

951-021.

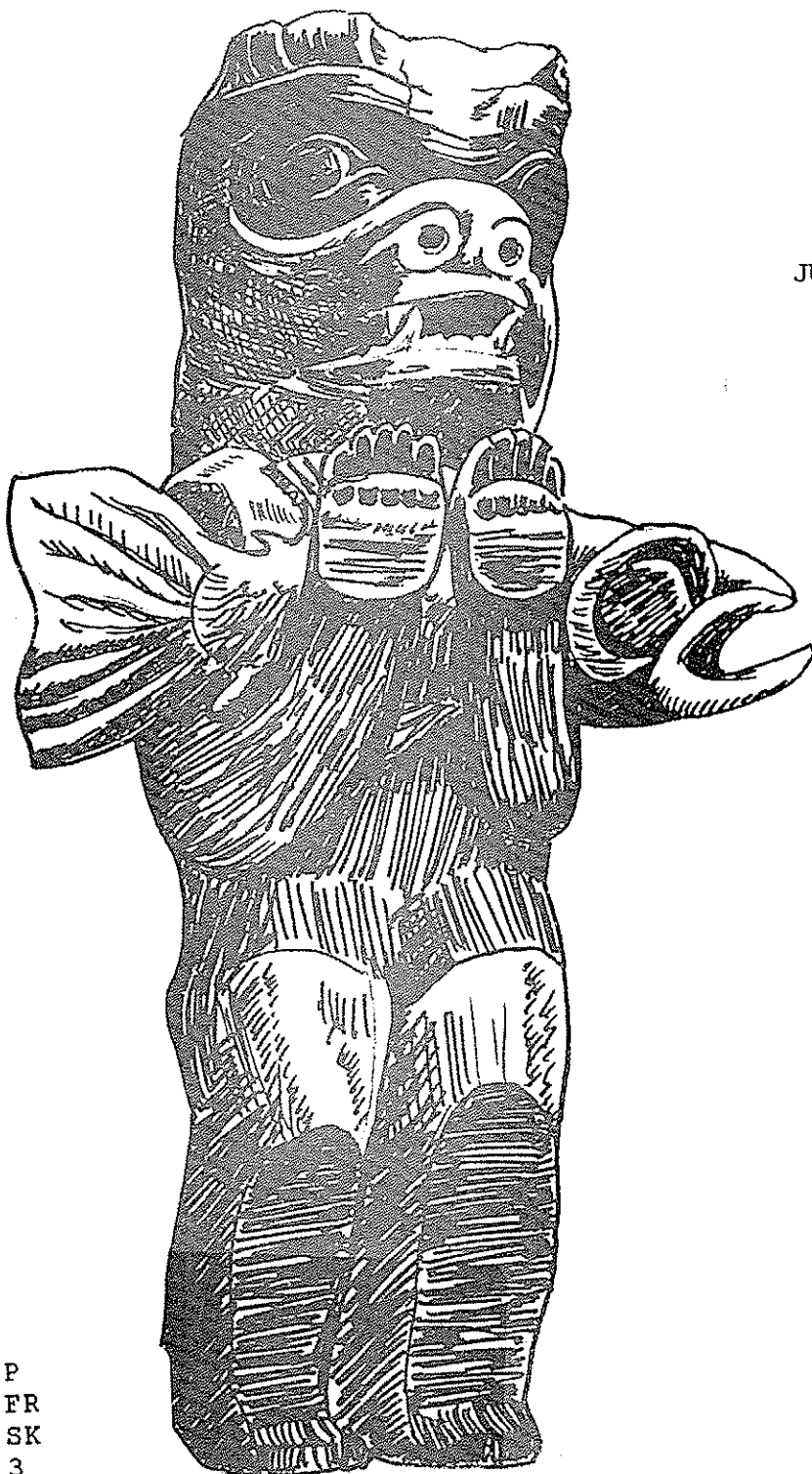
Fisheries Management

Skeena Region



British
Columbia
**Fish &
Wildlife**
Branch

*DO NOT REMOVE
MARKET*



PRELIMINARY SURVEY OF
JUVENILE SALMONID REARING HABITAT
SUMMER 1976
UPPER KITSUMKALUM RIVER
AND TRIBUTARIES

SK-3

by

M. Morris
B. Eccles

Fish & Wildlife Branch,
Smithers, B. C.

76-3

P
FR
SK
3
c. 1 mm

BJDD

mm
P/FR/SK/3
C.1

P/FR/SK/3
MORRIS, M.
PRELIMINARY SURVEY OF
JUVENILE SALMONID REARING
BJDD c. 1 mm SMITHERS

PRELIMINARY SURVEY OF
JUVENILE SALMONID REARING HABITAT
SUMMER 1976

UPPER KITSUMKALUM RIVER
AND TRIBUTARIES

by

M. Morris
B. Eccles

Fish & Wildlife Branch
Smithers, B.C.

TABLE OF CONTENTS

List of Appendices	ii
Introduction	1
Methods	2
Description of Study Area	5
Summary of Results	5
1. Maroon Creek	5
2. Wesach Creek	5
3. Douglas Creek	5
4. Dry Creek	6
5. Clear Creek	6
6. Un-named Creek, Clear Creek Road	7
7. Un-named Creek, Mile 29 Cedar Road	8
8. Cedar River	8
9. Hadenschild Creek	9
10. Little Cedar River	10
11. Upper Kalum River	10
12. Kalum Lake	11
Discussion	12
Acknowledgements	15
Bibliography	16

LIST OF APPENDICES

Appendix	Page
A. Gee Trapping Results Dry Creek, Maroon Creek, Douglas Creek, Un-named Creeks	17
B. Gee Trapping Results Clear Creek	19
C. Gee Trapping Results Cedar River	22
D. Gee Trapping Results Hadenschild Creek	26
E. Gee Trapping Results Little Cedar River	29
F. Upper Mainstem Kalum River (Beaver River)	31
F-1. Gee Trapping Results	
F-2. Electroshocking Results	
G. Gee Trapping Results Kalum Lake	34
H. Figures	36

INTRODUCTION

A preliminary study of the juvenile salmonid populations of the Upper Kalum River and its tributaries was conducted during August 1976.

The objectives of the study were:

- to locate and describe preferred rearing habitat of juvenile salmonids in the Kalum River above Kalum Lake and in the tributaries above the lake .
- to collect samples of rainbow, cutthroat and Dolly Varden for life history study.
- to assess the fisheries value of the Kalum and its tributaries in terms of salmonid rearing habitat

Sampling was carried out on the Beaver River (upper Kalum River), the Cedar River, Clear Creek, Little Cedar, Had-
enschild Creek, Maroon Creek, and Douglas Creek. From
the samplings, 50 rainbow, 20 cutthroat and 50 Dolly Var-
den were collected for life history study.

METHODS

Several methods were used to observe and sample juvenile salmonids in different rearing habitats. The method most frequently used was Gee trapping, with roe for bait. Traps were set where the water velocity was not over about 1.5 meters per second and where the depth was between 0.25 meters and 2 meters.

Another method used was electroshocking with a Smith Root VII Electroshocker. Shock sites on the Kalum were on side channels of the upper mainstem. For safety's sake, electroshocking was always done where the water was flowing less than 1 meter per second with a maximum depth of less than 1 meter. When fish were stunned by the shock, they were scooped up in a "kitchen" sieve on a long pole which proved to be easier to manouever than a large dip net. A small mesh beach seine was tied across the stream to catch the escapees.

In the lake, a gill net was set from the shore. Fish were captured in two hour sets as well as overnight. Most of the fish that were caught could be released.

There is easy access to much of the Kalum River system from the network of logging roads in the valley. The mainstem from Cedar River to the lake was surveyed from a riverboat. The upper Kalum above the Nass Road bridge was reached by helicopter.

