4
% pool	% run	% riffle	% pocket- water	% class I pools	% clas			class % class pools
12	50	20	18	4	20		3	0 0
% fines	%gravel	% bed mater % rubble	ial % boulder	%bedrock	D-90 (cm)	% gradient	Stability rating	Bank form
30	<u>*910761</u> 50	10	9	1	57	1.3	108	repose
50				*	% sta		100	% cover-
Bank	gene		Flood plain	Channel	chann	el % cov		er snorkel
Process	mater		debris	debris	debr			
failing	flu۱	/ial	moderate	moderat	e 20	1	30	11
Water cher	nistry data							
Cond. (umohs/	Alk.	Total carbon	Total phos.	No ₃	Ca ⁺⁺	Mg ⁺⁺	Na ⁺	K ⁺ SO ₄
Cm)	(<u>mg/1)</u>	(mg/1)	(mg/1)	(mg/1)	(mg/1)	(mg/1)	<u>(mg/1)</u>	$(\underline{mg/1})$ $(\underline{mg/1})$
		***	-tors into		269 1000	w/s		
Spawning	data		-					
Number of			Number of			Number of	5 _44	·
bull trou redds in	densit	:y	bull trout redds in	Redd density		bull trout redds in	Redd density	
reach	(no/km	<u>) Year</u>	reach	(no/km)	Year	reach	(no/km)	<u>Year</u>
***		***				↔		
Fish popu	lation data							aut
Density (no/100 m² su	rface area)					Mount	
Age 0	<u>Cutthroat</u> Age I Age	II Age	III+ Age 0	Bull tr Age I	out Age II	Age III+	White	fish 3rk trout
0		4 5.7		0	0	0	abse	ent absent
Biomass (grams/100 m²	surface are	<u>ea</u>)					
	Cutthroat		TTT. 1	Bull tr		Acc 111:		
Age 0		II Age		Age I	Age II	Age III+		
0	0 5	5 178	0	0	0	0		

Table 79. Stream habitat and fish population data for Yakinikak Creek Reach 5.

Stream Name	Reach number		each Tribut ength of	Upper ary reach boundar	- Y	Upper elev.(m	Lower reach boundary		Lower elev.(m)
Yakinika Creek	ak 005	DCC 2	.7 North Fork	n headwa	iters	1801	junctio Nokio (on with Creek	1506
Physical Stream order	Habitat dat Drainage area(km²)	Ave. wetted width(m) 3.4	Ave. depth for reach(m) .15	Ave. channel width(m)	Valley width(m)	Valley- channel ratio		Flow characteri SWirling	stics J/broken
Confine- ment F	Pattern N	Side channel occurence		Flow dun survey (m³/sec 0.22	y pe	verage ak water emp(C)	<u>Turbidity</u>	Maximum pool depth(m)	•
% pool	% run	low % riffle	% pocket- water	% class I pools	% cla II po			class	% class V pools
5 % fines	20 %grave1	50 % bed mater % rubble	25 ial % boulder	1 %bedrock	18 D-90 (cm)	20 gradient	Stability rating		O nk irm
26	42	15	15	2	33	10.7	80	rep	ose
Bank <u>Process</u>		ank etic <u>ria</u> l	Flood plain debris	Channel debris	% sta chan debi	nel % cove		ኧ c er sno	over- rkel tion
stable	fluv	'ial	1ow	high	20	30	20	2	8
Water cher	nistry data		v.						
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/1)	Total phos. (mg/l)	No ₃ (mg/1)	Ca ⁺⁺ (mg/l)	Mg ⁺⁺ (mg/1)	Na [†] (mg/1)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
***		***				বল ক্লক	400 300		***
Spawning o	<u>da ta</u>								
Number of bull trout redds in reach	t Redo densii (no/kr	ty	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
			**						
Fish popul	lation data							045	
	Cutthroat	urface area) E II Age	III+ Age O	Bull tr Age I	out Age II	Age III+	Mount White		Eastern Brk trout
0	0 0.	1 0.	7 0	0	0	0	abse	ent	absent
Biomass (g		surface ar	<u>ea</u>)						
Age 0 A	Cutthroat lge I Age	<u>II Age</u>	111+ Age 0	Bull tr	Age II	Age III+	•		

Table 80. Stream habitat and fish population data for Tuchuck Creek Reach 1.

