SURVEY OF TRIBUTARIES TO KINBASKET RESERVOIR

Prepared for
MICA COMPENSATION PROGRAM
Fisheries Technical Committee
B.C. Hydro & Ministry of Environment, Lands and Parks.

Aquatic Resources Limited

April, 1992

Aquatic Resources Limited

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Date: April 30, 1992
File: 110

Mr. Jay Hammond
Chair, Fisheries Technical Committee
Mica Compensation Program
Ministry of Environment
617 Vernon Street,
Nelson, B.C.
V1L 4E9

Dear Sir:

Re: Survey of tributaries to Kinbasket Lake

The final report on our 1991 fisheries and biophysical surveys of Kinbasket Lake tributaries is enclosed. Thank you for the opportunity to undertake this interesting project.

Regards,

Tim Slaney, R.P.Bio.
Project Manager.

Encl.

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by
R.J. Fielden, T.L. Slaney, and A.W.Wood
AQUATIC RESOURCES LIMITED
Vancouver, B.C.

April, 1992

ABSTRACT

B.C. Hydro retained Aquatic Resources Ltd. to conduct a biophysical survey of 28 tributaries to Kinbasket Lake. The lake is a reservoir formed by the Mica Dam on the Columbia River in southeastern B.C. The objectives of the study were to assess the habitat and fish populations in the tributaries in order to identify opportunities for the enhancement of stream resident and migratory sport fish in the tributaries.

Field work was conducted between August 29 and October 19, 1991. The 28 streams consist of nine glacial systems, 12 systems fed by icefields, and seven systems without glaciers or icefields. Seventy-five reaches were identified of which 36 had steep gradients and primarily boulder, riffle, rapid or cascade habitats, 21 had moderate gradients and 18 had low gradients. In 21 of the systems the water turbidty was high, while in the remaining seven systems the water turbidty was low.

Five sport fish species were encountered; rainbow trout, mountain whitefish, bull trout, brook trout and kokanee. Only Succour Creek, a clear lake fed system, supported large numbers of rainbow trout. An estimated 42,000 kokanee were present in nine systems between October 6 and 11, 1991. Bull trout was the most ubiquitous species as it was encountered in 21 systems, often above barriers. High densities of brook trout were encountered at the head of the Wood River system and low densities were found in Succour Creek. Mountain whitefish were prevalent in many low gradient reaches with high suspended sediment levels.

The potential for sport fish enhancement in most of the tributaries is generally limited by steep gradients, high suspended sediment levels, and instability. None the less, a number of possible enhancement programs were identified. These included: the removal of barriers on the Cummins and Beaver Rivers to allow access for bull trout and kokanee; the development of groundwater-fed spawning channels for kokanee spawners in the Bush, Sullivan and Wood Rivers; stabilizing Succour Arm to create rearing habitat for trout and water fowl; development of rainbow trout rearing habitats in Packsaddle Creek; the removal of a culvert on Packsaddle Creek to allow easier access for rainbow and bull trout; and the introduction of brook trout or rainbow trout to the upper reaches of Ptarmigan, Hugh Allen and Bachelor Creeks.

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PART I

INTRODUCTION

1.0 BACKGROUND

B.C. Hydro retained Aquatic Resources Ltd. to conduct a biophysical survey of selected tributaries to Kinbasket Lake during 1991. The lake (Figure 1) was created in 1973 after the Mica Dam, 130 km north of Revelstoke, was completed.

The purpose of the study was to provide habitat and fish utilization information for enhancement projects in the Kinbasket area which will be conducted under the auspices of the B.C. Environment/B.C. Hydro Mica Fisheries Compensation Program. The intention is to increase recreational fishing opportunities within the Columbia River area to compensate for the loss of habitat due to the Mica and Revelstoke dams. This study was one of several that were conducted on the Columbia River during 1991.

The specific objectives of the study were to:

1. Conduct a biophysical inventory of selected tributaries to Kinbasket Lake.
2. Provide photographic documentation of the various reaches of the each of the systems, barriers to fish migration and enhancement opportunity sites.
3. Assess opportunities for enhancement of the tributary streams for stream resident and migratory sport fish.

1.1 STUDY AREA

Kinbasket Lake is one of the largest lakes in B.C., covering an area of 276 km^2. It is situated in the Rocky Mountain trench between the Selkirk and Monashee Mountains in the west and the Columbia Range of the Rocky Mountains on the east. This region is the interior western hemlock zone (Krajina 1965) which is characterized by warm summers, cool winters and levels of precipitation second only to that of the coast. Vegetation associated with a wet climate, such as western red cedar, western hemlock and devils' club, is prevalent in the area.

The Mica Dam, the largest dam on the Columbia River, was constructed just downstream of the "Big Bend". From the Mica dam, the lake extends 90 km north along the Rocky Mountain trench towards Valemount and south for 100 km towards Golden. The reservoir flooded 586 km of riverine habitats in 1973 after the dam was completed. The Kinbasket reservoir is important for controlling flow

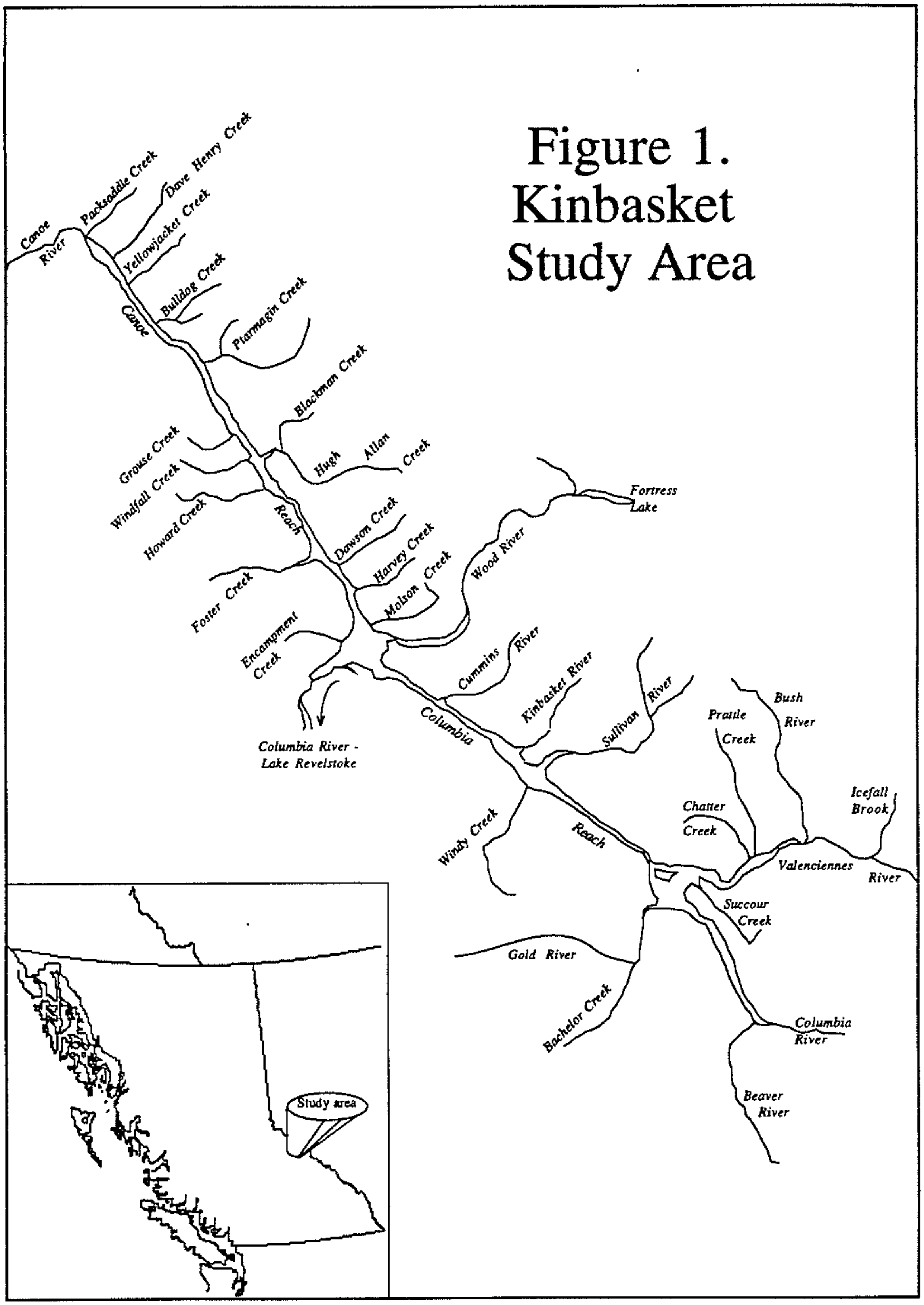


Figure 1. Kinbasket Study Area

to the lower Columbia River, and as a consequence it is subject to water level fluctuations of almost 50 m.

Access to many of the systems can be gained by logging roads (Table 1). The area along Canoe reach and the central basin area is within the McBride forest subdistrict and under various tree farm licences. Roads extend from the north end of the lake up the west side to Howard Creek and to Ptarmigan Creek along the east side of the lake. In the central basin area, roads extend to Encampment Creek and to Yellow Creek on the west side of the lake from the Mica Dam. A barge, operated by Downie St. Sawmills, provides access to a network of roads on the east side of the lake that lead into the Wood River area. The southern portion of the lake, along Columbia reach, is within the Golden Forest District. Roads extend along the south end of the lake to the Sullivan River on the east side and to Double Eddy Creek on the west side.