DESCRIPTION OF THE STUDY AREA

The Kitsumkalum River (also called the Kalum) is a major tributary of the Skeena River which it joins at Terrace, B.C. The Kalum watershed drains 1200 square miles (M.E.A.T. 1975) and runs north-south to Kalum Lake 18 miles north of Terrace. Kalum Lake is the largest on the Kalum system and is 7 miles long and over 400 feet deep. Above the lake, the main river runs approximately west to east and has a low gradient. The glacial headwaters of the system give the whole river and the lakes, a milky green colour which rarely clears. The largest tributaries of the upper Kalum are the Cedar River and Clear Creek, which flow into the river near its delta at the north end of the lake. Below the lake, the Kalum River is confined to a definite channel between valley bench land. There are canyons at mile 5 and 7 which are obstacles but not barriers to fish movement.

Soils in the valley are glacial tills overlying sedimentary and volcanic bedrock. (M.E.A.T. 1975) The valley was carved by glaciers during the last ice age which left gravel deposits as the ice retreated. The present river valley was formed as the river eroded through the loose gravel deposits, leaving the flat bench lands.

Natural vegetation is of the coastal western hemlock zone, (Krajina 1965). Dominant trees are western hemlock, amabilis fir and red cedar. The understory is dominated by devil's club and huckleberry.

The valley has been heavily logged and is presently mainly young forest of lodgepole pine and red alder.

CONT'd

The climate is moderated by the coast. Summers are cool and wet. Winters have moderate snowfall - significantly less than on the coast a few miles away - and moderate temperatures.

Population in the Kalum valley is sparse, being restricted to homesteaders on the fertile flatlands at the north end of Kalum Lake. The town of Terrace is at the mouth of the Kalum and has a population of 14,000. Economics of the area is based on the logging industry.

SUMMARY OF RESULTS

** NOTE: Complete results presented in the Appendices.

1. Maroon Creek

TABLE 1. Summary of Results from Maroon Creek

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
bridge over Maroon Creek, east Kalum road	August 8	1,2	6.5	No fish

Maroon Creek is located midway along the east shore of Kalum Lake. The creek flows in a series of steep cascades and has only marginal rearing potential. Creel census information indicates that a small resident population of Dolly Varden inhabit the upper sections.

2. Wesach Creek

Wesach Creek is a small steep glacial stream that enters Kalum Lake at the northeast corner. The creek flows in a long series of cascades and provides only limited rearing for resident Dolly Varden.

3. Douglas Creek.

TABLE 2. Summary of Results from Douglas Creek

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
Douglas Creek bridge on east Kalum road	August 8	3	9.0	No fish

Douglas Creek, located on the northeast corner of Kalum Lake, is a small, steep creek with only marginal rearing capabilities for Dolly Varden. No fish were captured or observed anywhere in this creek.

4. Dry Creek

TABLE 3. Summary of Results from Dry Creek

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
bridge on east Kalum road, 1/2 past Douglas Creek	August 6	4-6	6.0	7 DV

Dry Creek, located 1/2 mile past Douglas Creek on the east Kalum Road, is a small spring-fed creek. Excellent rearing habitat exists along its length. Large instream boulders and dense overhanging bank vegetation gives good cover for rearing fish.

Creel census information indicated that a run of coho spawn in the creek in late December and early January. Since no coho fry were captured in Dry Creek, it is likely that the fish spawned there rear in the swamp at the mouth of the creek.

5. Clear Creek

TABLE 4. Summary of Results from Clear Creek

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
Clear Creek, at bridge on Kalum east road	August 6	12-13	16.0	10 Ch 2 Co 2 DV
	August 8	7-11	9.8	4 Ch 3 Co 9 DV
bridge crossing midsection of the creek	August 6	14-20	9.0	52 DV 3 Ct
upper Clear Creek, near trappers cabin	August 13	21-22	7.2	1 DV
	August 13	23-26	9.5	23 DV 5 Co
			*	**

* Total Traps Set: 20

** Total Fish Captured: 87 DV, 14 Ch, 10 Co, 3 Ct

Clear Creek joins the Kalum River through a swamp at the north end of the lake. The swamp extends for about a mile from the lake and the slow water and rich conditions create a variety of rearing habitats. Clear Creek turned out to be extremely productive near the East Kalum Road bridge. High water in the creek had overflowed into a field beside the road and as the water dropped, the ponds in the field were cut off from access back to the creek. Large numbers of fry became concentrated in a small pond (Figure 1). The fish were collected in a beach seine and released into Clear Creek across the road. Collected on August 13 were:

191 chinook
40 coho
5 Dolly Varden
1 rainbow

Water Temperature of the pond was 22°C.

The midsection of the creek is glacial and fast flowing, and has a large population of rearing Dolly Varden. No rainbows were captured, though rearing sites do exist for them in sidechannels and along the banks. The upper creek is accessible to migrant fish to at least the swamp at mile 7, where coho juveniles were captured. The tributary near mile 7 has a population of Dolly Varden.

6. Unnamed humic stained creek, Clear Creek road

TABLE 5. Summary of Results from Unnamed Creek.

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
crossing of Clear Creek road	August 6	27,28	14.0	3 Co 9 Ct 2 DV

This small, swampy creek is an important rearing creek for cutthroat and coho. In two, one hour sets, 9 cutthroat and 3 coho were captured.

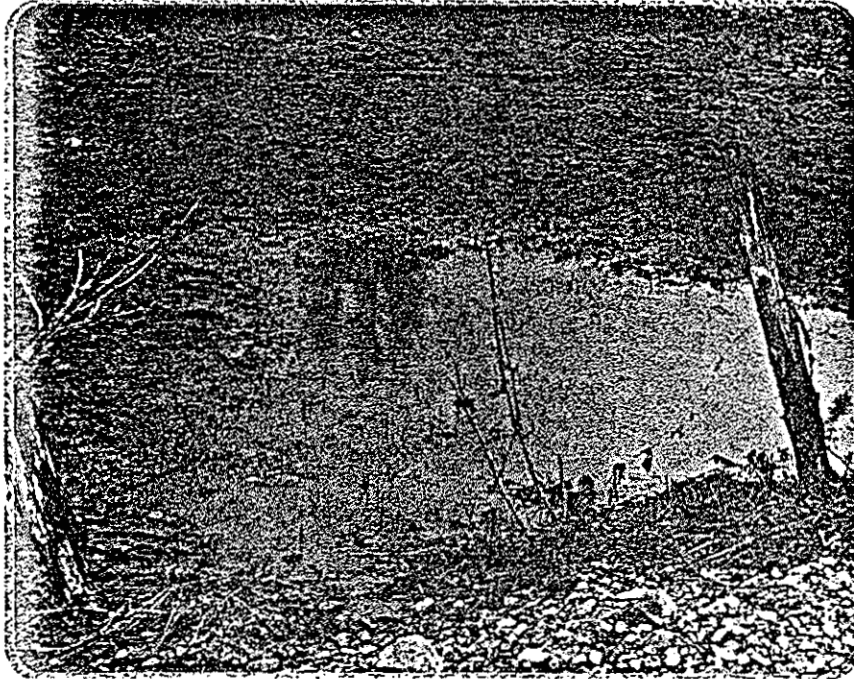


Figure 1. Puddle in the field beside Clear Creek, East Kalum Road bridge. Fry became concentrated in this pond as the water in the creek went down and cut off access to the culverts. Two hundred and forty fry were taken from the puddle.

7. Unnamed Humic Stained Creek, Mile 29 of Cedar Road

TABLE 6. Summary of Results from Mile 29 Creek.

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
crossing of Cedar Road, mile 29,	August 17	29,30	8.0	7 Ct

This small beaverized creek has good rearing habitat for resident cutthroat. Overhanging banks and instream debris gave fish lots of cover. Due to beaver activity and the swampy flow, anadromous fish probably do not use this creek.

