A PRELIMINARY INVESTIGATION OF

KITSUMKALUM RIVER STEELHEAD TROUT,

1980—81

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1.0 INTRODUCTION

Kitsumkalum River, located near Terrace, B.C. has become an important destination for anglers seeking a year—round, multispecie sport fishery. The “Kalum” supports major sport fisheries for salmon (particularly chinook), and summer and winter steelhead trout. Resident rainbow and cutthroat trout and Dolly Varden char are also angled.

Increasing angling pressure combined with intensive logging in the upper watershed and growing human development in the lower watershed during recent years prompted the B.C. Fish and Wildlife Branch to conduct a preliminary investigation of Kalum River steelhead trout (Salmo gairdneri Richardson) in 1980 and 1981. The study had several broad objectives:

1) To better understand and describe the sport fishery.
2) To better understand run timing and movements of Kalum steelhead within the sportfishery as well as their wintering and spawning behavior.
3) To establish baseline biological data for Kalum steelhead.
4) To identify management and enhancement options.

2.0 DESCRIPTION OF THE STUDY AREA

The Kalum River flows south from Kitsumkalum Lake and enters the Skeena River near Terrace, B.C. (Fig. 1). Kalum Lake is 2 km wide and 12 km long and forms a basin into which flow three major tributaries - the Kitsumkalum (Beaver), Cedar and Nelson Rivers, all of which are accessible to anadromous fish. The headwaters of these systems drain glaciers that lie in the Nass and Kitimat Ranges of the Coast Mountains, hence the entire watershed is usually colored from glacial silt. Treston and Redsand Lakes are small shallow lakes located immediately downstream of the outlet of Kalum Lake, all three of which are connected by the Kalum River. The Kalum River below the lakes is 30 km in length and is of moderate gradient except for 2 canyon areas located between Lean—To and Deep Creeks (Fig. 1). The canyons are passable to fish but are not navigable by riverboat. The river generally flows free throughout the year although shelf ice and anchor ice do form during harsh winters. The river was channelized to aid log drives (no longer in practice) and many side channels were cut off, forming swamps and ox—bow lakes.

The drainage system is surrounded to the North, East and West by spectacular mountains which climb quickly from the valley floor to over 2300 meters. Vegetation in the wide valley is typical of coastal areas, being predominately spruce and hemlock with limited cedar, fir and deciduous species (cottonwood, willow, alder). Heavy logging in the drainage has removed most virgin timber. Second growth timber is presently being harvested, with large clearcut openings evident