Table 1
List of Kinbasket Lake Tributaries

	System	Dates surveyed	Length surveyed (km)	Means of access
1	Bachelor Creek	Sept. 10	22	road
2	Beaver Creek	Aug 29,30, Oct 13	22	road, heli.
3	Blackman Creek	Oct 17	18	heli.
4	Bulldog Creek	Oct 16, 18	20	road, heli.
5	Bush River	Sept 7, 8 Oct 7	45	road, heli.
6	Chatter Creek	Sept 9, Oct 7	11	road, heli.
7	Cummins River	Oct 10, 11	25	boat, heli.
8	Dave Henry Creek	Oct 14, 15	14	road
9	Dawson Creek	Oct 11	14	heli.
10	Encampment Creek	Sept 11, Oct 11	5	boat, heli.
11	Foster Creek	Oct 11	15	heli.
12	Grouse Creek	Oct 17, 19	9	road, heli.
13	Harvey Creek	Sept 11, Oct 11	8	boat, heli.
14	Horse Creek	Oct 15, 18	9	road, heli.
15	Howard Creek	Oct 17	15	heli.
16	Hugh Allen Creek	Oct 17	39	heli.
17	Kinbasket River	Sept 2, Oct 11	18	boat, heli.
18	Molson Creek	Sept 11, Oct 11	14	boat, heli.
19	Packsaddle Creek	Oct 14, 18	13	road, heli.
20	Prattle Creek	Sept 9, Oct 7	24	road, heli.
21	Ptarmigan Creek	Oct 16, 18	28	road, heli.
22	Succour Creek	Aug 31, Sept 1, Oct 6,7	14	road, heli.
23	Sullivan River	Sept 3-5, Oct 7	26	road, heli.
24	Valenciennes River	Sept 6,7, Oct 7	25	road, heli.
25	Windfall Creek	Oct 17, 19	12	road, heli.
26	Windy Creek	Sept 3, Oct 7	7	boat, heli.
27	Wood River	Oct 9, 11	37	road, heli.
28	Yellowjacket Creek	Oct 15, 18	15	road, heli.

PART II

METHODS

2.1 BIOPHYSICAL SURVEY

The biophysical survey was undertaken in August, September and October, 1991 when water levels had subsided from peak spring and early summer flows and when kokanee had started to spawn. Seventeen of the 28 systems were accessible by road (Table 1). Less accessible areas were surveyed by boat and helicopter.

Surveys were conducted to identify which portions of the tributaries were likely to be contributing to local fisheries, which habitats had little current fishery value, and which habitats could support future enhancement.

In the field, Reach breaks which had been previously noted during a pre-typing phase, were defined precisely, obstructions located, and fish species composition and densities determined. The stream characteristics examined and the methods (DFO/MOEP 1987) employed are summarized in Table 2.

Table 2
Summary of habitat parameters examined

Parameter		Method	Precision
Channel width		Range finder*	± 0.5 m
		or hip chain**	± 0.2 m
Wetted width		Range finder*	± 0.5 m
		or hip chain**	± 0.2 m
Maximum depth		Metre stick**	± 0.1 m
Gradient		Topo mapping*	± 0.2 %
		Clinometer**	± 0.5 %
Proportion	pool	Visual inspection	± 5%
	run	Visual inspection	± 5%
	riffle	Visual inspection	± 5%
	side channel	Visual inspection	± 5%
Substrate composition		Visual inspection	± 5%
Cover and Debris		Visual inspection	± 5%
Water Temperature		pocket thermometer	±0.5°C
Velocity		Floating chip	± 0.2 $m \cdot sec^{-1}$

* Rivers
** Smaller systems.

Key features examined included; substrates, cover and velocities which typically define spawning and rearing habitats, as well as wetted width and depth which determine the extent of the contribution. Channel width, bank height, bank composition, channel form or constraints, flood signs, and water temperature were also noted. Data was recorded on Stream Survey Cards developed by the Fish Habitat Information and Inventory program (DFO/MOEP 1987).

In the office, stream information was summarized in two data bases. The first included point information from all of the sites samples (Appendix 1). The second summarized habitat data for each reach of the 28 study systems (Appendix 2). Information from both data bases was then geo-referenced using the Quikmap geographical information system and stream centre lines from the B.C. MOE Stream Atlas. At this stage additional information such as the Kinbasket Lake outline, as well as cascades, falls, and other migration barriers were also plotted. Quikmap was then used to generate maps of each of the study systems.

2.2 FISH SAMPLING

Beach seining, float surveys and electroshocking were the main methods used for obtaining density estimates and species composition. Where time, access and stream size permitted, stop nets were placed (de Leeuw 1981) and multiple-removal electroshocking was used to establish fish composition per unit area or per length of shoreline (Platts et al. 1983). Sites that were reached on foot from distances greater than 1 km were sampled mainly by 10 x 2 m beach seine with 1 cm stretch mesh. Catch per area seined was calculated when beach seines were used.

All captured fish were identified and enumerated. A sample of 20 fish of each species and size class were anesthetized with 2-phenoxy-ethanol and fork length was measured on a measuring board (±0.5 mm for fish <200 mm ±2 mm for fish >200 mm). They were then weighed, either on a portable electronic scale for small fish (Ohaus Port-O-gram, ±0.03 g to 150 g), an Ohaus Dial-O-gram triple beam balance (2610 g model) for medium sided fish, or a calibrated Chatillon spring scale (±0.05 kg) for large fish (>1 kg).

Scale samples were collected from the preferred area, located several scales above the lateral line on a line between the posterior end of the base of the dorsal fin to the origin of the anal fins of the fish. Five to ten scales were collected from each fish and placed between glass slides for ageing at a later date. Ageing criteria followed those suggested by McKay et al (1990). Bull trout were not aged as this species is difficult to age non destructively.

For kokanee, both post-orbital hypural and fork lengths were measured (±2 mm). Fish and gonad weights were measured with an Ohaus Dial-O-gram triple beam balance (2610 g model, ±0.05 g). Otoliths were taken for ageing as well as scales because many of the scales were too resorbed in most of the fish. Otoliths were removed and placed in numbered otolith bags which were subsequently stored in glycerine.

The development of each fish was categorized into either bright, transitional, mature, partially spent or spent. Fish that still had silver in the scales were classified as being bright. Transitional fish were those that had spawning colours and had eggs that had not yet ovulated (were still in the skeins) or did not express milt when the abdomen was squeezed. Males that expressed milt or females in which the eggs were loose and were ready to spawn were classified as mature. Partially spent fish had less than 100% and at least 10% of the testes or eggs retained when captured. Spent fish had less than 10% of the testes or eggs remaining.

Mature egg diameters were measured by water hardening a number of eggs and then placing 10 eggs on a measuring board. The length of a row of 10 eggs was measured (±0.5 mm) and the number was divided by 10 to give an average egg diameter.

Only the eggs of unspawned transitional or bright females were counted as the eggs were not loose and could not be forced out of the abdomen during capture. The eggs of nature females were not counted due to the possibility that some eggs could have been lost. The skeins were placed in formalin to harden the eggs and then the eggs were separated and counted using a tally wacker.

The gonadosomatic index for male and female kokanee was calculated using the formula:

$$GSI = (\text{gonad weight})/(\text{body weight})*100$$

PART III

RESULTS AND DISCUSSION

3.1 PHYSICAL CONDITIONS

During the spring and summer of 1991 mean air temperatures were slightly warmer and precipitation was heavier than in previous years. This produced higher and later freshets than usual.

3.1.1 Weather

Temperature data are available from the Environment Canada, Atmospheric Environment Service's Golden weather station, 40 km south of Kinbasket Lake, and the Valemount and Tete Jaune stations, 5 and 15 km north of the lake, respectively. (The Valemont weather station was terminated in June, 1989 and was replaced by a station in Tete Jaune in November, 1989). Temperature data was unavailable at time of reporting for the station at Mica Dam in the middle of Kinbasket Lake. Precipitation data is available from all three locations, as listed above, for the south, middle and north end of Kinbasket Lake.

Average mean daily air temperatures for 1991 at the Golden weather station south of Kinbasket Lake were within 2°C of the 40 year averages (1951-1990) in all months for which data is available, except February and August, which exceeded the averages by 7°C and 3°C, respectively (Figure 2).