8. Cedar River

TABLE 7. Summary of Results from Cedar River

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
confluence with Kalum River	August 17	31-33	8.0	2 Ch
bridge washout 1 mile from mouth	August 6	34-35	10.0	No fish
sidechannel of the Cedar at Nass Road bridge above Kalum river	August 9	36-38	8.0	1 Ch 1 Rb
bridge mile 31 of Kalum east road	June 27	39-43	6.5	No fish
	August 9	44-47	8.0	1 Ch 1 Rb
washout on spur road off Nass road mile 32.5	August 10	48-50	8.0	3 Rb 1 DV
washout on old Cedar River road (east bank)	August 13	51-57	8.5	2 DV 2 Rb

*

**

* Total Traps Set: 27

** Total Fish Captured: 7 Rb, 3 DV, 4 Ch

The Cedar River is probably the most important stream for rearing fish in the upper Kalum. It is the largest tributary of the Kalum. The lower river is shallow and braided with many log jams and side-channels providing rearing sites for young fish. From about Sterling Creek north, the upper river has a single channel and runs at the bottom of a steep-sided valley. There are no barriers to fish movement but because of the unvaried channel and steep gradient, the anadromous fish population is probably small. Rainbow smolts were taken as far upstream as the washout on the old Cedar Road, and a local angler said he had caught steelhead in October, just downstream of Sterling Creek.

9. Hadenschild Creek.

TABLE 8. Summary of Results from Hadenschild Creek

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
bridge on branch road off Nass road mile 32.5	August 10	58-63	9.8	1 Ct
				15 Co
				4 Rb
				5 Ch
				1 DV
bridge on branch road off Nass Road mile 38.5	June 27	64-69	7.0	5 Ct 30 Co
at Nass Road bridge mile 38	June 27	70-71	4.5	1 DV
			*	**
* Total Traps Set: 14				
** Total Fish Captured: 2 DV, 4 Rb, 6 Ct, 45 Co, 5 Ch				

The lower three miles of Hadenschild Creek holds the majority of the creek's salmonid rearing capabilities. The swampy margins, slow broken flow and abundant aquatic vegetation create ideal growing conditions for young fish. A large swamp, draining Sand Lake and filtering into Hadenschild Creek, between mile 2 and 3, is an important area for rearing coho and cut-throat. Above mile 3, the creek changes character. Rising from the valley floor, the creek becomes steep and glacial, supporting only marginal rearing habitat for Dolly Varden.

10. Little Cedar River.

TABLE 9. Summary of Results from Little Cedar River

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
at Nass road bridge	August 17	72-76	7.0	2 Rb
mouth of the Little Cedar	August 17	77-81	7.0	No fish

The Little Cedar, a tributary of the Cedar River, is a steep glacial creek. There is some rearing potential along the lower river for about one half mile from the mouth, though few fish were captured there. Further upstream, the gradient steepens, making the stream less suitable for rearing. At approximately mile 3 of the river, there is a falls which would be a barrier to juvenile fish. Dolly Varden were found at mile 6 above the falls (M.E.A.T. 1975)

11. Upper Kalum River (Beaver River)

TABLE 10. Summary of Results from Beaver River.

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
Kalum River just above lake (by jet boat)	August 7	82-85	9.0	No fish
Kalum River at Nass road bridge	August 9	86-90	8.5	3 Ch
		*		**
Electroshocking:				
1 1/2 miles above Nass road bridge	August 23	1	12.0	11 Wt
sidechannel half-way along humic stained sidechannel	August 23	2	8.5	No fish
just above first fork	August 23	3	7.0	2 Wt (adult)

* Total Traps set: 9

** Total Fish Captured: 3 Ch

The Upper Kalum (also called the Beaver River) is a glacier-fed, slow moving river. The lower ten miles of the Beaver meanders over a broad swampy flood plain. Many sidechannels and ponds create ideal rearing areas for coho and cutthroat. Above the flood plain, the river rises slowly into a narrow U - shaped valley and then forks into three glacier headed tributaries. Rearing is limited in this region by the cold sterile water and fine well packed substrate. Only two adult whitefish were captured in this upper section. Although Gee trapping and electroshocking results were poor, Fisheries Service reports indicate that there is a small run of sockeye, coho and chinook to the Upper Kalum. (See Appendix H, figure 2 to 8.)

12. Kalum Lake

TABLE 11. Summary of Results from Kalum Lake

LOCATION	DATE 1976	SET NUMBERS	WATER TEMPERATURE (C)	TOTAL FISH
Gee Trapping:				
half mile north of Wesach creek	August 8	91-92	8.5	No fish
clear swamp at north end of the lake	August 8	93-96	8.0	2 Ch 1 Co

Several of the Kalum's tributaries enter the system through the swamp at the north end of Kalum Lake. The upper Kalum, Clear Creek, Douglas Creek and Dry Creek all diffuse through swampland at their mouths. It is likely that a large number of juveniles from these streams use the swamp for rearing. The swamp habitat is best suited to coho fry but with the lack of rearing sites in other tributaries, most species probably are found in the swamp at some time.

Several small-mesh gill net sets were made in the lake to check for rainbow smolts (Table 12). The cutthroat and rainbow netted appeared to be resident adults. Most of the fish were released alive and scales were kept from the rainbow.

TABLE 12. Gill netting results from Kalum Lake

LOCATION	DATE 1976	LENGTH OF SET	FISH
Gill netting:			
mouth of Wesach Creek	August 7	3 ½ hr.	1 Ct 7 Wt
	August 8	2 hr.	5 Ct 7 Wt 1 Rb
about 3 miles south of Maroon Creek	August 8	24 hr.	1 So 10 Ct 2 Wt 3 DV
			*
* Total Fish Gill Netted:			16 Ct, 16 Wt, 3 DV, 1 So, 1 Rb

DISCUSSION

High water conditions prevailed all summer on the Kalum system. The rivers and the lake were high and silty compared to the usual August conditions. For this reason, trapping results were generally poorer than expected. Total fish caught in all the Kalum streams surveyed are listed in Table 13.

TABLE 13. Total Fish captured per creek Gee trapping and Electroshocking

	Rb	Ct	DV	Co	Ch	Wt
Maroon Creek	0	0	0	0	0	0
Douglas Creek	0	0	0	0	0	0
Dry Creek	0	0	7	0	0	0
Clear Creek	0	3	87	10	14	0
Unnamed Creek Clear Creek road	0	9	2	3	0	0
Unnamed Creek mile 29 Cedar road	0	7	0	0	0	0
Cedar River	7	0	3	0	4	0
Hadenschild Creek	4	6	2	45	5	0
Little Cedar River	2	0	0	0	0	0
Upper Kalum	0	0	0	0	3	13
Kalum Lake	0	0	0	1	2	0
Total Captures:	13	25	101	59	28	13

* See also Gill net results Table 12.

The steep glacial creeks including Maroon, Douglas and Little Cedar hold little rearing habitat for anadromous fish. There are a few resident Dolly Varden in the upper sections (M.E.A.T. 1975) but none were caught during this study.

The greatest numbers and varieties of rearing salmonids were found in Clear and Hadenschild Creeks, streams that possessed a more hospitable environment. The most important sections of these creeks were areas that flowed through swamp. Large numbers of coho, chinook and cutthroat were often found among the reeds or in the deeper ponds and sidechannels. The Dolly Varden and rainbow preferred the deeper sections of the main flow or along the banks close to cover.

The fact that the fish are concentrating in these two creeks may point out that there are few suitable rearing areas elsewhere. Heavy silt loads and cold water temperatures in the Cedar and Kalum may cause the fish to move into Hadenschild and Clear Creek.

As mentioned previously, the water conditions on the Kalum were not typical during the study period and thus the juvenile fish of each species were found in various rearing conditions. However, from previous work this summer (1976) on the Kitimat River, there are a few conclusions that can be made about habitat preference of different species of juvenile fish.