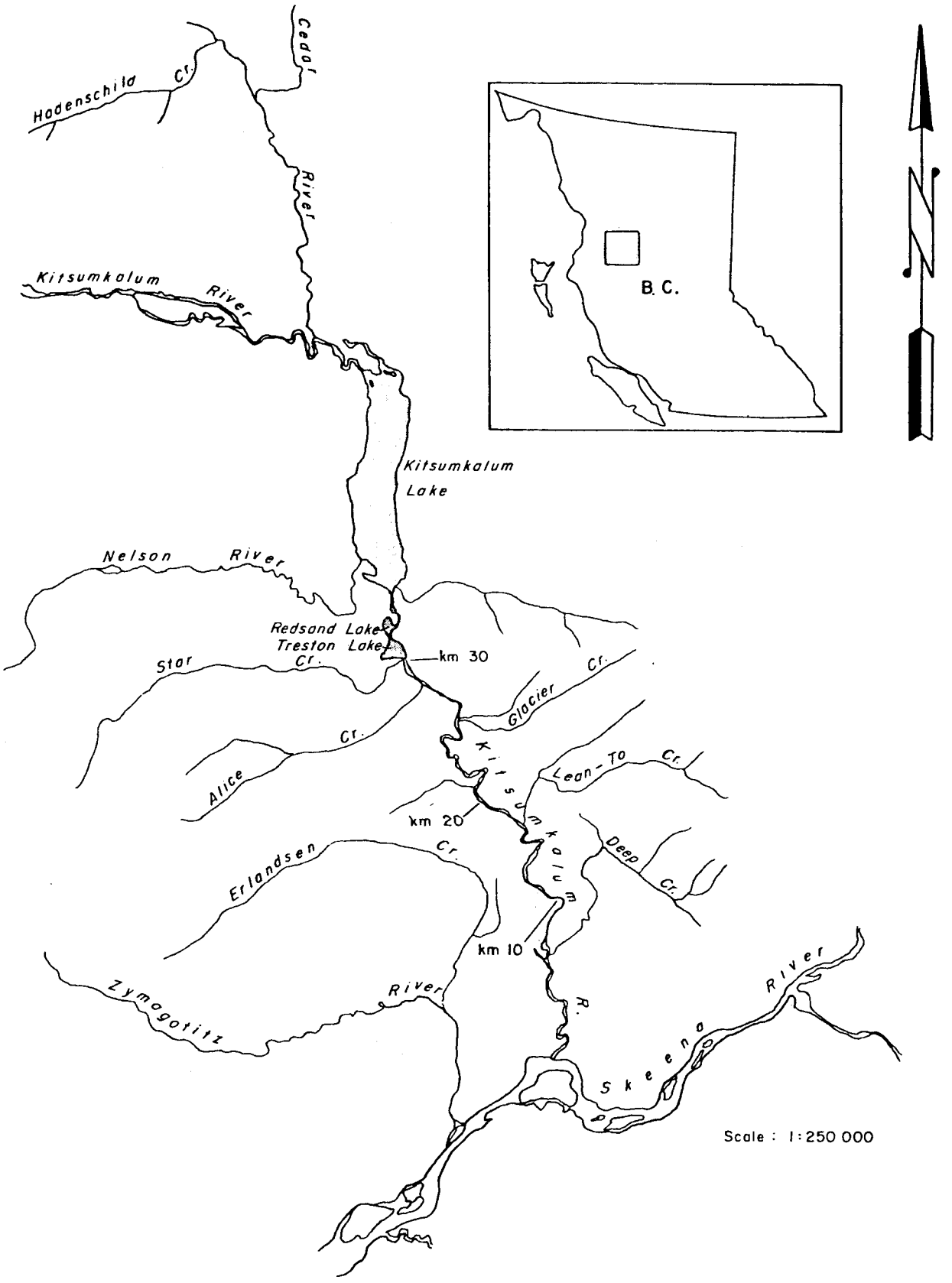
Cedar River
Hadenschild Cr.
Kitsumkalum River
Kitsumkalum Lake
B. C.
Nelson River
Redsand Lake
Treston Lake
km 30
Star Cr.
Alice Cr.
Glacier Cr.
Kitsumkalum R.
Lean-To Cr.
km 20
Deep Cr.
Erlandsen Cr.
km 10
Zymagotitz River
Skeena River
Scale : 1:250 000

Fig. I KITSUMKALUM RIVER STUDY AREA (1980—81)

throughout the valley. Main logging roads parallel the river on both sides, with numerous secondary roads providing access to the river.

3.0 DESCRIPTION OF THE SPORT FISHERY

Field work during this study was carried out from the fall of 1979 to the summer of 1980. Observations by field staff during that period provided a general overview of the Kalum fishery. Further discussions with anglers and local Conservation Officers provided details about the fishery during the months not included in the study.

A major fishery on the Kalum is the chinook salmon (“spring”) fishery. Fishermen angle for chinook as early as March if water conditions are favorable. These early chinooks are destined for the Cedar River (R. Kadowaki, Pers. Comm.). The main chinook run, which spawns below Kalum Lake, appears during June and July. Angling regulations limit this fishery to the lower 10 km of the Kalum from June 5 to August 1; often creating a crowded and intense fishery during the peak of the run. Many anglers troll for chinook as they move through Treston and Redsand Lakes. As the main chinook run moves into the upper (closed) portion of the Kalum River, angling success declines on the lower river, and as a result the heavy fishing pressure drops off as summer progresses.

The second major fishery on the Kalum is the steelhead fishery. Discussions with local anglers indicate that the Kalum has 3 main steelhead runs late summer, late fall (winter) and then spring, with

lesser numbers of fish continuing to trickle in throughout the rest of the year.

The steelhead fishery begins with the arrival of summer steelhead in September. The sport fishery during the fall is distributed throughout the entire river. Observations by field staff indicate that anglers tend to gravitate towards the upper river (Km 20 - Km 35) during the winter. The areas of heaviest angling pressure are the sections from Glacier Creek (Km 25) to the outlet of Kitsumkalum Lake (Km 35), probably because these areas have vehicle access. Observations indicate that most anglers avoid areas which are only accessible by foot during the winter, hence most of the steady and intensive winter fishery is focused on the upper river. A less intensive winter fishery exists on the Beaver and Cedar Rivers.

During the spring, anglers again disperse throughout the entire river in response to the spring run steelhead which move into the lower Kalum during this time. Boat access becomes more popular during this time because of the increased water levels during high spring flows. The two main areas of activity are the lower Kalum below the canyon (Km 10) and the upper Kalum above Glacier Creek (Km 25).