Stream Name	Reach number		Reach Tribut ength of		<u>y</u>	Upper elev.(m)	Lower reach boundary		Lower elev.(m)
Tuchuc Creek	k 001	DCH 6	.5 North Fork	n headwa	ters	1603	mouth campgr	Tuchuck ound	1496
Physical Stream order 3	Drainage area(km²)	Ave. wetted width(m) 4.0	Ave. depth for reach(m) .19	Ave. channel width(m) 8	Valley width(m)	Valley- channel ratio	_	Flow characteris roken/ro	
Confine- ment X	Pattern N % run	Side channe occurenc low % riffle	l low	Flow dui survey (m³/sec 0.23 % class I pools	y pea	ss % cla		Maximum pool depth(m) 1.0 class pools	% class
2 fines	40 %gravel	50 % bed mate % rubble	💈 boulder	1 %bedrock	9 D-90 (cm)	12 gradient	Stability rating	fo	O ink orm
26 Bank Process	gen	14 Jank Jetic Jeria	13 Flood plain debris	Channel debris	36 % sta chanr debr	iel % cover		% c er sno	over- orkel tion
failin	g flu emistry data		moderate	moderate	30	20	30		20
Cond. (umohs/	Alk. (mg/l)	Total carbon (mg/l)		No ₃ - (mg/l)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/l)	K ⁺ (<u>mg/1)</u>	SO ₄ (mg/1)
			unis -dan					***	Am-
Number or bull tropredds in reach	f ut Rec	ity	Number of bull trout redds in reach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	Year	
Fish pop	 ulation data	<u> </u>			wa m				
Density Age 0	(no/100 m² s Cutthroat Age I Ac]) !	Bull to O Age I	rout Age II	Age III+	Mount White		Eastern Brk trou

Density	(no/100	m ² surface	area)					Mountain	Eastern
-	Cutti	nroat			Bull t	rout		Whitefish	3rk trout
Age 0	Age I	Age II	Age III+	Age 0	Age I	Age II	Age III+		
2.3	2.8	6.9	9.3	0	0	0	0	absent	absent
Biomass	grams/1	lOO m² surf	ace area)						
	Cutth	roat			Bull t				
Age 0	Age I	Age II	Age III+	Age 0	Age I	Age II	Age III+		

KISHENEHN CREEK DRAINAGE

KISHENEHN CREEK REACH I

Channel Characteristics: Date Surveyed: 8-5-80 (Figure 36)