It is the microenvironments within a stream that determine salmonid rearing sites. Because the microenvironments of a certain place on the stream can change quickly, rearing sites cannot be located as points on a map of the stream but rather described as a set of conditions which apply to different places on the stream at different times.

Rainbows were most often captured in faster water (0.6 meters per second and greater). The fish were often taken at the interface between fast and eddying water such as behind an instream boulder or at an eddy along the stream bank. Cover was often present as sticks or roots underwater.

Cutthroat trout juveniles were most often taken in slower water than the rainbows, usually with lots of instream sticks for cover. Often the water was humic stained.

Dolly Varden char were generally distributed through all habitats, being captured in fast or still water, with or without cover. In glacial waters or above the migration limits of anadromous fish, resident Dolly Varden were often the only species captured.

Of the salmon species, cohos were the most frequently captured. They are present in nearly all still water and are often a good indicator of accessibility of a stream for anadromous fish.

ACKNOWLEDGEMENTS

We would like to thank the following people for their valuable help with this study:

- Dave Harding, Fisheries and Marine Service
- E.L.U.C. Secretariat
- Ken Holme, map department; Twin River Timber

BIBLIOGRAPHY

1. Krajina, V.J.; 1965; in Forestry Handbook for B.C.; Forest Club, U.B.C.; 3rd Edition; 1971
2. M.E.A.T. (Meziadin Environmental Advisory Team); 1975; CN Meziadin Project, Environmental Impact Study, Mile 0-75; Vol. 1; Edmonton, Alberta.
3. Stream files for the Kitsumkalum River; various authors and dates; Smithers Fish and Wildlife Branch Office

APPENDIX A

GEE TRAPPING RESULTS

DRY CREEK, MAROON CREEK,
DOUGLAS CREEK, UN-NAMED CREEKS

APPENDIX A. DRY CREEK, MAROON CREEK, DOUGLAS CREEK, UN-NAMED CREEKS. GEE TRAPPING RESULTS

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (Hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
Dry Creek, bridge on East Kalum Road	Aug. 6	4	Undercut bank downstream side of bridge	6.0	17:30	0.3	0.6	sand & gra- vel to 10 cm	3 DV
	Aug. 6	5	upstream of bridge eddy at undercut bank	6.0	17:30	0.3	0.6	fine gravel	3 DV
	Aug. 6	6	upstream of bridge in small side- channel	6.0	17:30	0.3	still	fine gravel to 5 cm	1 DV
Maroon Creek, bridge on east Kalum Road	Aug. 8	1	side pool be- low bridge	6.5	6:00	0.8	eddy	gravel & boulder to 40 cm; in- stream roots	No fish
	Aug. 8	2	downstream of bridge behind large boulder	6.5	6:00	0.5	0.6	gravel and boulder to 40 cm	No fish
Douglas Creek bridge on east Kalum Road	Aug. 8	3	pool at bank	9.0	22:30	0.3	eddy	angular boul- der to 40 cm	No fish
Unnamed humic stained creek, first creek crossed on Clear Creek road	Aug. 6	27	upstream end of culvert	14.0	25:00	0.8	still	silt + gravel to 15 cm	1 Co 2 Ct
	Aug. 6	28	downstream side of culvert	14.0	25:00	0.3	0.3	silt + gravel to 15 cm (algae on rocks)	2 Co 7 Ct 2 DV
Unnamed humic creek at mile 29 on Cedar Road	Aug. 17	29	under bridge	8.0	26:30	0.2	still	clay, silt	1 Ct
	Aug. 17	30	downstream of bridge	8.0	26:30	0.4	still	mud, silt, sticks	6 Ct

APPENDIX B

GEE TRAPPING RESULTS

CLEAR CREEK

APPENDIX B.

CLEAR CREEK.

GEE TRAPPING RESULTS

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (Hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
at bridge on East Kalum Road	Aug. 8	7	undercut bank of rip rap and stumps	9.8	20:00	0.7	0.6	angular bou- lder 40-80 cm	No fish
	Aug. 8	8	edge of main flow behind large bou- lder	9.8	20:00	0.3	eddy	sand + gravel to 5 cm	No fish
	Aug. 8	9	downstream of bridge behind large boulder	9.8	20:00	0.4	1.0	sand and fine gravel	No fish
	Aug. 8	10	still sidechannel above bridge, cut off from creek	9.8	20:00	0.4	still	silt and mud	8 DV 1 Co
farmers field at bridge on East Kalum Road	Aug. 8	11	small pool in road, ditch	--	20:00	0.2	0.3	silt and sand	1 DV 4 Ch 2 Co
	Aug. 6	12	shallow pool under willow bush	16.0	18:00	0.3	still	grass and mud	2 DV 5 Ch 2 Co
	Aug. 6	13	downstream side of culvert-out flow of farmers field	16.0	18:00	0.3	0.6	angular 15 to 30 cm	5 Ch
bridge crossing midsection of the creek	Aug. 6	14	interface with mainflow and bank	9.0	24:30	0.3	1.0	sand + angular gravel 1-15 cm	1 DV
	Aug. 6	15	instream log jam	9.0	24:30	0.4	0.4	sand + instream branches	6 DV
	Aug. 6	16	pool behind bridge abutment upstream	9.0	24:30	2.0	eddy	sand + angular boulder 20-30	2 DV

APPENDIX B.

CLEAR CREEK.

GEE TRAPPING RESULTS

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (Hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
bridge crossing midsection of the creek	Aug. 6	17	behind bridge abutment down- stream	9.0	24:30	0.4	interface	gravel to 15 cm	13 DV
	Aug. 6	18	20 meters down- stream of bridge east bank under debris of cut bank	9.0	24:30	0.7	eddy	gravel to 15 cm	8 DV
	Aug. 6	19	upstream of bridge west bank under log of bridge abutment	9.0	24:30	0.5	interface	gravel to 15 cm	7 DV
	Aug. 6	20	in sidechannel near sets 3 to 8	11.0	24:30	0.6	0.3	silt and sand	3 Ct 15 DV (Co fry observed)
glacial tri- utary of upper Clear Creek	Aug. 13	21	steep cascade under washed out bridge	7.2	23:45	0.3	eddy	boulder 20-40 cm	1 DV
	Aug. 13	22	behind large bou- lder 100 m. down stream of bridge	7.2	23:45	0.3	eddy	boulder 20-40 cm	No fish
upper Clear Creek	Aug. 13	23	under bridge by miner's cabin	9.5	23:00	0.5	1.0	angular rocks to 20 cm	3 DV
	Aug. 13	24	off old Beaver dam in flowing channel	9.5	23:00	0.6	0.6	silt + fine gravel to 5 cm	3 Co 8 DV
	Aug. 13	25	in front of miners cabin, in log jam	9.5	23:00	0.3	eddy	silt, sand gravel to 10 cm	6 DV
	Aug. 13	26	lakeside of beaver	9.5	23:00	1.0	still	silt + sand	6 DV

APPENDIX C

GEE TRAPPING RESULTS CEDAR RIVER

APPENDIX C

CEDAR RIVER

GEE TRAPPING RESULTS

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
at confluence with the Kalum	Aug 17	31	beside bank on Kalum, under roots	8.0	28:00	1.0	1.0	silt and sand	No fish
	Aug 17	32	cut bank over- hanging stump	8.0	28:00	1.5	0.3	sand	No fish
	Aug 17	33	sidechannel of Cedar, at cut- bank	8.0	28:00	1.0	still	sand	2 Ch
bridge washout 1 mile from mouth	Aug 6	34	behind instream logs, in main- channel	10	23:15	0.3	0.5	silt and sand	No fish
	Aug 6	35	in log jam-still water between logs	10	23:15	0.5	still	silt and sand and instream logs	No fish
sidechannel of Cedar, bridge on Nass Road just north of Kalum River	Aug 9	36	in mainflow beside bank	8.0	22:00	0.4	0.3	gravel 1-15 cm	1 Ch
	Aug 9	37	under bridge	8.0	22:00	0.5	0.6	gravel 5-15 cm	No fish
	Aug 9	38	near bank, under roots and sticks	8.0	22:00	0.6	0.3	sand	1 Rb
bridge at mile 31 of Kalum East Road	June 27	39	deep back eddy above bridge	6.5	3:00	1.0	eddy	silt, sand + gravel to 35 cm	No fish
	June 27	40	clear side- channel	6.5	3:00	0.2	0.2	sand and gravel 5-20 cm	Co fry observed
	June 27	41	sidechannel con- fluence with main stem	6.5	3:00	1.5	0.3	sand and silt	No fish
	June 27	42	mainstem below bridge beside bank	6.5	3:00	0.5	0.6	sand + gra- vel to 5 cm	No fish
	June 27	43	mainstem bank eddy	6.5	3:00	0.5	0.6	sand, silt +	No fish