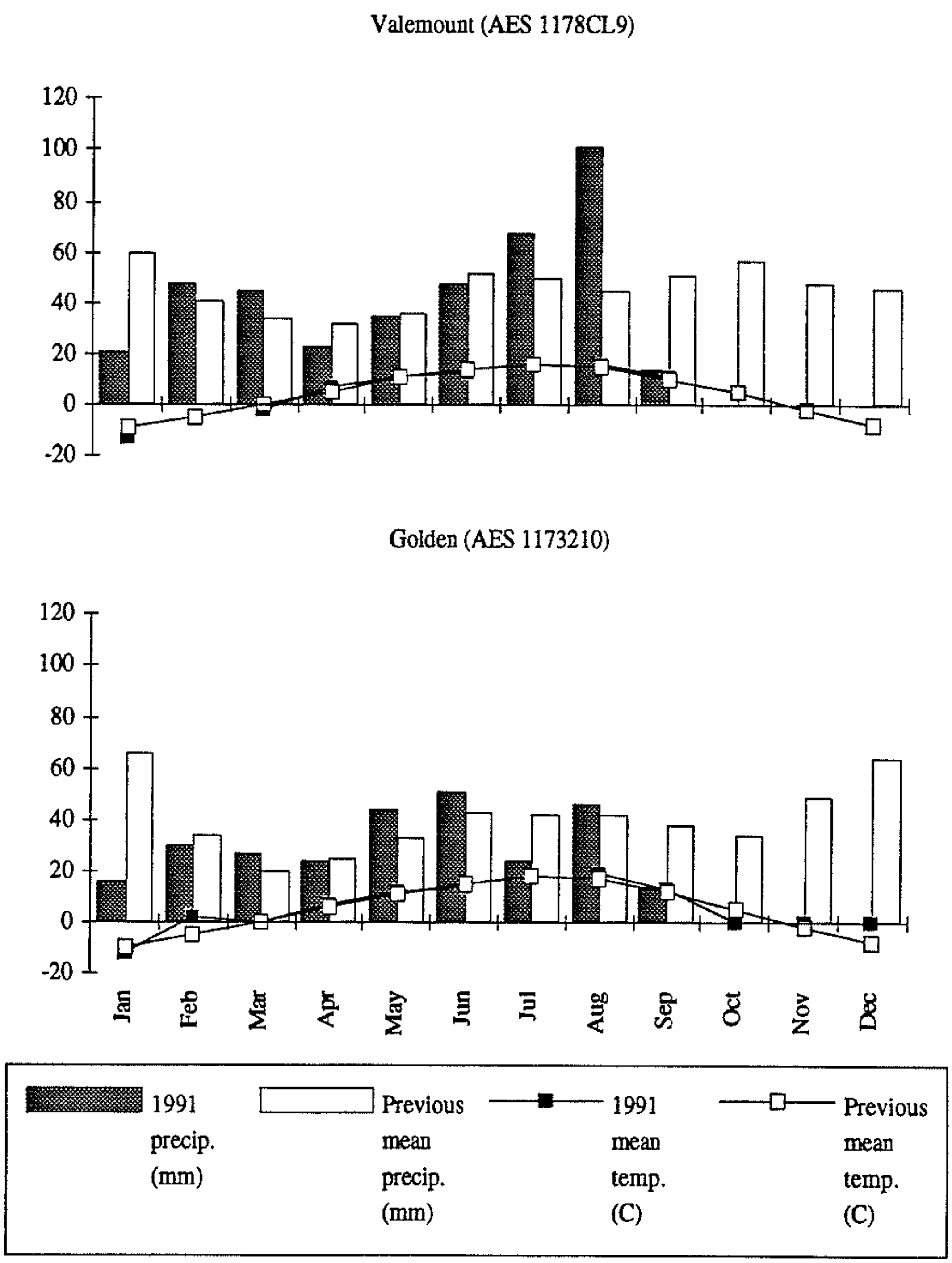
The available 1991 mean daily air temperatures at the Valemount/Tete Jaune weather stations, at the north end of Kinbasket Lake, were also similar to the 16 year averages (1975-1990), except for January, which was 5°C below the average (Figure 2).

Precipitation at the Golden station exceeded the 40 year averages (1951-1990) by 30% (10 mm), 16% (7 mm) and 12% (5 mm) in May, June and August, respectively, and fell below the averages by 43% (18 mm) and 62% (23 mm) in July and September, respectively (Figure 2).

Precipitation at the Valemount/Tete Jaune station exceeded the 20 year averages (1971-1990) by 34% (17 mm) and 124% (56 mm) in July and August, respectively, but fell below the average by 73% (37 mm) in September (Figure 2).

Precipitation at the Mica Creek weather station, close to the middle of Kinbasket Lake, was below the 40 year average (1951-1990) by 56% (39 mm) in June and

Figure 2
Temperature and precipitation in Kinbasket study area, 1991.



exceeded the averages by 55% (42 mm) and 58% (40 mm) in July and August, respectively.

3.1.2 Stream Conditions.

Discharge data in the study area for the current period is available for the Canoe River, at the north end of Kinbasket Lake, the Beaver River, at the south end of the Lake, and the Gold River, approximately 25 km north of the south end of Kinbasket Lake.

Water discharges on the Canoe River were 25% (11.4 $m^3 \cdot s^{-1}$) above the average in August (Figure 3). This is related to the higher than normal precipitation in the area during July and August.

Gold River discharges were 14% (7) below the 18 year average (1973-1990) in June; and 12% (7 $m^3 \cdot s^{-1}$) and 23% (10 $m^3 \cdot s^{-1}$) above the averages in July and August, respectively (Figure 3). These discharges are correlated to higher than average temperatures in August at Golden (July data unavailable) and precipitation data at Mica Creek (75 km north) for June, July and August.

Water discharge on the Beaver River was 35% (12 $m^3 \cdot s^{-1}$) above the 6 year average (1985-1990) in September, which does not correspond to the lower than average precipitation at Golden in September, but may be due, in part, to higher than normal precipitation and temperatures in August (September temperature figures not available).

3.2 HABITAT DESCRIPTIONS

The Kinbasket Lake tributaries which were examined under this program can generally be characterized as being unstable, having steep gradients, and having high levels of suspended solids (Table 3). Nine of the systems were glacial, 12 had icefields in their watersheds, and seven were fed by snow melt, groundwater and surface runoff. The glacial systems had very high levels of suspended solids and were generally unstable due to large bed loads. The reaches in low gradient areas of these systems often had wide, unstable, braided channels while higher gradient areas were entrenched and had boulder rapids for habitat. The systems fed by icefields were generally smaller and had lower levels of suspended solids. The systems without glaciers or icefields were low in turbidity but often were entrenched with steep gradients.

Figure 3.
Representitive stream discharge in the Kinbasket area, 1991.

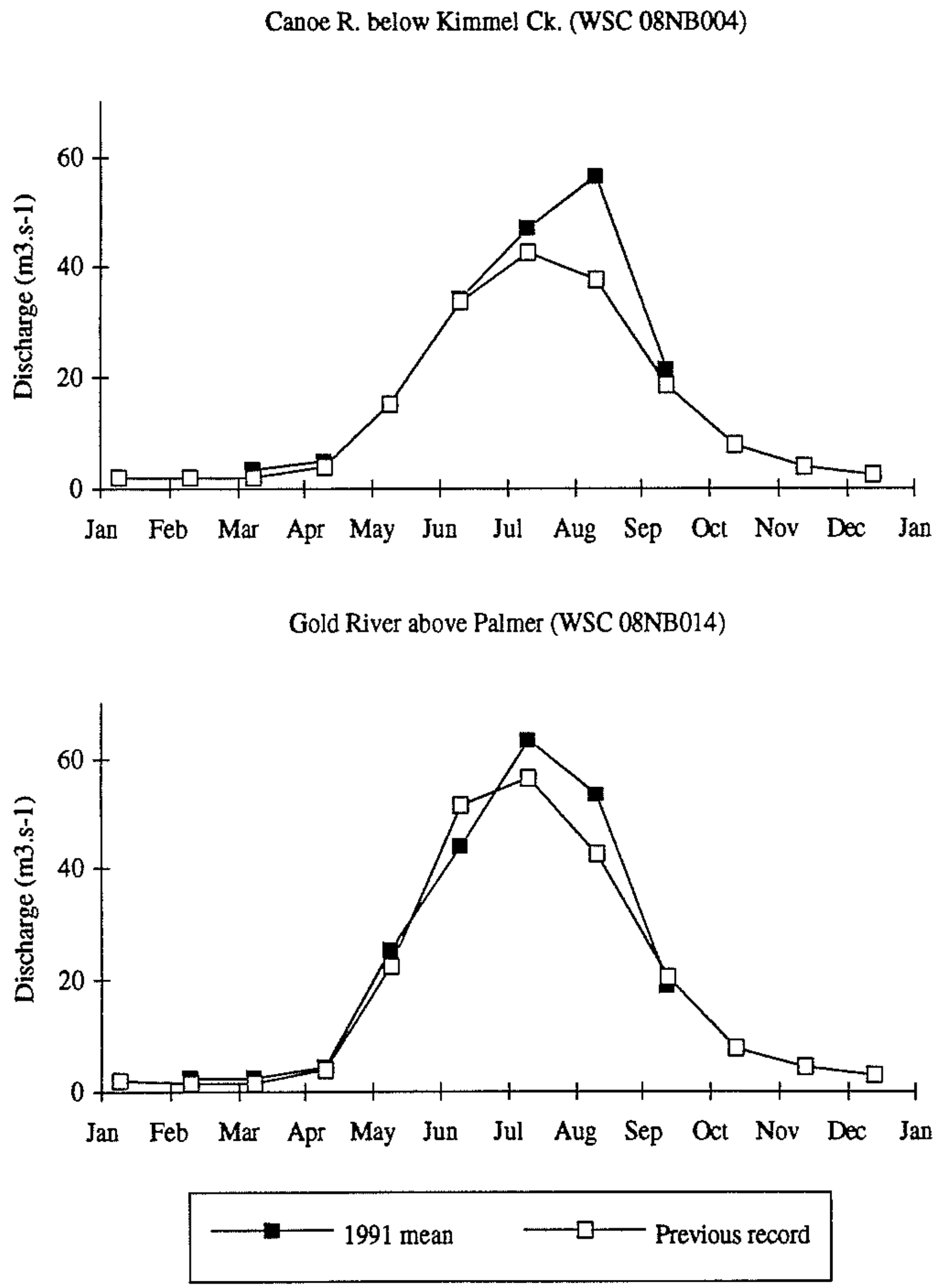


Table 3

General habitat characteristics of Kinbasket Lake tributaries, August-October,1991.