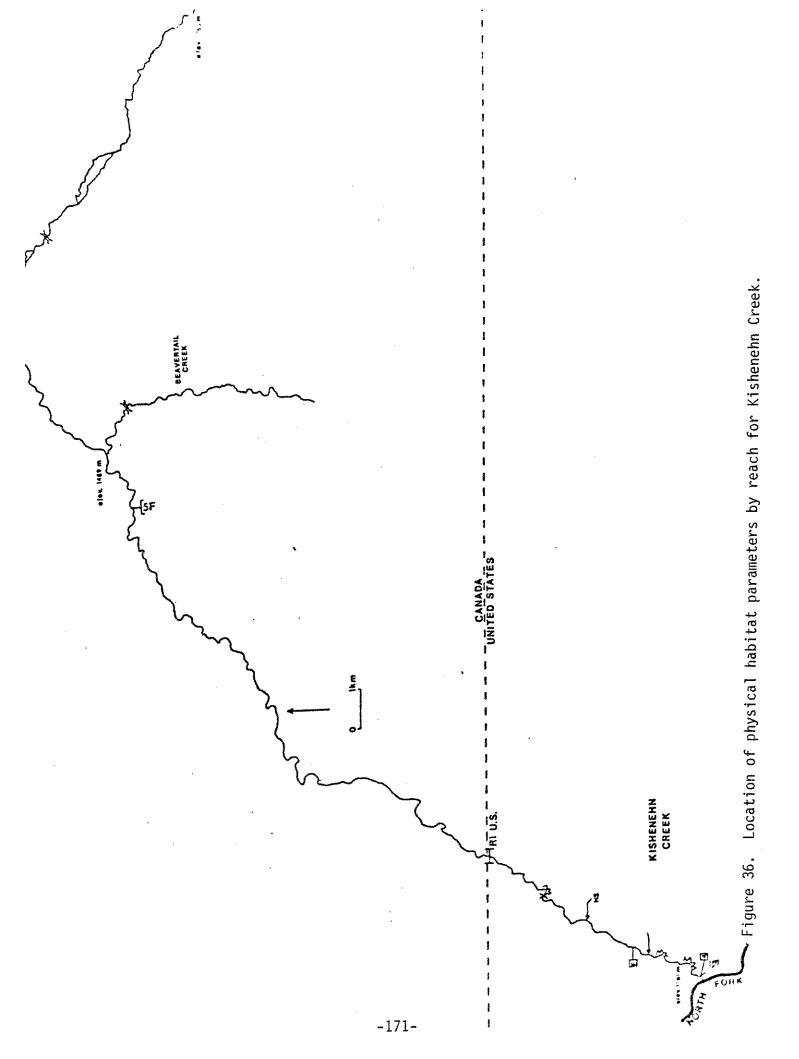
Kishenehn Creek Reach I is the only reach of this creek in the U.S. It flows from the U.S.-Canada border to the North Fork River and is a third order tributary. The average wetted width was 24 m and the average depth was 33.5 cm. Reach I contained 55% run and 45% pocketwater. Channel debris was low, with 70% being stable. Overhanging vegetation provided little bank cover and instream cover was moderate. Stream gradient was 1.5% and the D-90 was 35 cm. Three major slump areas were observed.

Valley Characteristics:

The upper bank slope gradient was 30-40% and the valley to channel ratio was 2:1. The average valley width was 150 m. Reach I was occasionally confined and had an irregular meandering stream pattern. The upper end of the Kishenehn drainage has been heavily logged although a 75 m buffer strip remains on each bank.

<u>Fish Populations</u>: (Figure 37)

Bull trout, westslope cutthroat trout, mountain whitefish and sculpins were observed in Reach I. Kishenehn Creek was used extensively by migratory westslope cutthroat and to a moderate extent by adfluvial bull trout. A barrier to adfluvial migration is located 2 km below the mouth of Beavertail Creek in Canada.