APPENDIX C

CEDAR RIVER

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (Hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
bridge at mile 31 Kalum East Road	Aug 9	44	trap set along bank under willow bush	8.0	19:00	0.5	0.6	sand, gra- vel + boul- der to 40 cm	1 Rb
	Aug 9	45	behind log abuttment	8.0	19:00	0.5	0.3	sand and silt	No fish
	Aug 9	46	under bridge near abuttment	8.0	19:00	0.6	0.6	gravel 5-15 cm	1 Ch
	Aug 9	47	downstream side of bridge abut- ment	8.0	19:00	1.0	eddy	gravel 5-15 cm	No fish
washout on Spur road at mile 32.5 of Nass Road	Aug 10	48	deep back eddy	8.0	21:00	2.0	eddy	silt and clay	1 Rb 1 DV
	Aug 10	49	beside riffle under logs	8.0	21:00	0.4	interface	gravel 5-15 cm	2 Rb
	Aug 10	50	beside fallen tree in eddy	8.0	21:00	0.7	eddy	gravel 5-15 cm	No fish
washout on old Cedar River road (east bank)	Aug 13	51	behind boulder in eddy	8.5	23:00	0.4	eddy	angular boulder 40-60 cm	1 DV
	Aug 13	52	behind boulders and branches	8.5	23:00	0.6	1.0	angular boulders	No fish
	Aug 13	53	near bank behind large boulder	8.5	23:00	0.5	1.3	angular boulder	No fish

APPENDIX C

CEDAR RIVER

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (Hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
approx. 1/2 mile below washout, near rock slides	Aug 13	54	beside bank of angular boulders	8.5	22:45	0.8	0.6	angular boulder	2 Rb 1 DV
	Aug 13	55	shallow run behind boulder	8.5	22:45	0.4	0.3	angular boulder 20-40 cm	No fish
	Aug 13	56	main flow of sidechannel	8.5	23:00	0.3	0.6	angular boulder 20-30 cm	No fish
	Aug 13	57	behind boulder near bank	8.5	23:00	0.4	1.0	gravel 5-15 cm	No fish

APPENDIX D

GEE TRAPPING RESULTS HADENSCHILD CREEK

APPENDIX D

HADENSCHILD CREEK

GEE TRAPPING RESULTS

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (Hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
bridge on branch road off Nass road mile 32.5	Aug 10	58	along bank under overhanging shrubs	9.8	21:00	0.4	0.2	silt and sedges	1 Ch 2 Co
	Aug 10	59	under bridge up- stream side	9.8	21:00	1.2	still	silt and sedges	1 Rb 1 Co
	Aug 10	60	downstream of bridge, at east bank	9.8	21:00	0.5	0.2	silt and fine sand	2 Rb
	Aug 10	61	downstream of bridge under floating debris west bank	9.8	21:00	0.5	0.3	silt and sand	3 Co 1 DV
	Aug 10	62	under bridge	9.8	21:00	0.5	0.3	silt, sand and reeds	5 Co 4 Ch
	Aug 10	63	downstream of bridge under log and bank shrubs	9.8	21:00	0.8	0.3	silt	1 Rb 4 Co 1 Ct
Swamp Creek, mid- section of Haden- schild Creek branch road off Nass Road mile 38.5)	June 27	64	deep clear pool upstream of bridge	7.0	4:15	1.3	still	silt and sand	1 Ct 12 Co
	June 27	65	under bridge up- stream side	7.0	4:15	0.3	0.3	silt, sand + fine gravel	6 Co
	June 27	66	weedy border of pool, upstream from bridge	7.0	4:15	0.3	still	vegetative debris and silt	2 Co
	June 27	67	confluence of Beaver channel and pool - upstream side of bridge	7.0	4:15	1.0	0.3	silt and sand	4 Co

APPENDIX D

HADENSCHILD CREEK

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (Hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
CONT'D									
Swamp Creek, midsection of Hadenschild Creek (branch road off Nass Road mile 38.5)	June 27	68	shallow run downstream of bridge	7.0	4:15	0.2	0.6	sand and gravel 5 to 15 cm	3 Ct 2 Co
	June 27	69	swampy beaver channel	7.0	4:15	0.3	still	silt	1 Ct 6 Co
at Nass Road bridge Mile 38	June 27	70	bouldery side channel	4.5	4:30	0.3	eddy	sand, gra- vel and boulder to 40 cm	No fish
	June 27	71	pool at conflu- ence of 2 side channels	4.5	4:30	0.4	eddy	sand and instream logs	1 DV

APPENDIX E

GEE TRAPPING RESULTS LITTLE CEDAR RIVER

APPENDIX E

LITTLE CEDAR RIVER

GEE TRAPPING RESULTS

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (Hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
Nass Road ridge	Aug 17	72	upstream of bridge behind boulder	7.0	24:00	0.5	1.3	gravel and boulder to 50 cm	1 Rb
	Aug 17	73	rip rap bank above bridge	7.0	24:00	0.4	1.0	angular boulder to 40 cm	No fish
	Aug 17	74	edge of main- flow behind boulder	7.0	24:00	0.3	eddy	gravel and boulder to 30 cm	No fish
	Aug 17	75	edge of main- flow behind boulder	7.0	24:00	0.4	eddy	gravel and boulder to 40 cm	No fish
	Aug 17	76	edge of fast riffle	7.0	24:00	0.3	1.0	large gra- vel and boulder to 30 cm	1 Rb
outh of the ittle Cedar	Aug 17	77	sidechannel behind willow branches	7.0	24:00	0.2	1.0	sand and gravel to 3 cm	No fish
	Aug 17	78	confluence of sidechannel and deep pool	7.0	24:00	1.0	still	sand and silt	No fish
	Aug 17	79	confluence of little Cedar and sidechannel	7.0	24:00	0.8	eddy	silt, sand and boulder to 40 cm	No fish
	Aug 17	80	pool under washed out bridge	7.0	24:00	1.0	still	sand and mud	No fish
	Aug 17	81	eddy at mouth of sidechannel	7.0	24:00	0.4	interface	boulder to 30 cm	No fish

APPENDIX F

1. GEE TRAPPING RESULTS UPPER MAINSTEM KALUM
2. ELECTROSHOCKING RESULTS UPPER MAINSTEM KALUM

APPENDIX F - 1.