System	Reach	Length (km)	Gradient %	Turbidity	Dominant Substrate	Dominant Habitat
Bachelor Creek	1	14.5	3.0	moderate	boulder	rapids
	2	7.5	0.3	low	gravel	pool-glide
Beaver River	1	1.2	0.0	high	fines	glide
	2	1.5	2.0	high	boulder	rapids
	3	4.9	<0.6	high	cobble	riffle
	4	>14.0	0.3	high	gravel	glide
Blackman Creek	1	12.0	5.1	moderate	boulder	rapids
	2	5.6	3.3	moderate	gravel	riffle
Bulldog Creek	1	1.4	12.0	moderate	boulder	rapids
	2	6.3	5.6	low	boulder	glide
Bush River	1	7.0	0.3	high	cobble	glide
	2	7.0	0.8	high	boulder	riffle
	3	1.5	2.0	high	boulder	rapids
	4	3.8	1.2	high	boulder	rapids
	5	13.5	0.4	high	cobble	glide
	6	1.3	2.2	high	boulder	riffle
Chatter Creek	1	8.0	6.5	low	boulder	rapids
	2	2.7	2.3	low	cobble	riffle
	3	7.0	6.1	low	boulder	rapids
Cummins River	1	3.1	3.7	high	boulder	rapids
	2	22.0	0.1	high	gravel	glide
Dave Henry Creek	1	6.2	7.4	low	boulder	rapids
	2	9.2	3.4	low	cobble	riffle
Dawson Creek	1	13.7	3.8	low	cobble	riffle
Encampment Creek	1	5.2	4.5	low	boulder	rapids
Foster Creek	1	14.6	4.9	high	boulder	rapids
Grouse Creek	1	8.9	11.6	low	boulder	rapids
Harvey Creek	1	5.9	8.9	moderate	boulder	rapids
	2	2.4	0.5	moderate	gravel	pool-glide
Horse Creek	1	6.3	13.1	low	boulder	rapids
	2	2.2	2.8	low	cobble	riffle
Howard Creek	1	15.0	4.7	moderate	boulder	rapids
Hugh Allen Creek	1	7.6	1.8	moderate	boulder	rapids
	2	8.6	0.5	moderate	cobble	pool-glide
	3	14.8	3.2	moderate	boulder	rapids
	4	8.4	2.6	low	cobble	glide-pool
Kinbasket Creek	1	2.6	2.6	high	boulder	rapids
	2	2.1	1.5	high	cobble	glide-rif.
	3	13.0	1.0	high	gravel	rif.-glide

Table 3 (continued)
General habitat characteristics of Kinbasket Lake tributaries, August-October, 1991.

System	Reach	Length (km)	Gradient %	Turbidity	Dominant Substrate	Dominant Habitat
Molson Creek	1	11.5	5.3	clear	boulder	rapids
	2	2.8	1.1	clear	gravel	glide-rif.
Packsaddle Creek	1	3.4	4.5	clear	boulder	rapids
	2	9.1	8.7	clear	cobble	riffle
Prattle Creek	1	4.5	3.8	moderate	boulder	rapids
	2	19.0	1.9	moderate	cobble	riffle
Ptarmigan Creek	1	5.5	3.6	high	boulder	rapids
	2	10.2	2.8	high	cobble	riffle
	3	12.6	1.4	low	gravel	pool-riffle
Succour Creek	1	3.2	1.0	low	gravel	glide-pool
	2	5.3	3.2	low	cobble	riffle
	3	5.3	<0.5	low	fines	glide
Sullivan River	1	4.3	0.0	high	fines	glide
	2	7.3	<0.5	high	cobble	glide
	3	7.0	0.5	high	boulder	rapids
	4	6.9	0.4	high	cobble	riffle
Valenciennes River	1	0.2	1.0	high	cobble	glide
	2	10.0	1.8	high	boulder	rapid
	3	4.5	<0.4	high	gravel	riffle
Icefall Bk.	1	1.8	<0.4	high	gravel	riffle
2	2.0	2.0	high	boulder	rapids	
3	7.0	1.7	high	gravel	riffle	
Windfall Creek	1	3.5	9.1	low	boulder	rapids
	2	4.5	2.7	low	cobble	riffle
	3	2.6	10.6	low	boulder	rapids
	4	1.3	4.7	low	cobble	riffle
Windy Creek	1	3.5	3.0	high	boulder	rapids
	2	3.4	1.5	high	cobble	riffle
Wood River	1	9.5	<0.5	high	cobble	glide-rif.
	2	5.6	4.3	high	boulder	rapids
	3	8.6	1.0	high	cobble	riffle
	4	6.6	6.1	high	boulder	rapids
	5	6.9	<0.4	low	gravel	glide
Yellowjacket Creek	1	5.0	6.7	low	boulder	rapids
	2	9.9	4.3	low	cobble	riffle

A total of 75 reaches were surveyed (Table 3). Thirty-six of them had high gradients which generally resulted in a boulder substrate and riffle, rapids or cascade habitat types. Twenty-three of the reaches surveyed had moderate gradients and 16 of the reaches had low gradients.

Bachelor Creek
Bachelor Creek flows into the Gold River which in turn discharges into Columbia Reach on the west side of the lake (Figure 1). Some high gradient sections possibly prevent the migration of fish from Kinbasket Lake into Bachelor Creek as no fish were found in Bachelor Creek when the system was surveyed on September 10. A logging road that parallels the creek to the headwaters allowed access by truck. Turbidity was low

Reach 1 is 14.5 km long with a mean gradient of 3% (Figure 4, Plate 1). The stream channel is generally entrenched and the habitat primarily boulder, rapids, and riffle. There were several cascades up to 2 m high in one section of the lower reach, where the gradient was 10% for 700 m. Fish would likely find it difficult to migrate upstream past this section. September wetted widths averaged 15 m and depths averaged 0.6 m deep. The water was fairly clear with 2 m visibility, however there are some small icefields in the watershed that may increase turbidity during the spring and summer freshet.

The gradient in Reach 2 is 0.3% and the habitat is primarily pool, glide and riffle. The channel irregularly meanders through marsh habitat for almost 6 km before the gradient sharply increases at the head of the valley. This reach appears to be suitable habitat for species such as rainbow due to the clear water, the gravel substrate, the abundance of cover and variation in habitat. However, it is high in elevation (1,370 m) so water temperatures are likely to be cool through most of the year.

Beaver River
The Beaver River flows into the south end of Columbia Reach (Figure 1). It was surveyed on August 26 and 27, 1991 and again on October 13. Water levels and turbidity were high when the system was first examined making it difficult to determine substrate type and depths. Water visibility ranged from 0.15 m in August to 1.5 m in October. All but the lower 8.9 km of the Beaver River flows through Glacier National Park.

Four reaches were identified within the lower 23.1 km of the system (Figure 5). The first is 1.2 km long and extends to the "Gateway" where the river is constricted at one point by a bedrock slab jutting out into the stream channel (Plate 2). Reach one is affected by the reservoir levels and at the time of the survey when the reservoir was close to full capacity, the reach was deep, slow flowing glide (Plate 1).

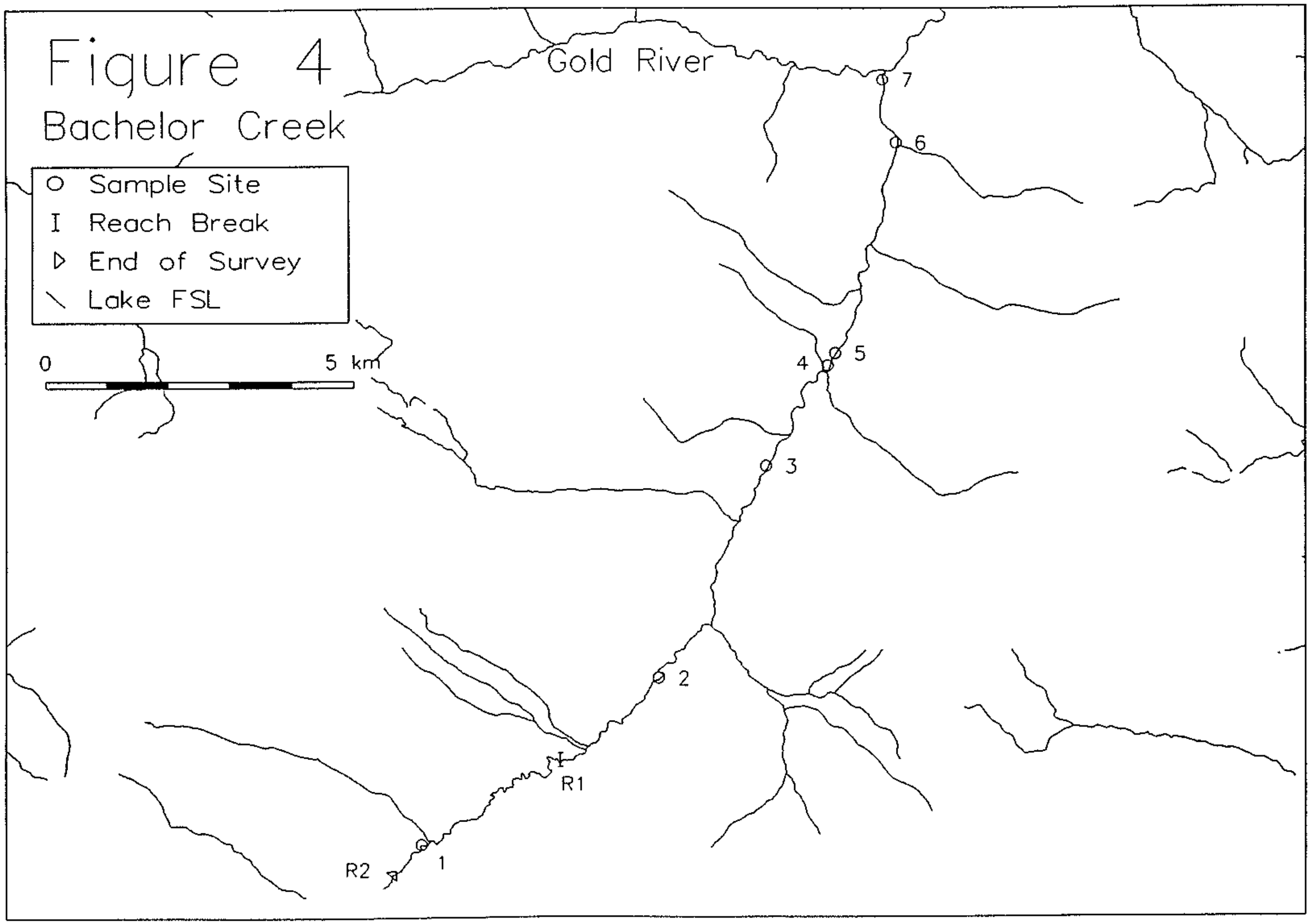
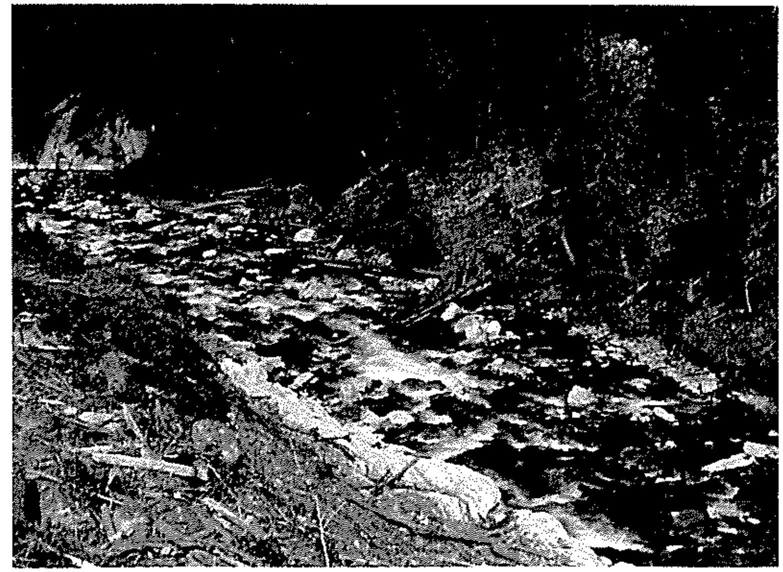