It is difficult to determine the proportion of harvest attributable to each of these fisheries, but general steelhead angling data is available through the annual Steelhead Harvest Analysis (B.C. Fish and Wildlife Branch, Victoria, B.C.)
(Table 1).

Table 1. Kitsumkalum River steelhead sport fishery, 1973-1983[1].

Year	Estimated Days Fished	Estimated Anglers	Estimated Kill	Estimated Release	Kill per Day	Total Catch per Day
1972—73	2429	348	569	299	.336	.368
1973—74	2132	348	683	275	.322	.419
1974—75	2201	400	392	136	.178	.241
1975—76	3351	367	567	207	.171	.235
1976—77	2591	435	387	196	.150	.226
1977—78	2695	459	389	77	.145	.274
1978—79	1799	305	200	108	.112	.173
1979—80	2248	377	173	125	.125	.220
1980—81	1944	332	240	179	.078	.135
1981—82	3006	446	286	803	.095	.359
1982—83	4037	531	459	1003	.114	.360

[1]Data compiled from Steelhead Harvest Analysis (1973—83), B.C. Fish and Wildlife Branch, Ministry of Environment, Victoria, B.c.

A cursory examination of the Harvest Analysis data shows some noteworthy trends:

i) The total steelhead kill has remained relatively stable at around 300-500 fish over the 10 year period.

ii) Numbers of anglers and total effort on the Kalum have increased substantially since 1980.

iii) A dramatic increase in fish caught and released since 1980 has resulted in increased total catch while showing a marked decrease in the kill per angler day.

A sport harvest of Kalum summer steelhead probably also occurs in the Skeena River bar fishery between Terrace and Prince Rupert during August. Although quantitative data is not available, a previous telemetry study (Lough, 1981) established that a run of Kalum summer steelhead moves through the lower Skeena during the third week of August.

4.0 STEELHEAD MOVEMENT AND BEHAVIOR

In order to better understand the behavior of Kalum River steelhead, a total of 22 steelhead were radio tagged and an additional 45 steelhead were spaghetti tagged during the period November 1980 - April 1981 (Appendix I).

4.1 Methods of Tagging

Poor weather and water conditions prevented tagging before late November. Most fish were tagged throughout the length of the river below Kalum Lake, although 2 fish were radio tagged and 19 spaghetti tagged in the Beaver River. Lengths, weights and scale samples were taken from all tagged fish before they were released. Those that were too small to carry a radio tag were spaghetti tagged instead. Female steelhead were preferred over males because their movements in previous studies (Lough, M.S. 1979) were found to be less erratic. Methods of live capture, radio tagging and tracking were the same as those detailed in previous telemetry studies (Lough, M.S. 1980).

The frequency of telemetry equipment used in this study was 151 Megahertz. This system required smaller antennas which were highly adaptable to tracking from boats and aircraft. Stationary scanners were installed beside the river to detect tagged fish as they passed. Two scanners were used in this study; one at Km 2 on the Kalum to detect fish as they left the study area and one at the outlet of Kalum Lake to monitor movements in and out of the lakes.

4.2 Movements of Tagged Fish

Tracking data for each fish was summarized in map form showing the dates that it was located at various points on the river. Interpretations were made from these maps regarding seasonal movements of the fish throughout the Kalum drainage as described by Lough (M.S. 1980).

Fish tagged during December and January remained active throughout the winter. Ten (45%) of the radio tagged steelhead spent at least part of the winter in either Kalum, Redsand or Treston Lakes. Two of these fish were tagged above the lakes and the remaining eight were tracked while in the lakes. Some stayed for only a few weeks before moving back down to the river while others overwintered in the lakes before moving out to spawn in the spring. By late April, all radio tagged fish but one had left the lake and had moved downstream toward their spawning sites below the lakes. The one exception moved upstream above the lakes to spawn.

The 12 tagged fish which did not overwinter in the lakes held in the deep, slower sections of the mainstem Kalum between Km 20 and Km 30. Some of these moved very little while others moved constantly, although they never left this section of the river.

Fish that wintered in the Beaver River above the lake dispersed during April and May throughout the lower Beaver and Cedar Rivers. The only concentration of wintering fish in this area was located at the confluence of the Beaver and Cedar
Rivers (5 km above Kalum Lake). One

steelhead radio tagged at Km 16 of the Beaver River, moved downstream and entered the Cedar to spawn, while another fish which was tagged in the Cedar moved downstream and then up the Beaver before it was recaptured (Appendix I).