UPPER KALUM MAINSTEM

GEE TRAPPING RESULTS

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (Hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
Nass Road bridge	Aug 9	86	among large rip rap boulders under bridge	7.0	24:00	0.4	0.3	sand and rip rap to 40 cm	trap lost
	Aug 9	87	edge of mainflow downstream of bridge	7.0	24:00	0.3	0.3	sand and silt	No fish
	Aug 9	88	undercut bank with roots	7.0	24:00	0.3	0.6	sand, silt and small gravel to 5 cm	No fish
	Aug 9	89	edge of side channel upstream of bridge	7.0	24:00	0.5	0.3	silt	3 Ch
	Aug 9	90	under bridge	7.0	24:00	1.0	0.6	sand and rip rap	trap lost
from the lake stream to Cedar River	Aug 7	82	mouth of Douglas Creek	9.0	4:00	0.5	1.0	sand	No fish
	Aug 7	83	mouth of Douglas Creek	9.0	4:00	0.4	0.6	fine gravel	No fish
	Aug 7	84	mouth of Dry Creek	8.0	4:00	0.5	0.3	sand and silt	No fish
	Aug 7	85	log jam just below Cedar River	7.0	4:00	1.0	still	silt and sand	No fish

APPENDIX F - 2

UPPER KALUM MAINSTEM

ELECTROSHOCKING RESULTS

LOCATION	DATE 1976	SITE NO.	TEMPERATURE (C)	SUBSTRATE	FISH	COMMENTS
shallow sidechannel 1 mile above Nass Road bridge	Aug 23	1	12.0	packed sand and fine gravel	11+ Whitefish fry	No fish in usual spots
sidechannel of mainstem, halfway along humic sidechannel	Aug 23	2	8.5	sand and fine gravel, instream branches	1 sculpin	one trout? observed
just above first fork on north branch of the river	Aug 23	3	6.5	boulder 20 - 40 cm	2 Whitefish	- -