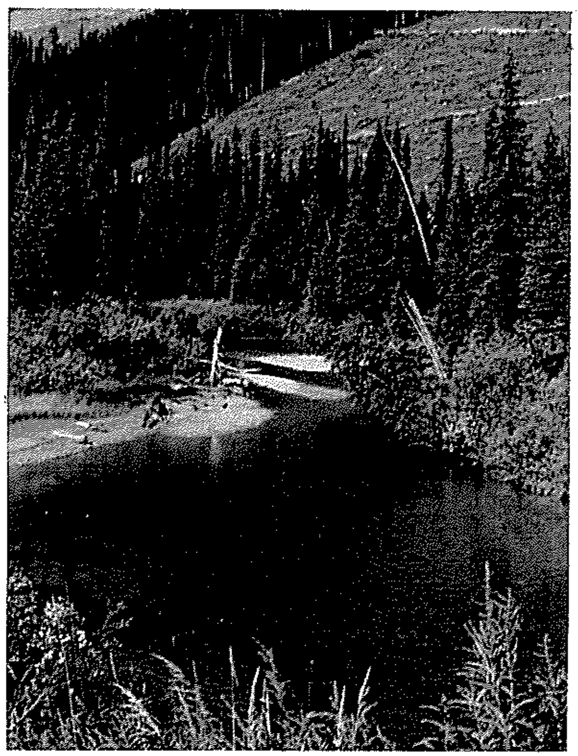
Figure 4
Bachelor Creek
Sample Site
Reach Break
End of Survey
Lake FSL
0
5 km
Gold River
1
2
3
4
5
6
7
R1
R2

Plate 1.

Reach 1 of the Bachelor River has a steep gradient which may impede fish from moving upstream (upper right). In Reach 2 (lower right) the gradient is only 0.3%. This reach appears to be good fish habitat, although no fish were captured. No fish were found in either area.



Reach 1 of the Beaver River (below) is deep, slow flowing glide when the lake level is high.



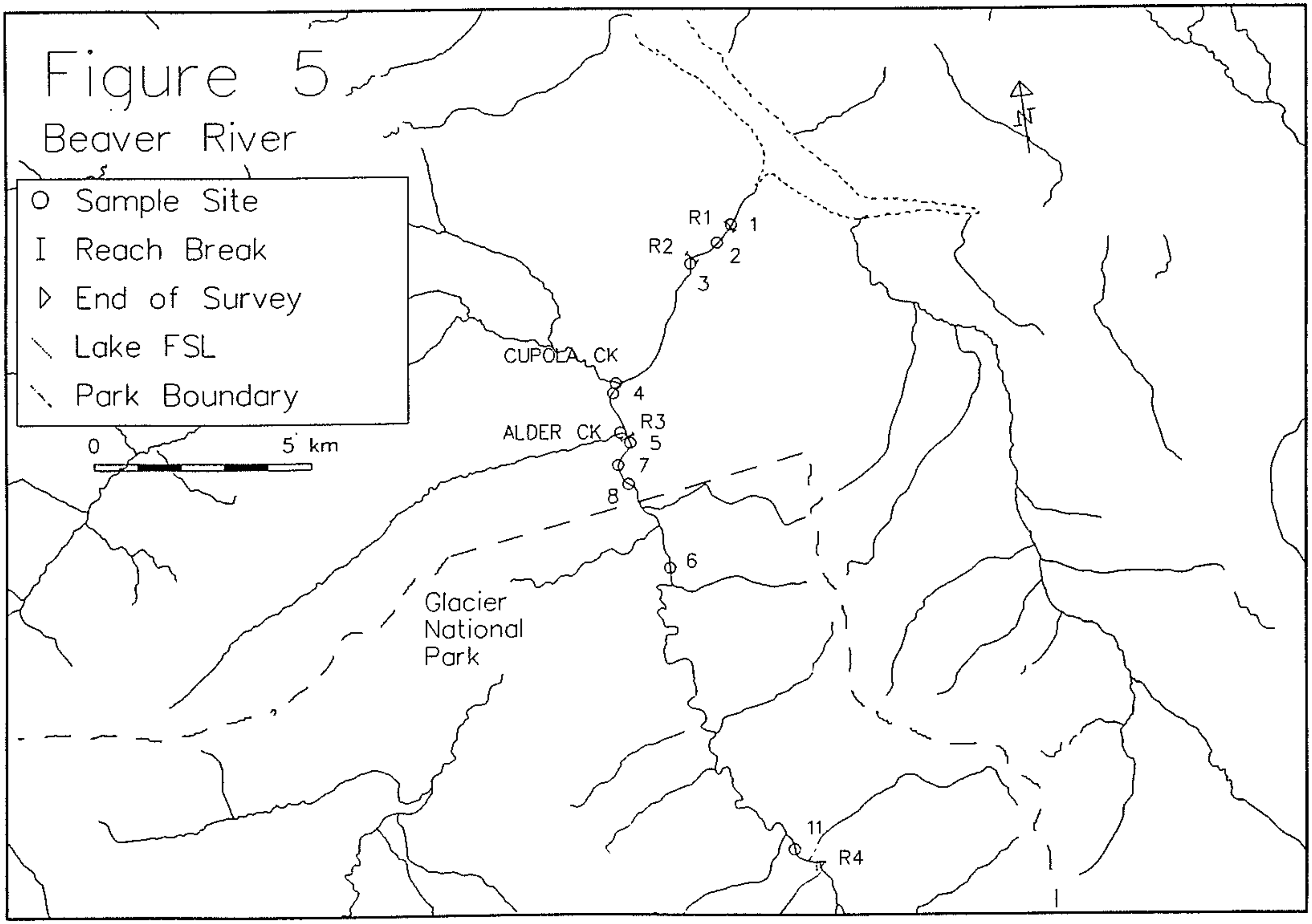
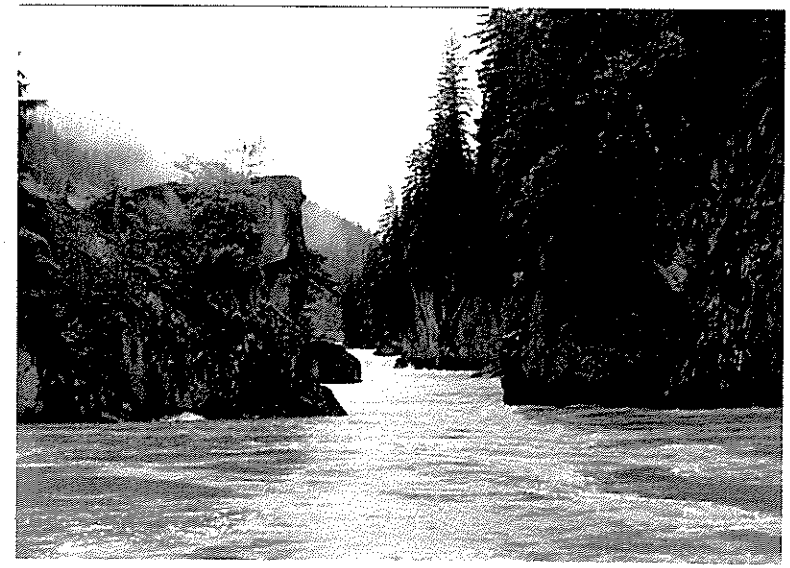


Figure 5
Beaver River
Sample Site
Reach Break
End of Survey
Lake FSL
Park Boundary
0
5 km
N
R1
R2
R3
R4
1
2
3
4
5
6
7
8
11
CUPOLA CK
ALDER CK
Glacier
National
Park

Plate 2.

Just above the "gateway" on the Beaver River at the bottom of Reach 2, is a set of cascades that probably prevents the passage of fish upstream (upper right). Reach 3 is a single channel which is primarily riffle with a gradient of <0.6% (lower right). Further upstream, mountain whitefish and bull trout were found in the glides of Reach 4 (below).



Reach 2 extends 1.5 km upstream from the "Gateway". It is entrenched and primarily boulder rapids with a section of cascades at the lower end of the reach. The cascades probably prevent the upstream passage of most fish species.