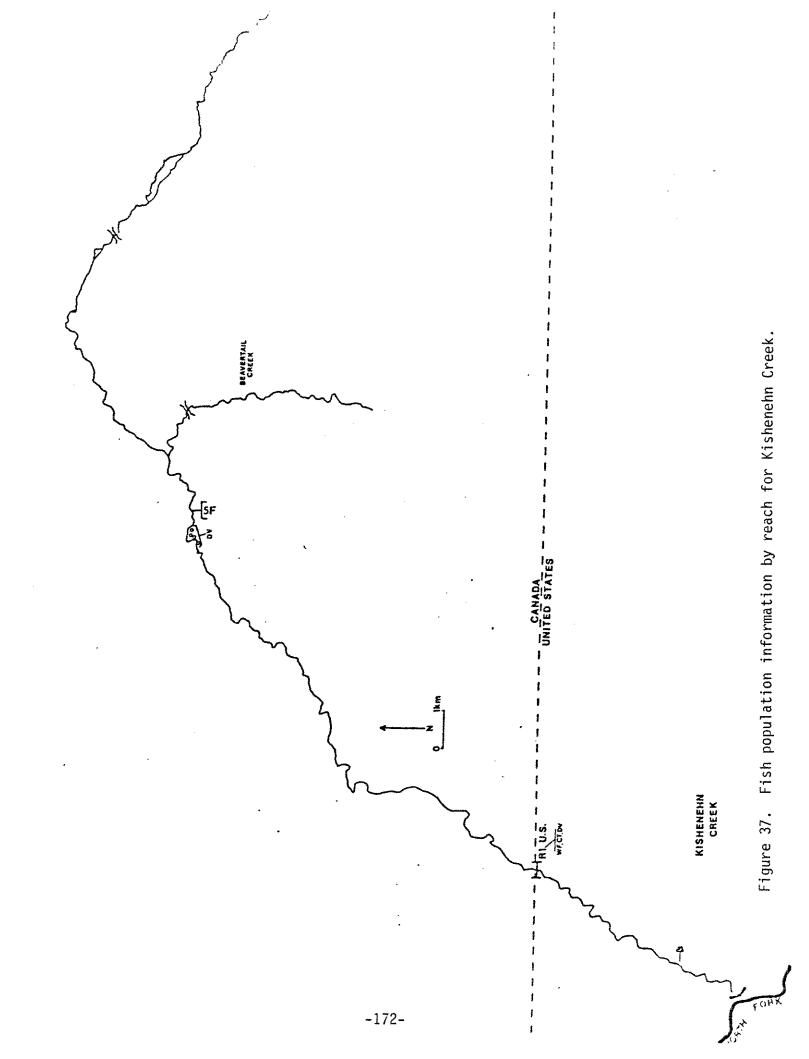


Table 81. Stream habitat and fish population data for Kishenehn Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributary of	Upper reach boundary	Upper elev.(m)	Lower reach boundary	Lower elev.(m)
Kishenehn Creek	001	DB0	8.7	North Fork	Canadian border	1307	mouth	1179

Physical Stream order	Habitat dat Drainage area(km²)	Ave. wetted width(m)	Ave. depth for _reach(m)	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	:	Flow characteristics	
3	17.7	14.0	. 34	76	150	2	rolling		
Confine- ment	<u>Pattern</u>	Side channel occurence	Average low flow	Flow dur survey (m³/sec	, pe	verage ak water emp(C)	Turbidity	Maximum pool depth(m)	
χ	C	high	1.39 % pocket-	1.90 % class	% clas			1.5 class % class pools V pools	
<u>% pool</u>	% run	% riffle	water	I pools	II poc				
0	55	45 % bed mater	0	0	50 p-90	5(%)	O Bank	
% fines	%gravel	% rubble	% boulder	% <u>bedrock</u>	<u>(cm)</u>	gradient	rating	<u>form</u>	
23	37	33	7	0	35	1.5	103	repose	
Bank Process		ank etic <u>ria</u> l	Flood plain debris	Channel debris	% sta chanr debr	nel % cov		% cover- er snorkel	
failing	flu	vial	moderate	low	70	10	10	13	
-	mistry data								
Cond. (umohs/ cm)	A1k. (mg/1)	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ SO _n (mg/1)	
112	70	0.46	.005	0.01	24.9	.073	1.6	5.1	
Spawning	data			·					
Number of bull trou redds in reach		ty	Number of bull trout redds in reach	Redd density (no/km)	Year 	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
	lation data							Other species	
<u>Density (</u>		urface area)					Mount White	ain Eastern	
Age 0	Cutthroat Age I Ag	e II Age	III+ Age O	Bull tr Age I	Age II	Age III+	MILI CO	:113tt 91 K 61 000	
0	0	0 0		0	0	0	pre	esent absent	
<u> Biomass (</u>	grams/100 m	² surface ar	<u>ea</u>)				-		
	Cutthroat		·	Bull tr					
Age O	Age I Ag	<u>e II Age</u>	<u> </u>	Age I	Age II	Age III+			
0	0	0 0	0	0	0	0			

SPRUCE CREEK DRAINAGE

SPRUCE CREEK REACH I

Channel Characteristics: Date Surveyed: 7-28-80 (Figure 38)

Reach I of Spruce Creek is a third order tributary which originates in Canada. Average wetted width was 5.3 m and the average depth was 18.1 cm. This reach contained 20% run and 80% riffle with no pools or pocket water. Debris presence was variable throughout the reach and was 70% stable. There was a moderate amount of instream and bank cover present. The channel gradient was 1.8% with a D-90 of 19.3 cm. The lower end of Spruce Creek flowed through a cottonwood flat and became intermittent during time of low flow.

Valley Characteristics:

The upper bank slope gradient was less than 30% and the valley to channel ratio was 99:1. The average valley width was 800 m. This reach had an unconfined channel.

Fish Populations: (Figure 39)

Cutthroat trout and sculpins were present in this reach.