APPENDIX G

GEE TRAPPING RESULTS KALUM LAKE

APPENDIX G

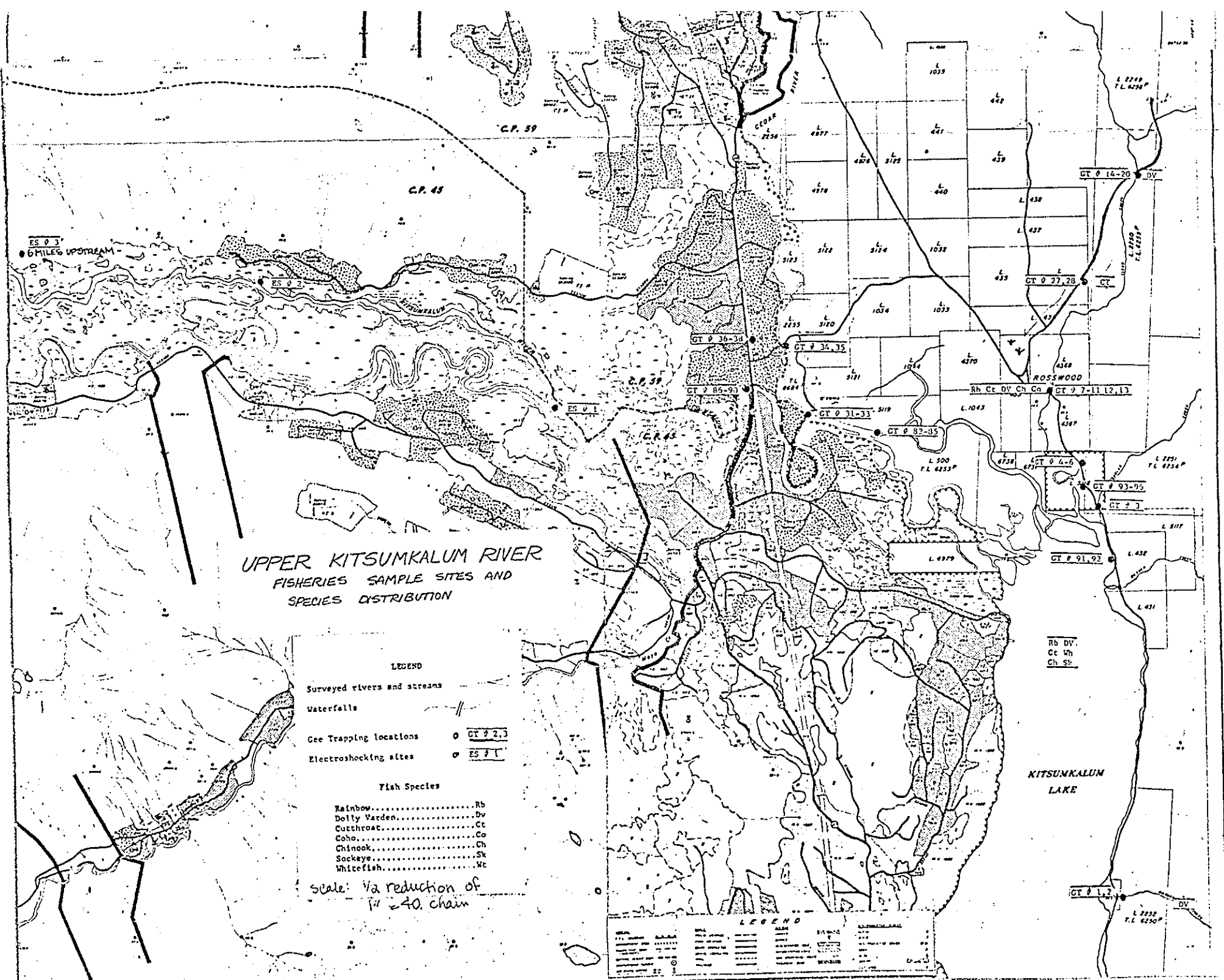
KALUM LAKE

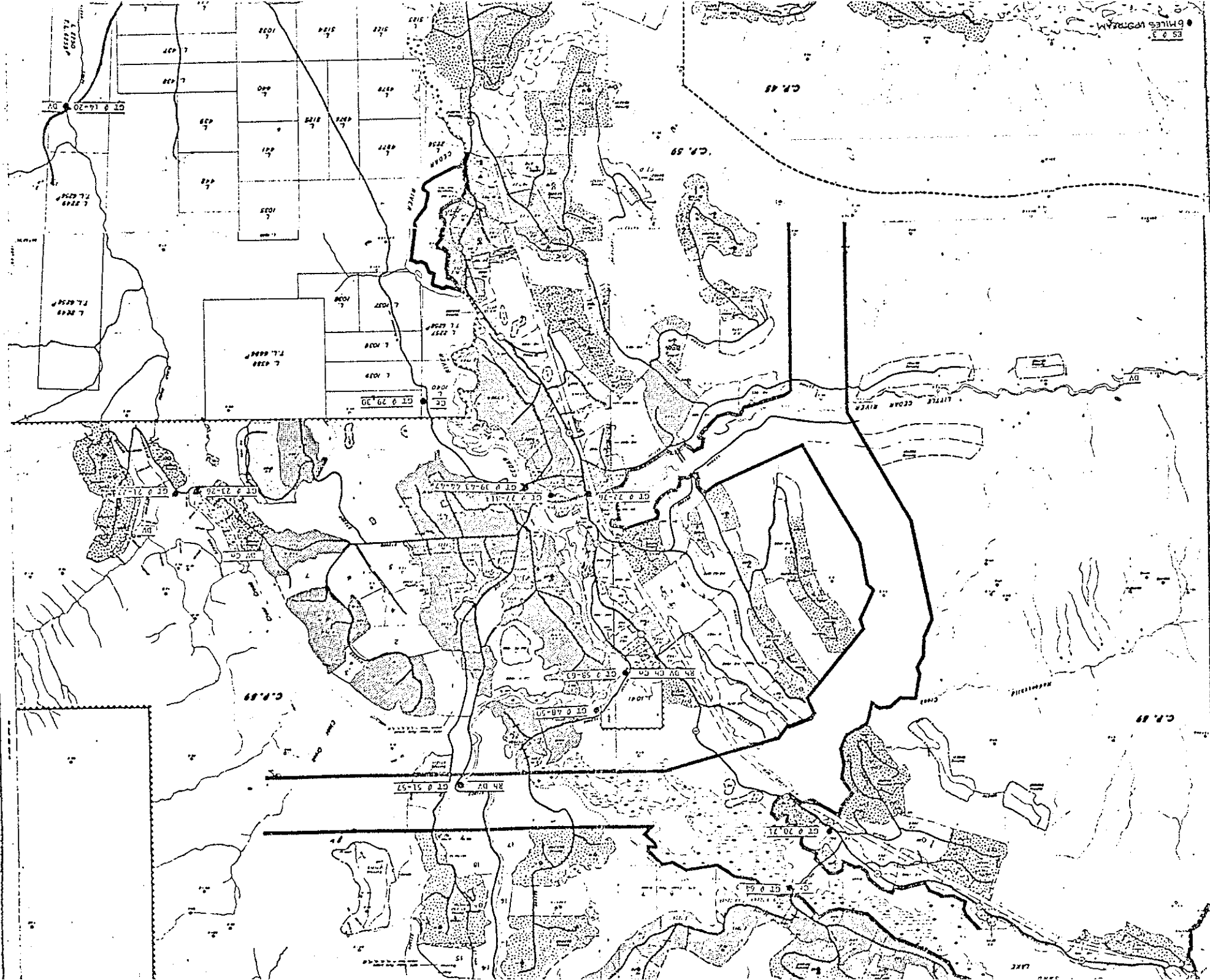
GEE TRAPPING RESULTS

LOCATION	DATE 1976	SET NO.	SITE	WATER TEMPERATURE (C)	LENGTH OF SET (Hr Min)	DEPTH (meters)	VELOCITY (min/sec)	SUBSTRATE	FISH
half mile north of Wesach Creek	Aug 8	91	lake shore	8.5	20:00	0.6	still	silt, sand and boulder to 40 cm	No fis
	Aug 8	92	lake shore	8.5	20:00	0.5	still	boulder to 60 cm	No fis
clear swamp at north end of the lake	Aug 8	93	edge of swamp among reeds	8.0	22:30	0.4	still	sand, silt and sticks	No fis
	Aug 8	94	undercut bank with overhanging alder	8.0	22:30	0.4	still	silt and sticks	No fis
	Aug 8	95	away from shore among logs	8.0	22:30	0.6	still	silt and sticks	2 Ch 1 Co
	Aug 8	96	near shore	8.0	22:30	0.5	still	muck and sticks	No fis

APPENDIX H

FIGURES





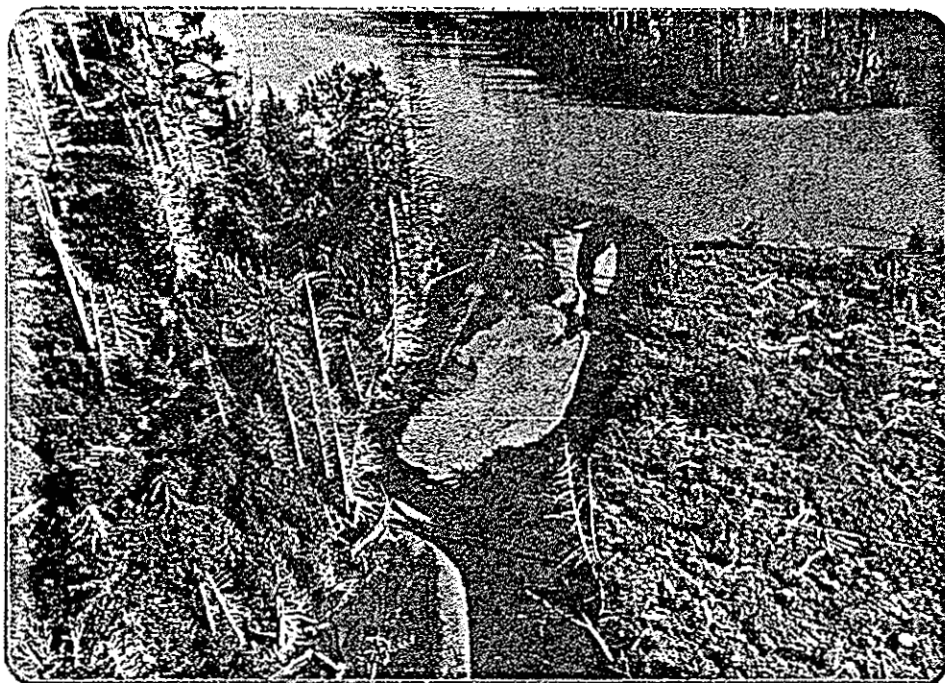


Figure 2. Confluence of Cedar River and Kalum River

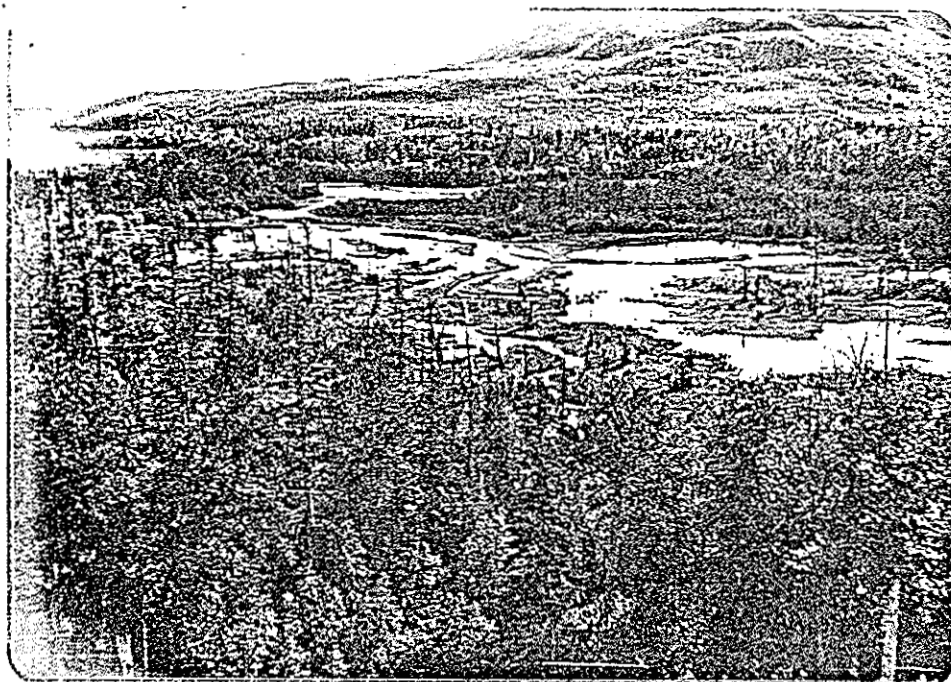


Figure 3. Upper Kalum River. Section of swampland at the north end of Kalum Lake. Picture taken looking towards Mayo Creek mouth.

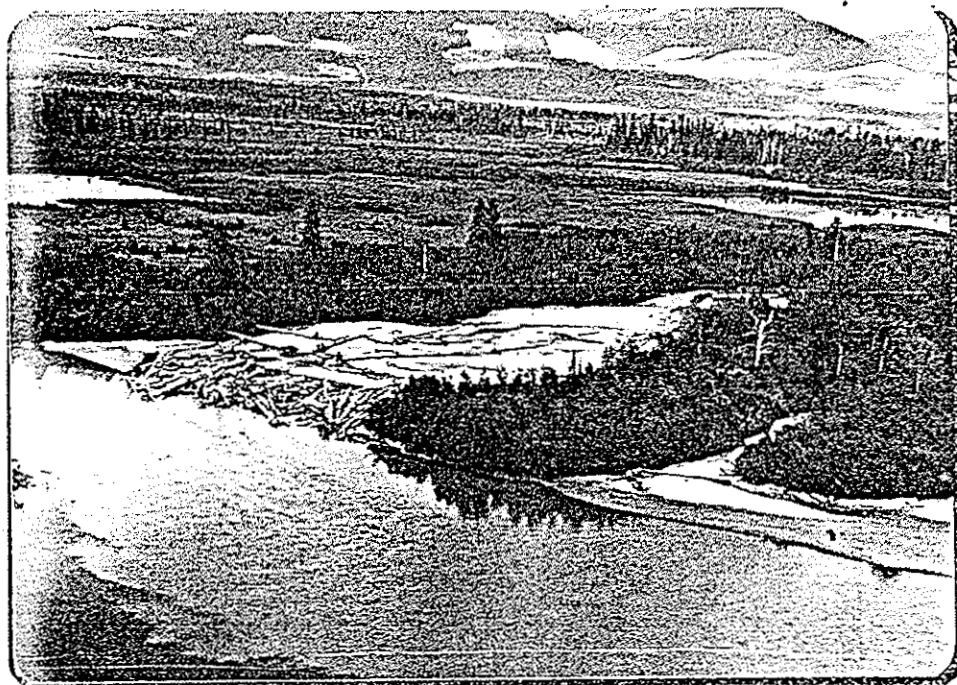


Figure 4. Upper Kalum River. Electroshock site 1 in the sidechannel among logs. Note the confluence of the rusty-coloured sidechannel at bottom left of the picture.