By late April most fish had moved to mainstem spawning areas or were holding off the mouths of creeks. Spawning sites were identified for 19 of the 22 radio tagged fish. Eleven (50%) spawned in tributaries and 8 (36%) spawned in the mainstem Kalum or side channels of the mainstem.

Five (23%) of the radio tagged steelhead in this study spawned in Deep Creek during May when water temperatures ranged from 7°C - 9°C (Appendix II). Although the longest recorded stay in Deep Creek was 20 days, the average stay was 10 days. Spawning took place between the mouth and the base of the impassable falls located about 5 km from the mouth. The first fish entered Deep Creek on April 30, and the last remaining fish stayed until May 27.

Three tagged steelhead spawned in Lean-To Creek between May 7 and May 21 when water temperatures ranged from 5°C to 8.5°C. All of these fish spawned downstream of the bridge located approximately 3 km from the mouth of the creek.

The only other tributary that was used for spawning by radio tagged fish was the Cedar River and one of its tributaries, Hadenschild Creek. Three fish entered the Cedar as early as April 6 but did not spawn until early or mid-May. One of these fish was last recorded in Hadenschild Creek on May 8, and was recorded at the outlet of Kalum Lake 3 days

later, indicating an average rate of 7 km/day through the lake as a kelt. There was no documented spawning in the Beaver above the Cedar confluence. The substrate here is composed largely of compacted fines, and is heavily stained with rust colored mineral deposits. Most steelhead that venture into the Beaver probably return to spawn in the Cedar, as did one of the radio tagged fish.

All of the Kalum mainstem—spawning radio fish utilized the section from Km 14 (mouth of Lean—To Creek) to Km 29 (mouth of Alice Creek), where spawning habitat is readily available. Only one spawner was observed in a side channel.

Spawning began in late April when the water temperature in the Kalum was 4°C, and continued until mid-May when it was 8°C. Kelts were monitored by automatic scanners as they left the Kalum starting May 1, with many of the fish leaving around mid-May. By June 9, all fish had left their spawning sites.

5.0 LIFE HISTORY

Of the 75 steelhead sampled on the Kalum during tagging, 69 had scales that were readable for total age determination. Eight age groups were identified among the sampled fish during 1980—81 (Table 2). The most frequently observed age groups were 3.2 (38.3%), 4.2 (26.0%), 3.1 (14.5%) and 3.3 (9.6%).

Table 2. Steelhead trout age groups, Kitsumkalum river, 1980-81.

AGE GROUP	NUMBER STEELHEAD	NUMBER MALES	NUMBER FEMALES	PERCENT TOTAL
2.2	1	0	1	1.5
3.1	10	8	2	14.5
3.2	28	13	15	38.3
3.3	7	5	2	9.6
3.1S1	1	1	0	1.5
4.1	2	1	1	2.6
4.2	19	10	9	26.0
4.1S1	1	0	1	1.5
8	69	38	31	100%

Among the total scale sample, only 2 (2.6%) were observed to be repeat spawners. Both (one male, one female) were returning to spawn a second time.

6.0 STEELHEAD LENGTH-WEIGHT RELATIONSHIPS

Length and weight data were collected from as many adult steelhead as possible during the study. In the most frequently observed ocean age group (.2), males averaged 77.2 cm and 5.1 kg while females averaged 73.2 cm and 4.2 kg (Table 3). The sampled steelhead ranged from .9 kg to 7.3 kg in weight and from 50.8 cm to 88.9 cm in length.

7.0 DISCUSSION

Kalum River steelhead appear to be divided into 3 main subgroups according to their run timing. Much like the nearby Lakelse and Zymoetz Rivers, the true summer run enters the river during the last half of August. A second run of late fall steelhead arrives during the last part of November and the last major run enters the Kalum during April.

Tagging data indicated that there was a spatial segregation of the runs within the Kalum River. The summer run fish tended to move to the top end of the system, including the Beaver and Cedar Rivers as well as the lakes. By winter, most of this run had moved upstream of Km 20 where they remained until spring. Steelhead that entered the river during

Table 3. Round weights and fork lengths of male and female steelhead of different ocean ages among fish sampled during the winter and spring of 1980-81. Repeat spawners are not included.