SPRUCE CREEK REACH II

Channel Characteristics: Date Surveyed: 7-29-80 (Figure 38)

Reach II of Spruce Creek is a third order tributary which originates in Canada. Average wetted width was 5.8 m and the average depth was 21.4 cm. The reach had 25% run, 70% riffle and 5% pocketwater. Channel debris was low and 30% was stable. Bank cover was low and instream cover was generally moderate. The channel gradient was 2.6% and the D-90 was 38.3 cm.

Valley Characteristics:

The upper bank slope gradient was 30-40%. This reach had a valley to channel ratio of 7:1 with an average valley width of 100 m.

Fish Populations: (Figure 39)

Cutthroat trout were observed in this reach at a density of 9.8 trout per $100~\text{m}^2$.

SAGE CREEK DRAINAGE

SAGE CREEK REACH I

Channel Characteristics: Date Surveyed: 7-28-80 (Figure 38)

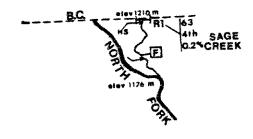
Reach I is a fourth order tributary. Average wetted width was 16.4 m and the average depth was 29 cm. This reach had 66% run, 24% riffle and 10% pools. It contained a low amount of debris and 10% was stable. There was only a trace of bank cover and instream cover was moderate. The channel gradient was 0.2% and the D-90 was 21 cm.

Valley Characteristics:

The upper bank slope gradient was less than 30% and the valley to channel ratio was 3:1. The average valley width was 150 m with an unconfined channel.

Fish Populations: (Figure 39)

Cutthroat trout, mountain whitefish and sculpins were observed in Reach I. Cutthroat were the predominant species with a density of 11.1 cutthroat per $100~\text{m}^2$. Juvenile bull trout were not observed in electrofishing or snorkeling transects although spawning by adfluvial bull trout has been documented.



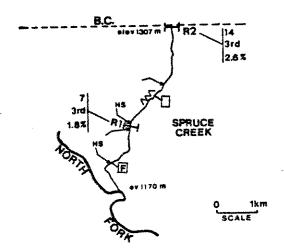


Figure 38. Location of physical habitat parameters by reach for Spruce Creek and Sage Creek.

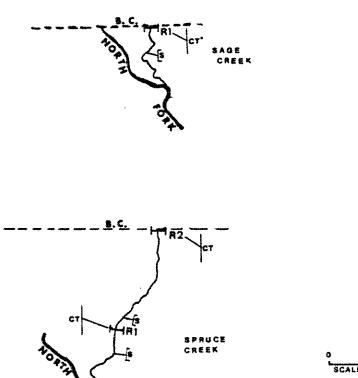


Figure 39. Fish population information by reach for Spruce Creek and Sage Creek.

Table 82. Stream habitat and fish population data for Spruce Creek Reach 1.