Stream gradient decreases in Reach 3 to <0.6% from 2% in Reach 2. As a consequence, the current velocities are lower and the substrate less coarse. The habitat is 40% riffle and 60% glide, the channel is 52 m wide, and the substrate primarily cobble. The stream is a single channel and entrenched. Reach 3 is 4.9 km long. Above it, Reach 4 is primarily slow flowing glide with a gravel and fine substrate. The channel is occasionally confined and follows an irregularly meandering coarse. The reach extends from 7.6 km from the mouth to at least 23.1 km which was the upstream survey limit.

Blackman Creek

Blackman Creek flows into Hugh Allen Creek approximately 300 m upstream from Kinbasket Lake (Figures 1 and 6). It was surveyed by helicopter on October 17, 1991. At that time, visibility ranged from 50 cm in Reach 1 to 35 cm in Reach 2.

The first reach is 12 km long and has a gradient of 5.1% (Figure 6, Plate 3). The channel is entrenched and the habitat is primarily boulder rapids. A falls near the mouth of Blackman Creek may prevent fish from passing upstream. The gradient decreases in Reach 2 to 3.3% over a distance of 5.6 km in Reach 2. This reach has a mixture of glide and riffle habitat with some sections of rapids.

Bulldog Creek

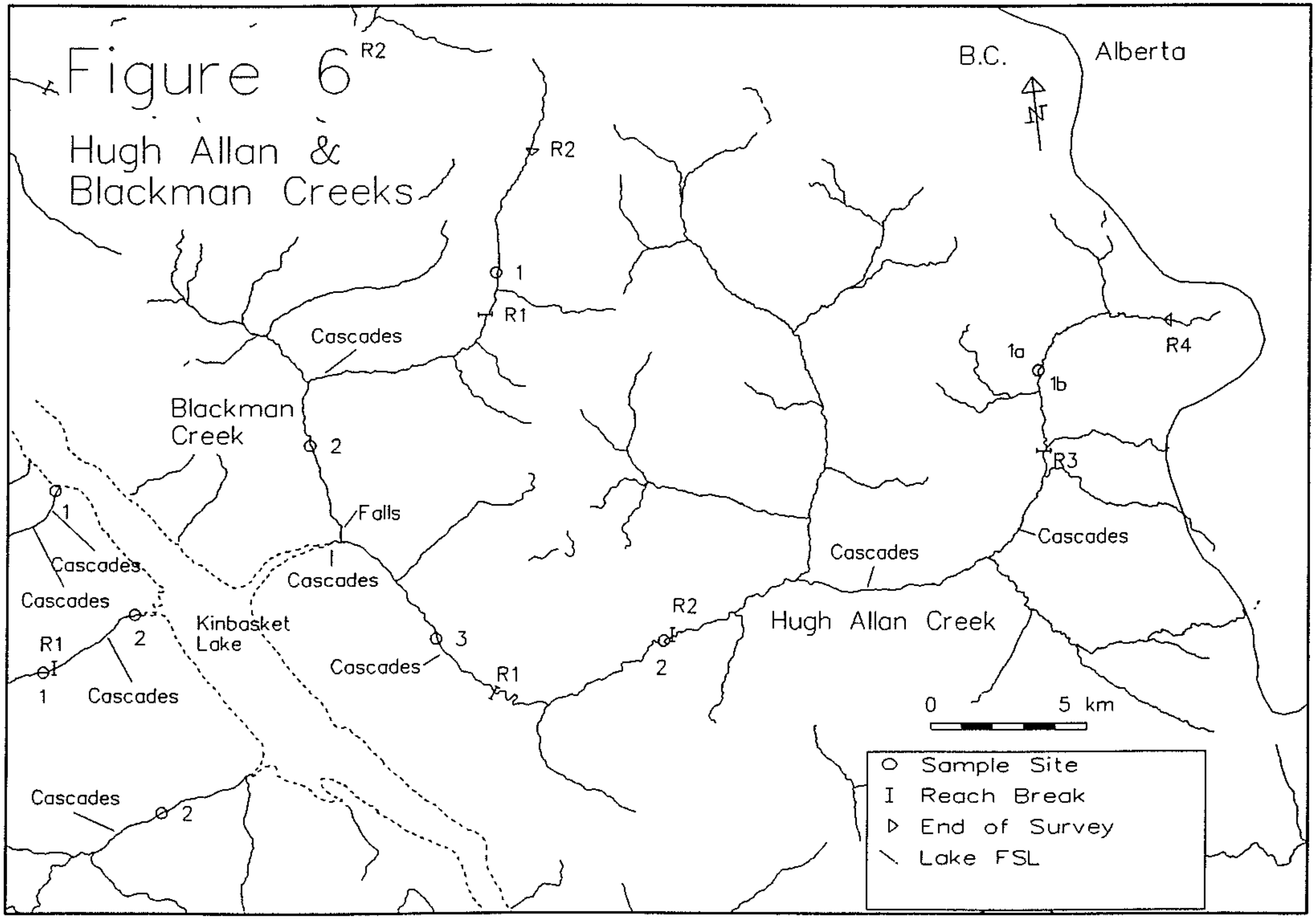
Bulldog Creek flows into the west side of Canoe Reach south of Ptarmigan Creek (Figure 1). Its watershed has not been logged but the mainline along the lake passes close to the mouth of the creek. Water visibility ranged from 100 cm at the mouth to clear at the upper end of the system.

Bulldog Creek has three reaches (Figure 7). Reach 1 is 1.4 km long and has a slope of 12%. The creek flows through a deep canyon along this section and the habitat consists of falls, rapids and cascades. Fish can not pass much beyond the mouth of the creek. The canyon ends at the start of Reach 2 which is still entrenched and is primarily rapids in the lower end and riffle in the upper end. Stream gradient is 5.6% over 6.3 km (Plate 3). The gradient decreases to 3% in Reach 3, which is 12 km long. The habitat is primarily glide and riffle with several sections of cascades. There are few trees along Reach 3 due to the numerous avalanche tracks that lead to the edge of the creek.

A relatively large tributary flows into Bulldog Creek from the south midway through Reach 2. This tributary had a gradient of 4.3% over 12.5 km. The

Figure 6

Hugh Allan & Blackman Creeks



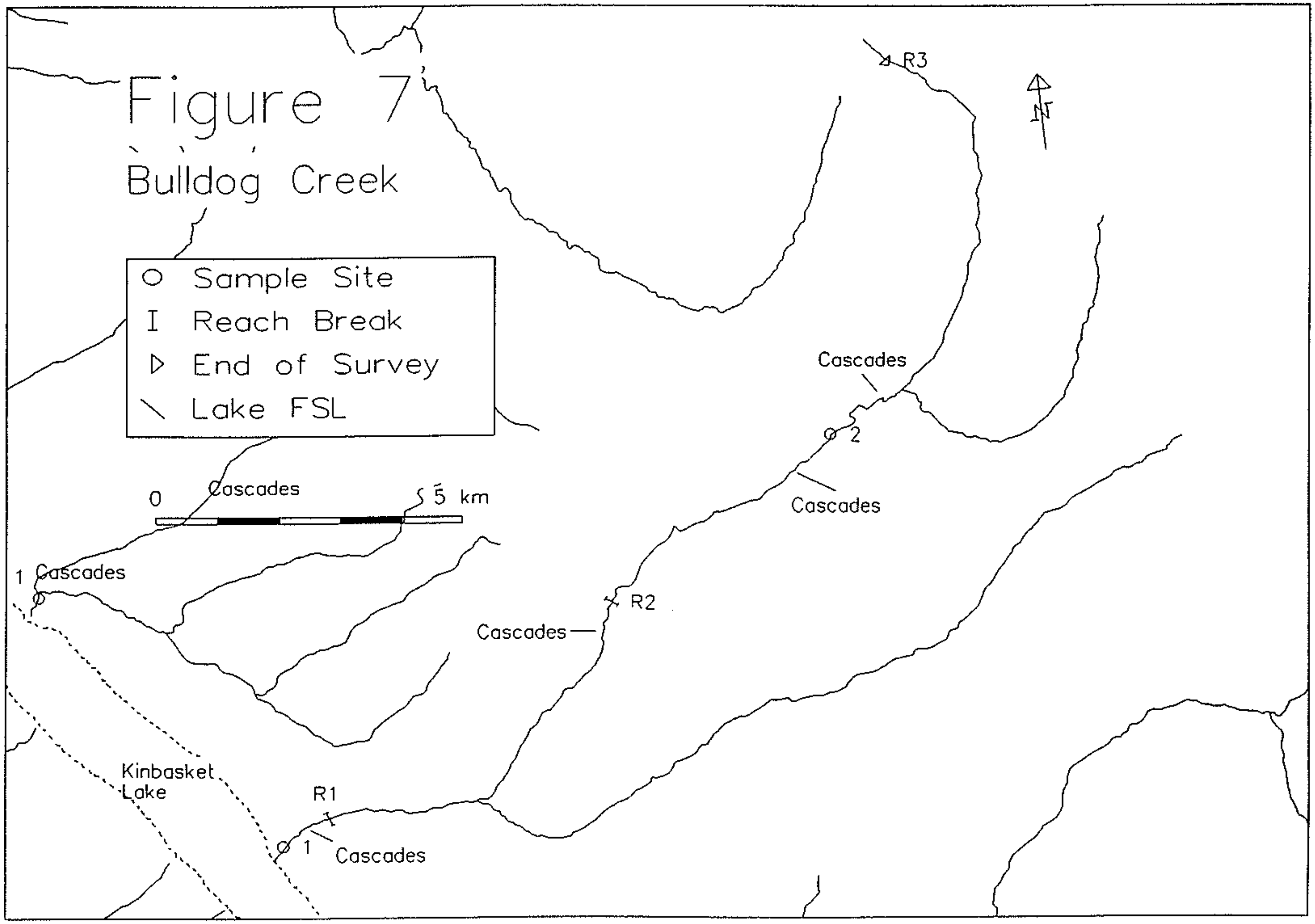
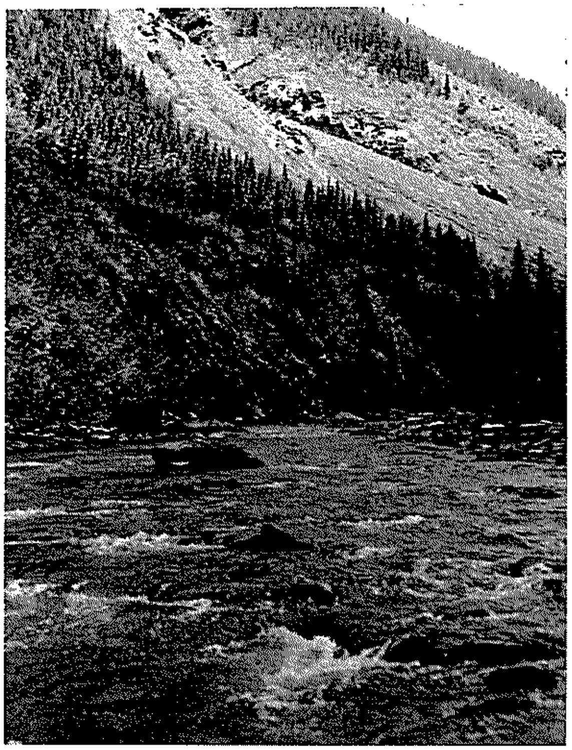