SEX	OCEAN AGE	AVERAGE	RANGE	NUMBER
		Weight – Kg		
Male	.1	1.9	1.4 – 2.3	9
	.2	5.1	2.3 – 6.8	25
	.3	6.7	5.4 - 7.3	5
Female	.1	2.0	0.9 – 2.7	3
	.2	4.2	2.3 – 5.9	28
	.3	4.7	4.1 – 5.4	2
		Length – Cm		
Male	.1	57.0	50.8 – 61.0	9
	.2	77.2	58.4 – 88.9	26
	.3	84.4	81.3 – 87.7	5
Female	.1	58.4	50.8 – 66.0	3
	.2	73.2	61.0 – 81.3	26
	.3	78.7	76.2 – 81.3	2

November apparently remained in the middle portion of the Kalum during the winter. The April run of fish remained in the lower 20 km of the Kalum during their relatively short stay of 1 or 2 months.

The summer run steelhead are clearly the most heavily harvested stock in the sport fishery. These fish are exploited in the Skeena bar fishery, the fall fishery in the Kalum and in the winter and spring fishery on the upper river. The spring run of steelhead, by comparison, is only fished on the lower Kalum during April because the river is generally high and muddy during the remainder of their stay in May and June.

Summer fish should be afforded greater protection than the relatively untouched spring fish. One way of reducing this harvest is to eliminate the kill fishery on the upper Kalum during the winter and spring. The easiest and most beneficial cut—off area is Glacier Creek, above which summer fish are vulnerable and fishing pressure is heavy and in many cases spawning fish are taken off their redds. As a result, it is recommended that all waters upstream of Glacier Creek be limited to “catch and release” from December 1 to June 15 to protect wintering summer steelhead and spawners in this area.

Kalum, Redsand and Treston Lakes are important wintering areas for summer steelhead in the upper Kalum River. Forty—five percent of the radio tagged fish spent at least part of their winter in these lakes. Most of the fish that wintered in the lakes moved downstream to spawn in the spring, although tagged summer fish did move through the lake in the spring to spawn above the lake in the Cedar River. Telemetry data

suggests that most fish that spawned in the Cedar River wintered in the lower Cedar and Beaver River.

Telemetry data provided useful information about time and locations of spawning. Fifty percent of the tagged fish spawned in tributaries. The most heavily used was Deep Creek, where 5 of the radio tagged fish spawned during May. The other tributaries that were utilized by radio fish were Lean-To Creek with 3, and Cedar River with 3. It is suspected that Lower Star Creek was also used by radio tagged fish, but this was unconfirmed. The last fish was lost in April; perhaps the result of a transmitter failure.

All of the above mentioned systems appear to have some enhancement potential. Both Deep and Lean—To Creeks have impassable barriers to their upper reaches, so reconnaissance work should be carried out to determine their value in headwater fry stocking. In the Cedar River, 2 of the 3 tagged fish spawned in lower Hadenschild Creek, which is a system with little spawning habitat. Although gravel abounds in the Cedar, spawners are attracted to Hadenschild, perhaps by warmer temperatures and more stable flows. Further investigation may clarify this behavior with consideration to creating spawning habitat such as gravel spawning platforms.

The heavy use of tributaries by tagged fish underlines their value as spawning and rearing habitat. These systems must be carefully protected in order to maintain their current levels of production. In terms of angling regulations, the measures are straight forward; these tributaries should be closed to angling. In terms of habitat protection,

the measures are less clear. The District of Terrace currently holds water licences on Deep and Spring Creeks and removal of water from these systems will obviously affect fish production, therefore such plans must be closely examined to reduce the effects of dewatering. A notice to this effect has been put on file in the Regional Water Management Branch in Smithers. In addition, further urban development of Deep Creek and Spring Creek must be restricted to maintain water quality and natural streamside cover if possible.

Side channel spawning was also documented just upstream of Lean—To Creek (Km 14). Historically the Kalum had numerous side channels but many were closed off to assist log drives on the mainstem. In many cases, re—opening of side channels would provide excellent habitat for spawning and juvenile rearing.

Radio tagging showed that only summer run steelhead spawned in the upper Kalum above the lake. Winter fish and some summer fish spawned in the lower half of the Kalum. An example of this was Lean-To and Deep Creeks ‘where a mix of summer and winter fish were recorded spawning in May. If fry stocking is found to be a viable enhancement option, then care must be taken to obtain summer fish for brood stock because they provide the most recreation for anglers, and are the most heavily exploited stock of the Kalum steelhead. For Cedar River projects the brood stock should be obtained at the Cedar/Beaver confluence during low winter flows. For fry stocking below the lakes, brood stock should be obtained from the Kalum mainstem above Km 25 before April.