Stream Name	Reach number		leach .ength	Tributa of	ry re	per each oundary	,		Upper elev.(ær ich indary	·····	Lower elev.(m)
Spruce Creek	001	DBP	2.0	North Fork		km ι outh	up fr	om	1216	mc	outh		1170.0
Physical	Habitat data	a											
Stream order	Drainage area(km²)	Ave. wetted width(m)		for h(m)	Ave. channe width	e l	Valley width(n		Valley- channel ratio			Flor characte	
3	7.5	5.8	.18	}	7		800		99		S	wirlin	g
Confine- ment	<u>Pattern</u>	Side channe occurence	1	lverage low flow	5	ow dur survey n³/sec	•	Aver peak temp	water	Turbi	iity	Maximu pool depthi	
U	P	modera [.]	te "		٥.	.07	<i>a</i> c		-	low	ov.	0.7	0/ 3
<u>% pool</u>	% run	% riffle	<u></u>	ocket- ater		lass ools		lass pools		lass pools		class pools	% class V pools
0	20	75	5		C)		0		0	• • •	0	100
% fines	%gravel	<pre>% bed mater % rubble</pre>		oulder	%bed	rock	D-90 (cm)		% gradient	Stab rai	lity ing		Bank form
15	55	30		0	0		19		1.8	95			repose
Bank <u>Process</u>	Ba g ene mater		Flood plain debri		Chann debr		ch	stabl annel ebris	% cov		% cove	er s	cover- norkel ection
failing	fluv	ial	low		low			70	15		17		13
Water chem	istry data							•					
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)		Total phos. mg/l)	No ₃ (mg/1		Ca ⁺⁺ (mg/1)	<u>)</u>	Mg ⁺⁺ (mg/1)		a+ a/1)	K ⁺ (<u>mg/1</u>	50. (mg/1)
***						ı				-			
Spawning d	a ta												•
Number of bull trout redds in reach	Redd densit (no/km	y	bull redd:	er of trout s in ach	den:	edd sity /km)	<u>Year</u>	b r	umber of ull trout edds in reach	Red densi (no/k	ty	<u>Year</u>	
Fish popul	ation data												
Density (n	o/100 m² sui	rface area)							-		Mount		Eastern
Age 0 A	<u>Cutthroat</u> ge I <u>Age</u>	II Age	111+	Age 0	8u Age	I troi	ut Age II	A	ge III+		<u>White</u>	fish	Brk trout
O Biomass (g	0 1. rams/100 m²			0	0		0		0		pre	sent	absent
	Cutthroat	7	777	8		1 trou			-				
Age 0 A	ge I Age	II Age	111+	Age 0	Age	<u> </u>	∖ge II	<u> 49</u>	je III+				
0	0 12	81		0	0		0		0				

Table 83. Stream habitat and fish population data for Spruce Creek Reach 2.

Stream Name	Reach number		each Tributa ength of	Upper ary reach boundar	у	Upper elev.(m	Lower reach m) boundary	Lower elev.(m)
Spruce Creek	002	DBS 3	3.4 Nort Fork	h Canadi border	-	1307	1 km up 1 mouth	from 1216
Physical	Habitat data	a. Ave.	Ave.	Ave.		Valley-		
Stream <u>order</u>	Drainage area(km²)	wetted width(m)	depth for reach(m)	channel width(m)	Valley width(m)	channel ratio		Flow acteristics
3		5.1	.21	14	100	7	brok	cen/rolling
Confine- ment	Pattern	Side channel occurence		Flow dur survey (m³/sec	, pea	erage k water mp(C)		aximum pool epth(m)
Х	Р	high	 % pocket-	0.12 % class	% clas		low C).9 s %class
% pool	% run	% riffle	water	I pools	II poo	ls III	pools IV poo	
0	31	62 % bed mater	7 ial	6	18 D-90	£	15 31 Stability	O Bank
% fines	%gravel	% rubble	% boulder	%bedrock	(cm)	gradient	rating	form
20	40	30	10	0	38	2.6	106	repose
Bank Process	Ba gene <u>mate</u> r		Flood plain debris	Channel debris	% sta chann debr	el % cove		% cover- snorkel section
failing	j fluv	/ial	1 ow	low	30	3	3	19
Water cher	mistry data							
Cond. (umohs/ cm)	Alk. (<u>mg/l)</u>	Total carbon (mg/l)	Total phos. (mg/l)	No ₃ - (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K ⁺ SO ₄ (mg/1)
	***	***		AM 180. A				
Spawning	data							
Number of bull trou- redds in reach	t Redo densit (no/km	у	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	Number of bull trout redds in reach	Redd density (no/km) Yea	<u>ur</u>
		700 with	dire see		-	wa +==		-
· · · · · · · · · · · · · · · · · · ·	lation data						Λ+h	mer species
Density (no/100 m² su	rface area)		Bull tr	A*		Mountain Whitefish	Eastern
		II Age		Age I	Age II	Age III+	Will FC1 121	<u> </u>
	.2 5. grams/100 m²	8 1.8 surface are		0	0	0	absent	absent
	Cutthroat		············	- Bull tr	out			
Age 0		II Age	III+ Age O	Age I	Age II	Age III+		
0	15 7	0 56	0	0	0	0		

Table 84. Stream habitat and fish population data for Sage Creek Reach 1.