Figure 5. Upper Kalum River and meandering rusty-coloured sidechannel. Picture looking upstream from shock site 1.

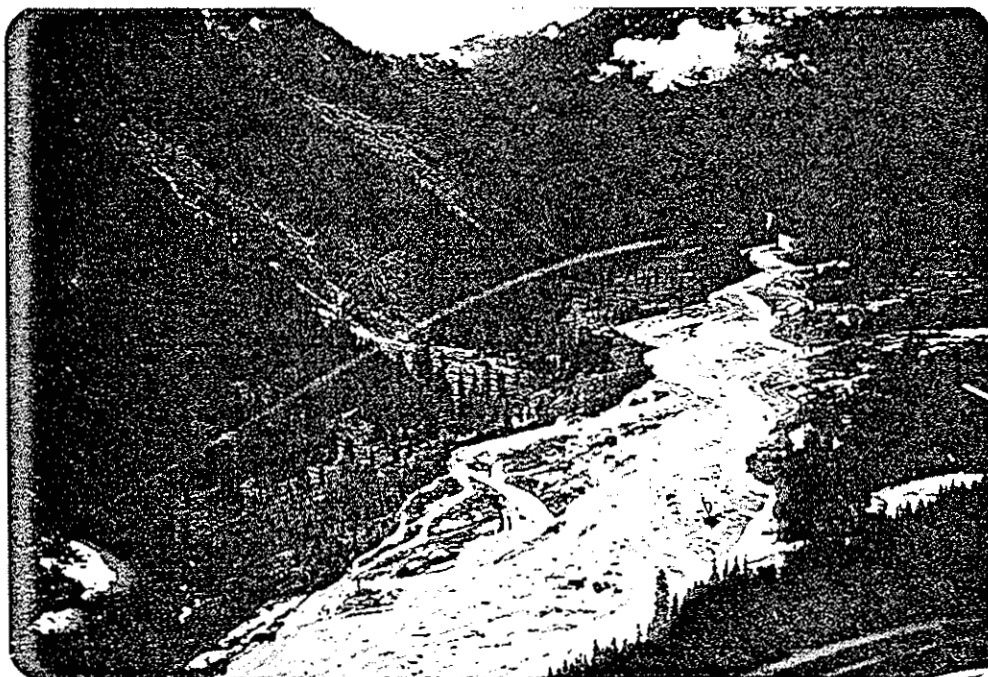


Figure 6. Upper Kalum River above the broad floodplain looking upstream from Electroshock site 3.

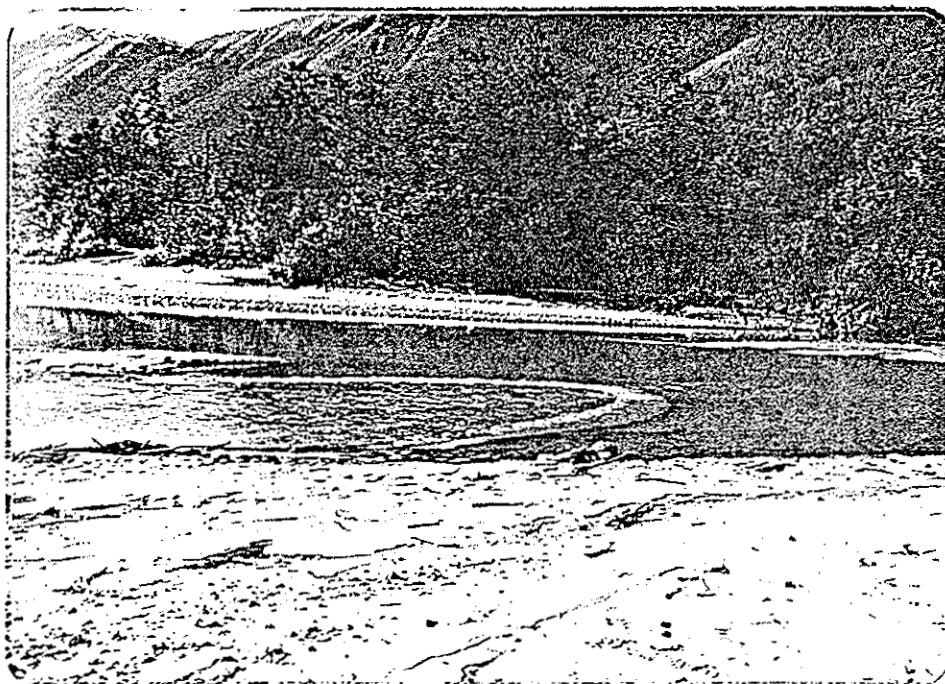


Figure 7. Upper Kalum River at Electroshock site 2. Note the fine, sandy substrate.

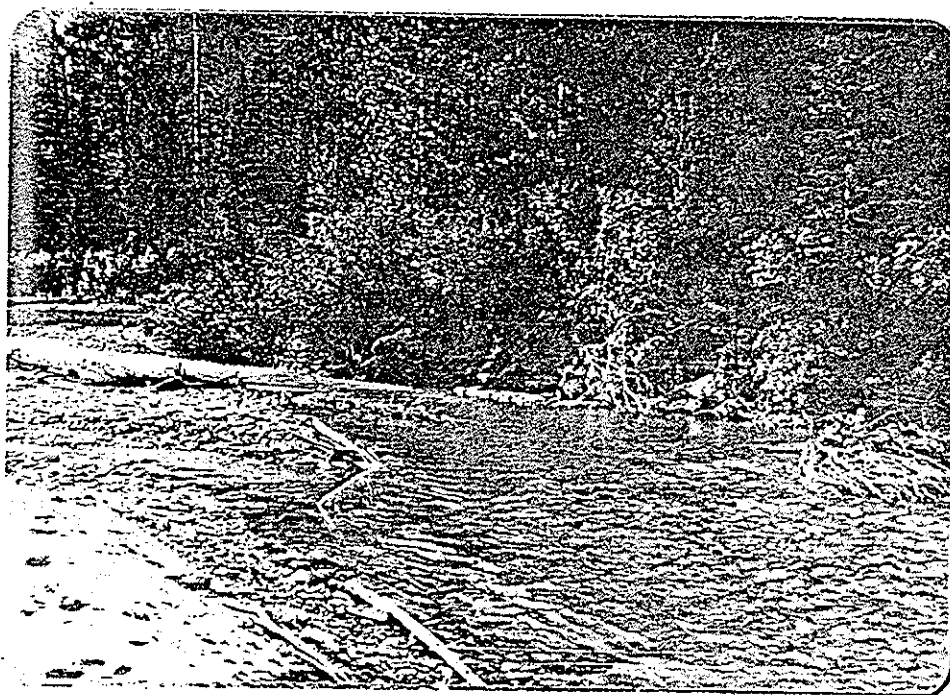


Figure 8. Upper Kalum River at Electroshock site 3.