Kelts were found to leave the Kalum in early May, with the exodus peaking around mid-May. Some fish lingered until June which is not uncommon for Skeena steelhead (Lough, 1983). One tagged kelt from the Cedar River was monitored during its downstream migration through Kitsumkalum Lake and was found to average 7 km/day for the 3 day journey; a rate similar to the upstream average of 8.6 km/day established during a previous study (Lough, 1981). The slower rate could be due to an indirect route through the lake.

Readable scales taken from 69 tagged fish showed that the most common age groups were 3.2 (38.3%) and 4.2 (26%). Only 2 fish were repeat spawners. Since the time of river entry for these fish was difficult to determine, all fish were assumed to be winter fish and were aged only to the last obvious annulus. A true summer fish aged at .2+ ocean growth would have extensive erosion of the “plus” growth during sampling in the spring, and would therefore be aged as a winter fish with 2 winters of ocean growth, or .2 ocean. The result is that true summer run fish may have been aged slightly younger than they actually were. More intensive sampling when only summer run fish are in the river (September – October) will give more accurate aging of these summer run steelhead.

8.0 SUMMARY

Description of the Sportfishery

- The Kalum supports a major chinook salmon fishery (spring and early summer) as well as a steelhead fishery.
- During the fall and spring, steelhead anglers appear to distribute themselves throughout the Kalum.
- The winter steelhead fishery centers mostly on accessible parts of the upper river below the lakes.
- Although total steelhead catch has increased in recent years, the kill has remained fairly stable due to an increasing incidence of catch and release.

Steelhead Movements

- 22 steelhead were radio tagged and 45 were spaghetti tagged during the period December, 1980 to April, 1981.
- The Kalum has 3 main steelhead runs: late summer, late fall and spring; all of which remain to spawn during May.
- Kitsumkalum, Redsand and Treston Lakes are heavily used as wintering habitat.
- Deep and Lean—To Creeks and the Cedar River were identified as valuable spawning and rearing systems.
- Mainstem spawning was only documented on the upper Kalum above Lean— To Creek.
- Side channel utilization pointed out their value as spawning and rearing habitats. Opening closed side channels as an enhancement opportunity should be investigated.
- Most spawning takes place during early and mid-May, and most kelts leave the Kalum by June.
- Summer steelhead are heavily harvested throughout their summer, winter and spring residence in the Kalum and Skeena, and angling restrictions are recommended to limit this harvest.

— Enhancement and management opportunities are discussed.

LIFE HISTORY

- Seventy-five steelhead were sampled during the study, from which 69 scale samples were read. Eight age groups were identified. The most frequently observed were 3.2 (38.3%), 4.2 (26.0%), 3.1 (14.5%) and 3.3 (9.6%).

— The average weights for male steelhead of ocean age .1, .2 and .3 were 1.9, 5.1 and 6.7 kg, respectively.

— The average lengths for male steelhead of ocean age .1, .2 and .3 were 57.0, 77.2 and 84.4 cm respectively.

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APPENDIX 1

Tagging data for steelhead tagged in the Kitsumkalum River, 1980—81.

1. Radio tagging data

2. Spaghetti tagging data

Appendix I — 1. Steelhead Radio Tagging Data — Kitsumkalum River 1980—81.

Fish No.	Weight (kg)	Sex	Date Tagged	Location of Tagging (km on Kitsumkalum River)[1]	
1	5.0	M	80/12/09	27 km	
2	2.3	F	81/01/06	34 km	
3	8.2	M	81/01/07	22 km	
4	5.5	F	81/01/07	22 km	
5	4.5	F	81/01/08	26 km	
6	6.8	M	81/01/08	26 km	
7	7.3	M	81/01/08	26 km	
8	5.0	M	81/01/08	26 km	
9	5.9	M	81/01/09	15 km	
10	7.3	M	81/01/09	20 km	
11	6.4	M	81/01/09	21 km	
12	5.0	F	81/01/12	28 km	
13	5.9	F	81/01/13	22 km	
14	5.5	M	81/01/13	9 km	
15	4.1	M	81/01/14	+4 km	(above lake)
16	5.5	F	81/02/25	26 km	
17	5.5	F	81/02/25	26 km	
18	4.1	F	81/03/03	+16 km	(above lake)
19	4.5	F	81/04/15	27 km	
20	9.1	M	81/04/23	5 km	
21	5.5	F	81/04/23	3 km	
22	5.5	M	81/04/24	5 km	

[1]Tagging location taken to nearest kilometer as measured from the confluence of the Kitsumkalum River and the Skeena except where the zero km point is Kitsumkalum Lake (plus (+) sign indicates tagging site above Kitsumkalum Lake).