Stream Name	Reach number	Serial number	Reach Length	Tributar of	Upper y reach boundar	Y	Upper elev.(m)	Lower reach boundary	Lower elev.(m	<u>ı)</u> .
Sage Creek	001	DBT		North Fork	Canadi border		1210	mouth	1195	õ
Physical	Habitat dat	a								
Stream order	Drainage area(km²)	Ave. wetted width(m)	Ave depth reacl	for	Ave. channel width(m)	Valley width(m)	Valley- channel ratio	<u>cl</u>	Flow haracteristics	
4	6.2	16.4	.29		63	150	3	SV	virling/rolli Maximum	ing
Confine- ment	<u>Pattern</u>	Sid chann <u>occuren</u>	el	verage low flow	Flow dur survey (m³/sec	, pea	erage k water mp(C)	Turbidity	pool depth(m)	
U	Р	high		0.90 ocket-	1.35 % class	 % clas	- s % cla		1.6 lass % class	
<u>% pool</u>	% run	% riffle		ter	I pools	II poo		******	oools <u>V pools</u>	
10	62	24 % bed mat			40	0-a0 0-a0	0	40 Stability	Bank	
% fines 25	<u>%gravel</u> 50	% rubb1 25	<u>e %bo</u> O	oulder	%bedrock O	(cm) 21	gradient 0.2	rating 101	<u>form</u> flat	
25					V	ži % sta		101	% cover-	
Bank <u>Process</u>		ank etic <u>ria</u> l	Flood plain debris	<u>.</u>	Channel debris	chann debr	el % cover		r snorkel	
failing Water che	flu mistry data	vial	moder	ate	low	10	3	3	19	
Cond. (umohs/ cm)	Alk. (mg/l)	Total carbo (mg/l	n [otal hos. ng/l)	No ₃ * (mg/1)	Ca ⁺⁺ (mg/1)	Mg ⁺⁺ (mg/1)	Na ⁺ (mg/1)	K [†] 50 ₄ (<u>mg/1) (mg/1</u>	<u>l)</u>
115	92	0.71	.0	06	0.01	29.4	.078	1.8	3.4	
Spawning	data									
Number of bull trou redds in reach		ty	bull redd:	er of trout s in ach	Redd density (no/km)	Year	Number of bull trout redds in reach	Redd density (no/km)	<u>Year</u>	
0	0	80								
Fish popu	lation data								Other species	
<u>Density (</u>	no/100 m ² s		<u>a</u>)		Bull tr	out		Mounta Whitei	in Eastern	
	Cutthroat <u>Age I Ag</u>).1	<u>e II Ag</u>	<u>e III+</u> 1.0	<u>Age 0</u>	Age I	Age II	Age III+ O	abse		
Biomass (grams/100 m	² surface	area)		. .					
Age 0	Cutthroat Age I Ag		e III+	Age 0	Bull tr Age I	out Age II	Age III+			
1	1	0	343	0	0	0	0			

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 Montana Department of Fish, Wildlife and Parks. Kalispell, Montana.

STATE CODE NUMBERS BY CREEK

08-1160 Canyon Creek

08-4640 McGinnis

08-3820 Kimmerly

08-0680 Big Creek

08-3240 Hallowatt

08-6400 Skookoleel

08-7660 Werner

08-5020 Nicola

08-3840 Kletomus

08-4000 Langford

08-1110 Camas Creek

08-2390 Dutch

08-0210 Anaconda Creek

08-4270 Logging Creek

08-1620 Coal Creek

08-4580 Mathias

08-6620 South Fork Coal

08-1980 Dead Horse

08-1840 Cyclone

08-5650 Quartz Creek

08-1810 Cummings

08-4920 Moran Creek

08-3340 Hay Creek

08-0830 Bowman

08-0110 Akokala Creek

08-5370 Parke

08-4275 Long Bow

08-5760 Red Meadow

08-4900 Moose Creek

08-2810 Ford Creek

08-7700 Whale Creek

08-6320 Shorty

08-3830 Kintla Creek

08-7330 Trail Creek

08-3790 Ketchican

08-7940 Yakinikak

08-7400 Tuchuck

08-6990 Starvation Creek

08-3835 Kishenehn Creek

08-6845 Spruce Creek

08-6030 Sage Creek