Figure 7
Bulldog Creek
Sample Site
Reach Break
End of Survey
Lake FSL
0
5 km
N
R3
R2
R1
1
2
Cascades
Cascades
Cascades
Cascades
Cascades
Cascades
Kinbasket Lake



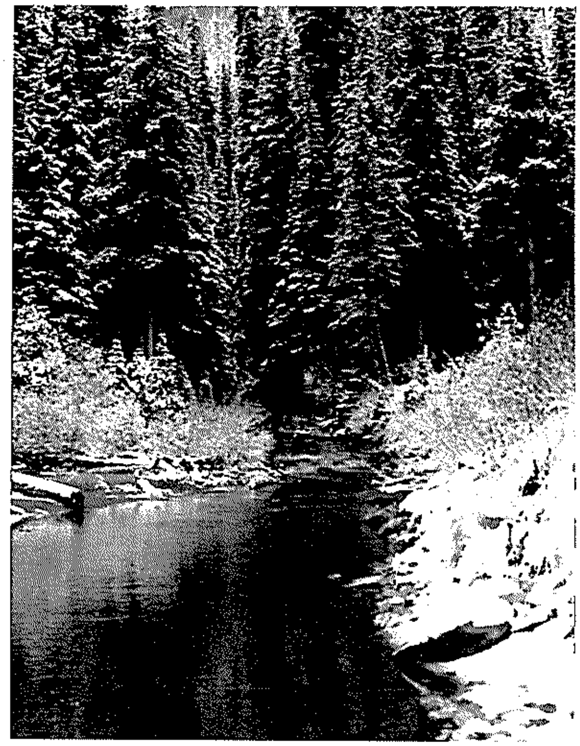


Plate 3.

Reach 1 of Blackman Creek is fast flowing and bouldery (upper left). The slope of Reach 2 is less (3.3%) and the habitat is primarily riffle and glide (upper right). Bull trout were found throughout the system.

The lower reaches of Bulldog Creek are steep and unproductive. Reach 2 contains some glide sections (below) however, no fish were observed.

turbidity was low during the October survey, average depth was approximately 0.4 m and the width was about 8 m. About 30% of the creek contains sections of rapids and the rest is a mixture of glide and riffle.

Bush River

The Bush River originates in the Columbia Icefields and flows south into the head of Bush Arm and the Columbia Reach (Figure 1). The system was surveyed by truck on September 7 - 8 as a logging road parallels the system almost to the headwaters. The lower reaches were surveyed by helicopter on October 7. Water visibility increased from 30 cm in Reach 1 to 200 cm during that period of time and flows dropped substantially.

The Bush River is composed of six reaches (Figure 8). Reach 1 is 7 km long, braided, and the habitat is glide and riffle and the substrate primarily gravel and cobble (Plate 4). The lower portion of the reach becomes inundated by the lake at high water levels.

In Reach 2 the river is mainly a single channel 7 km long. The habitat is primarily glide and riffle, the substrate cobble and boulder, and the gradient 0.4%. Water velocities are moderate.

The river flows through a bedrock canyon in Reach 3 for 1.5 km. The river is a series of cascades, falls and plunge pools in this section. The canyon is impassable to fish moving upstream.

For the next four km (Reach 4) the river remains entrenched and flows through a straight section of channel (Plate 5). The habitat is fast glide (80%) and riffle (20%) over a boulder-cobble substrate.

Reach 5 is 13.5 km long. The river in this area has a wide (channel width = 72 m), braided channel with a cobble-boulder substrate. The habitat is glide and riffle and the slope is only 0.4%.

The Bush River in Reach 6 is a single entrenched channel with a slope that averages 2.0 %, increasing to 6 % in one short section. The substrate is primarily cobble and gravel.

Chatter Creek

Chatter Creek flows into Wood Arm near its confluence with the Columbia Reach (Figure 1). The lower 4 km of Chatter Creek was surveyed on September 9, 1991. Access was gained by a road along Kinbasket Lake that crosses the mouth of the system. The rest of the system was surveyed by helicopter on October 7, 1991.

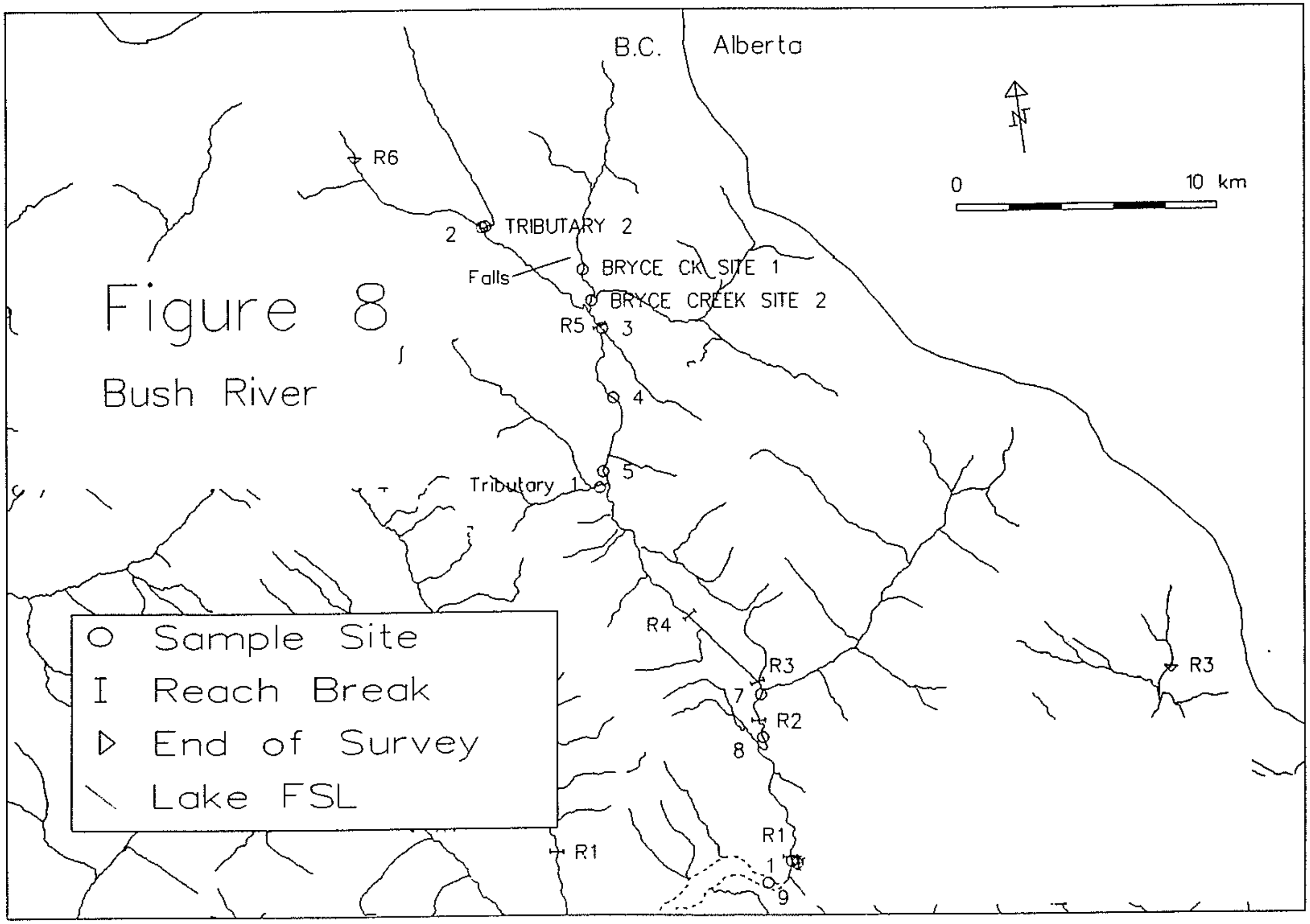
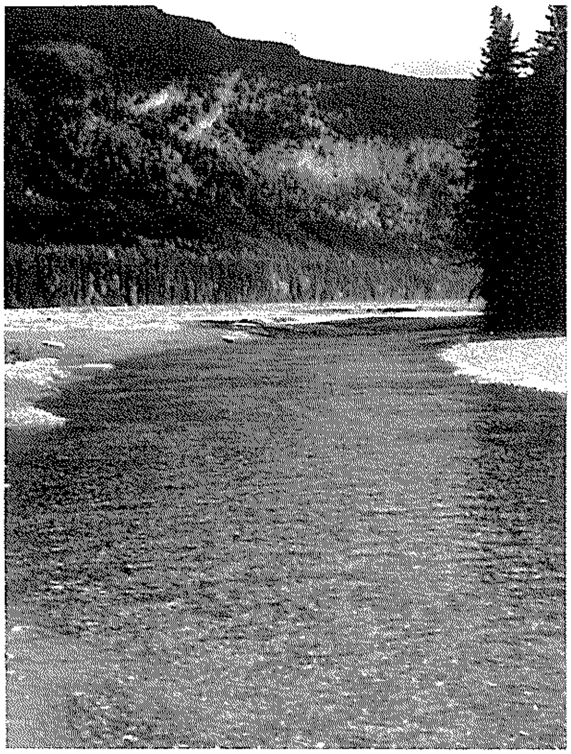