Appendix I - 2. Steelhead spaghetti tagging data Kalum River 1980-81.

Fish No.	Wt. (kg)	Sex	Date Tagged	Spaghetti Tag Number (Green)
1	2.7	F	80/11/21	00164
2	2.3	M	80/11/21	00163[a]
3	1.8	M	80/11/21	00162
4	2.3	M	80/11/21	00256
5	4.1	F	81/01/07	00301
6	4.1	M	81/01/07	00302
7	4.1	F	81/01/08	00303
8	3.9	F	81/01/08	00304[b]
9	5.4	M	81/01/09	00304
10	4.1	M	81/01/09	00101
11	4.5	F	81/01/13	00166
12	0.9	F	81/01/13	00165
13	1.4	M	81/01/14	00306
14	2.7	M	81/01/14	00308
15	2.7	M	81/01/14	00309
16	2.3	M	81/01/14	00310
17	2.3	F	81/01/14	00349
18	4.5	F	81/02/23	00261
19	4.5	F	81/02/23	00260
20	3.2	F	81/02/24	00262
21	5.0	M	81/02/24	00263
22	5.4	F	81/02/24	00264
23	3.6	F	81/02/24	00265
24	5.4	M	81/02/25	00266

Appendix I — 2 (cont'd). Steelhead spaghetti tagging data Kalum River 1980-81.

Fish No.	Wt. (kg)	Sex	Date Tagged	Spaghetti Tag Number (Green)
25	7.3	M	81/02/25	00267[c]
26	4.5	M	81/02/26	00268
27	7.3	M	81/02/26	00269
28	7.3	M	81/02/26	00270
29	4.5	F	81/02/26	00271
30	6.4	M	81/02/26	00272
31	5.0	M	81/02/26	00273
32	3.6	F	81/03/04	00170
33	1.8	M	81/03/04	00172
34	5.4	F	81/03/05	00102
35	6.8	M	81/03/06	00173
36	5.4	F	81/03/10	-----
37	3.6	F	81/03/10	00149
38	5.0	M	81/03/10	00150
39	5.9	F	81/03/19	00148
40	5.4	M	81/04/07	00174
41	4.5	F	81/04/23	00105
42	4.5	F	81/04/25	00146
43	2.4	M	80/11/20	00120 (yellow)
44	4.1	F	81/02/19	00103 (yellow)
45	4.5	F	81/02/19	00104d(yellow)

a. Steelhead #00163 recaptured March 22, 1981 after it dropped down out of the Cedar River and moved up the Beaver River approximately 13 km.

b. Steelhead #00304 recaptured January 18, 1981 approximately 6 km upstream of tagging site.

c. Steelhead #00267 recaptured February 28, 1981 approximately 3 km upstream of tagging site.

d. Steelhead #00104 recaptured May 24, 1981 approximately 5 km upstream of tagging site.

APPENDIX II

Spot water temperature observations of the Kitsumkalum River and its tributaries, 1980—81.

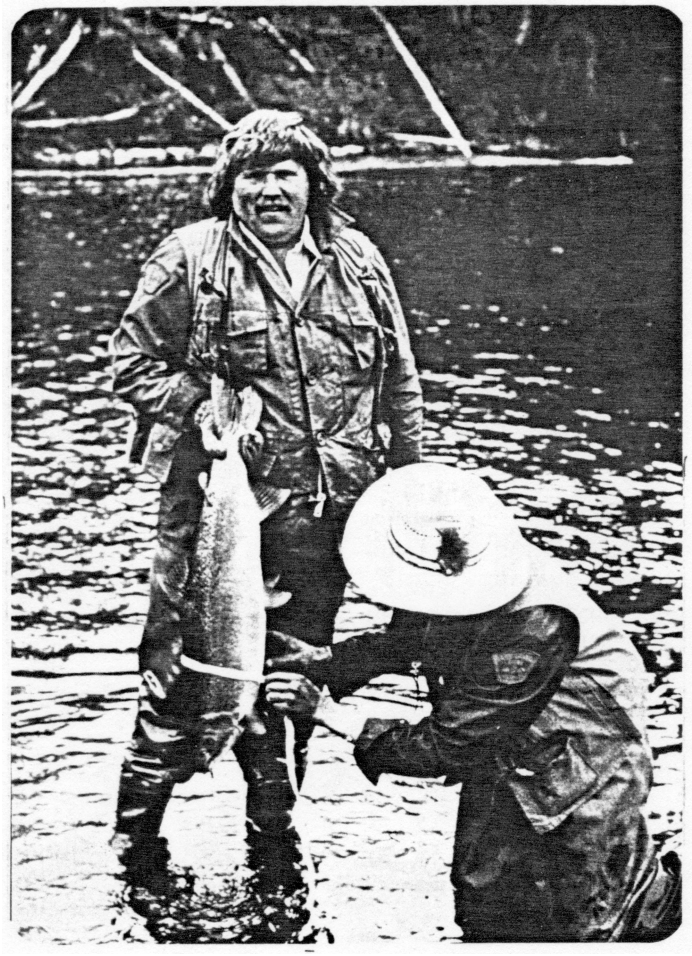
Appendix II Spot temperature observations and water conditions in the Kalum River drainage, 1981.

	Kalum	Cedar	Beaver	Deep	Lean—To	Glacier	Clear
March 15	4°,Green	3.5°,Lo	4.0°,Lo	3.5°,Lo	2.5°,Lo	3.5°,Lo	4°,Lo
March 25	4.5°	--	--	--	--	--	--
April 3	4.0°	--	--	--	--	--	--
April 6	5.50	--	5.5°	--	--	--	--
April 14	3.5°	--	--	3.5°	3.0°	--	--
April 15	4.0°,Lo	--	--	--	--	--	--
April 23	4.0°,Lo	--	--	--	--	--	--
May 1	5.0°,Hi	6.0°,Lo	6.0°,Lo	7.0°,Lo	4.5°,Lo	3.0°	7,Clear
May 7	--	4.8°,Hi	4.8°,Hi	7.0°	5.0°	4.0°	--
May 20	8.0°	--	--	--	--	--	--
May 21	9.0°,Hi	--	--	9.0°	8.5°	4.0°	--
May 27	9.0°	--	--	--	--	--	--
May 28	7.0°	--	--	8.0°	7.0°	--	--
June 4	6.5°,Hi	--	--	10.0°	6.5°	--	--

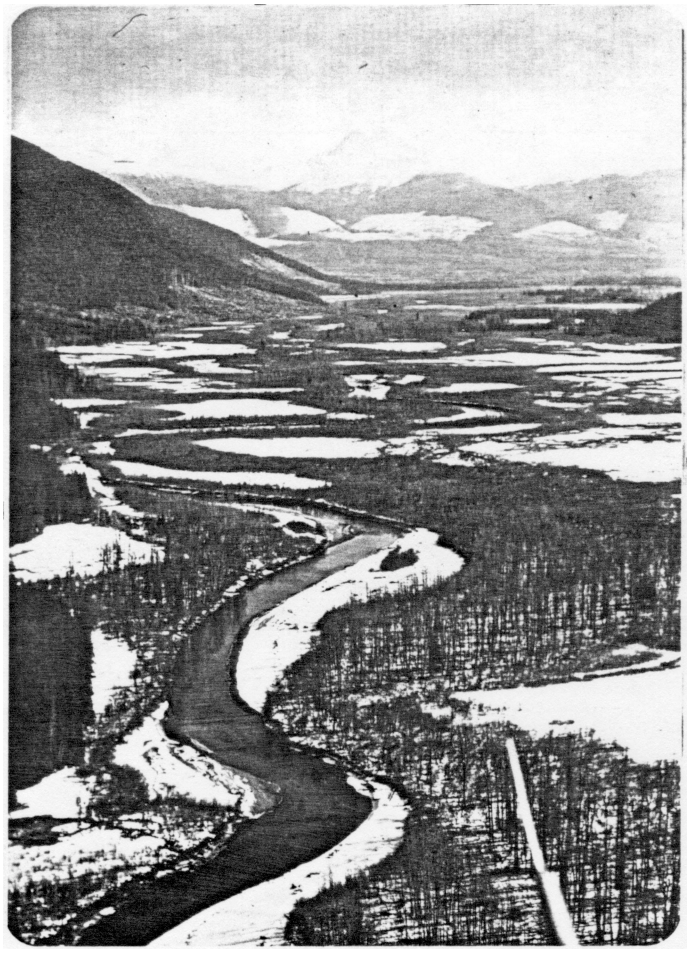
a) Water temperature of Kalum Lake (@ 0.5 m depth) on March 18/81 = 3°C.
b) Water temperature of Treston Lake (@ 0.5 m depth) on May 2 1/81 = 8°C.

APPENDIX III

Photographs



Kalum River. Live capture of steelhead by angling.



Beaver River. Looking downstream toward Kitsumkalum Lake at Km 15 of the Beaver River.

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