Figure 8
Bush River
B.C.
Alberta
0
10 km
R6
TRIBUTARY 2
2
Falls
BRYCE CK SITE 1
BRYCE CREEK SITE 2
R5
3
4
5
Tributary 1
R4
R3
7
R2
8
R1
1
9
R1
R3
Sample Site
Reach Break
End of Survey
Lake FSL



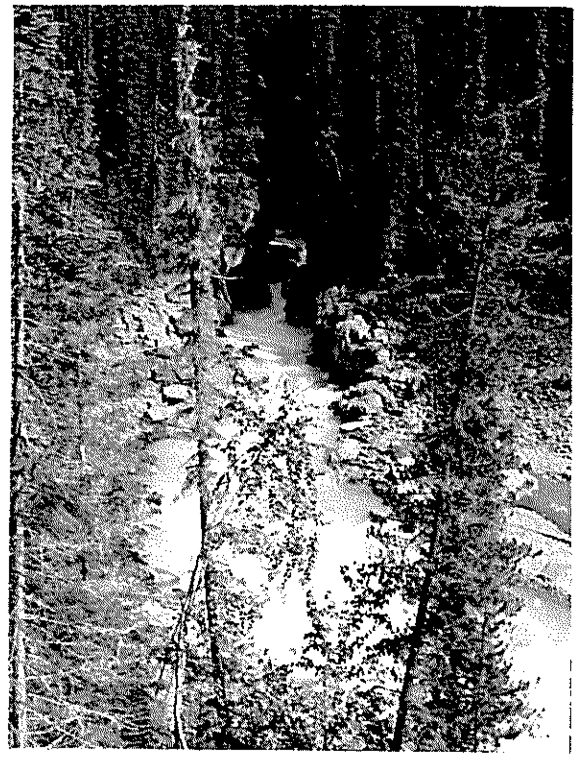


Plate 4.
Reach 1 of the Bush River has a wide, braided channel (upper left) which is used by kokanee and mountain whitefish. Bull trout were found in Reach 2 which is a single channel with primarily riffle habitat (lower). Falls and cascades in the canyon of Reach 3 prevent fish from passing further upstream (upper right).

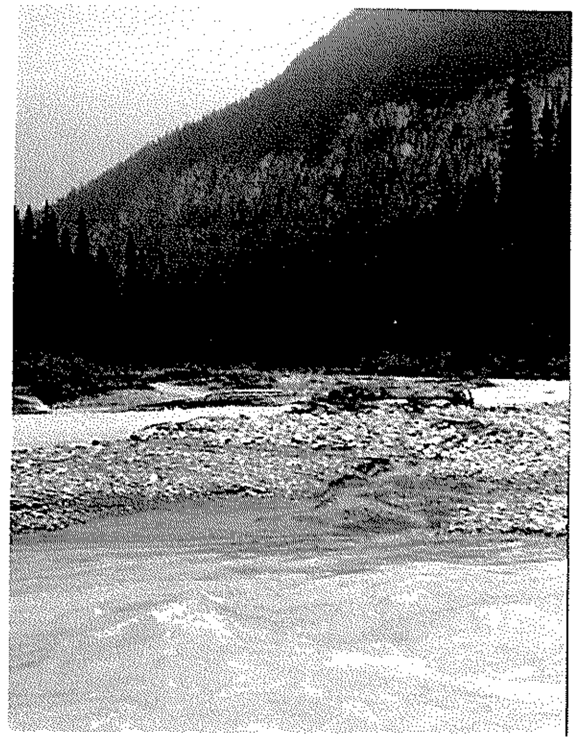
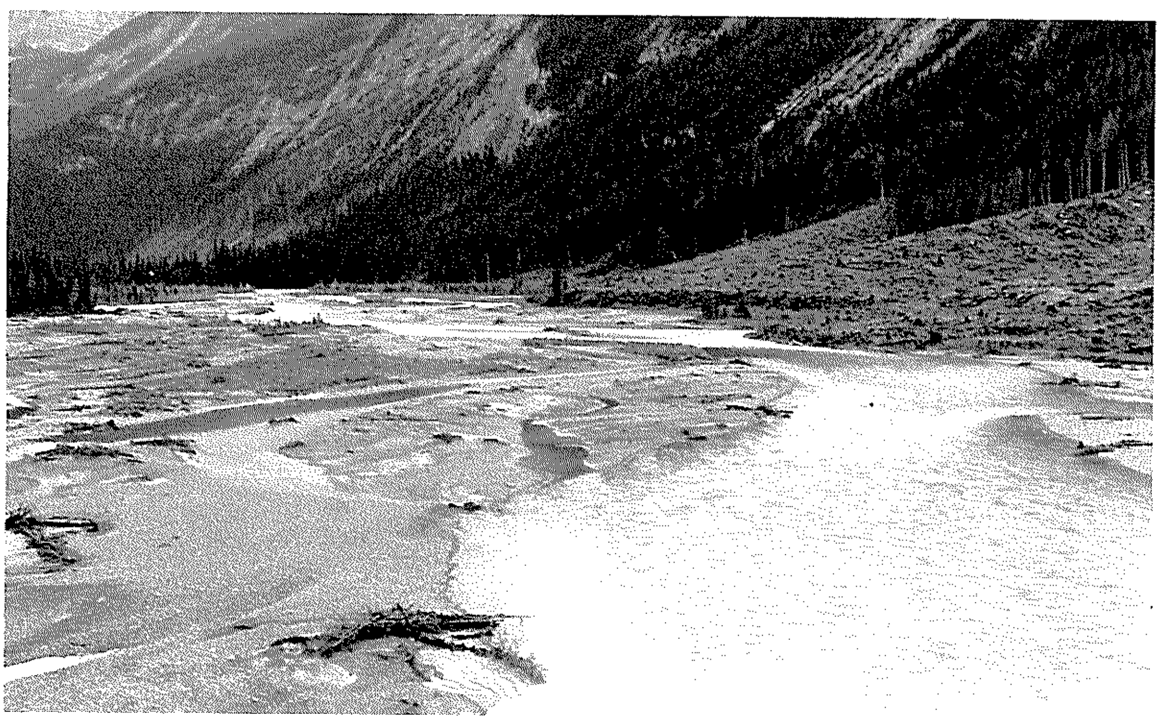


Plate 5.

Reach 4 of the Bush River is a single entrenched channel (upper left). The gradient decreases in Reach 5 and the channel is unstable and braided (below). Riffle is the predominate habitat type of Reach 6 (upper right). Only mountain whitefish were found in these areas.



The upper portion of the watershed has been logged, although the road into this area now appears impassable. Icefields in the watershed were responsible for the slightly turbid conditions that were encountered during September.

Reach 1 is entrenched, extends for 8 km and is mainly boulder rapids (Figure 9, Plate 6). Despite the steep gradient (6.5%) this section appears to have no obstructions to fish passage. Stream gradient in Reach 2 decreases to 2.7%. The substrate is primarily cobble-gravel and the habitat a mixture of riffle, glide and pool. This reach is only 2.7 km long and then the gradient increases again to 6.1%. Reach 3 extends for 7 km to the end of the valley.

Cummins River

The Cummins River lies on the eastern side of the Columbia Reach (Figure 1) and is one of the few major systems in the Kinbasket watershed that has not yet been logged. The lower reach was first surveyed on October 10, 1991 by boat and the rest of the system was surveyed by helicopter on October 11. Water turbidity was still high (30 cm) at the time of the survey unlike most other systems at that time.

Reach 1 (Figure 10) is steep (gradient = 3.7%) and entrenched, with boulder rapids making up most of the habitat. A 4 m high falls is situated about 20 m above the reservoir full service level (FSL) and prevents the passage of fish upstream.

Reach 2 contains an extensive amount (22 km) of low gradient (0.1%) habitat (Plate 6) which is unusual in most of the Kinbasket tributaries. The river slowly meanders through meadow and marsh in this reach. There are few bars and the channel appears quite stable. The habitat is primarily glide and the substrate is gravel and fines. The head of the valley lies just beyond Reach 2.

Dave Henry Creek

Dave Henry Creek flows into the east side of Canoe Reach near its north end (Figure 1). A logging road extends up the valley almost to the top of the system. This creek was surveyed on October 14 and 15, 1991, using a truck for access. Only one reach was identified in this system (Figure 11). The reach has an overall gradient of 4.8% and length of 15.4 km. The lower 100 m of Dave Henry Creek is mainly boulder riffle with 10% pool habitat (Plate 7). Above this, falls and cascades in a canyon prevent the passage of fish upstream. The rest of the system is primarily boulder riffle and glide habitat. The stream is a single channel and is confined.

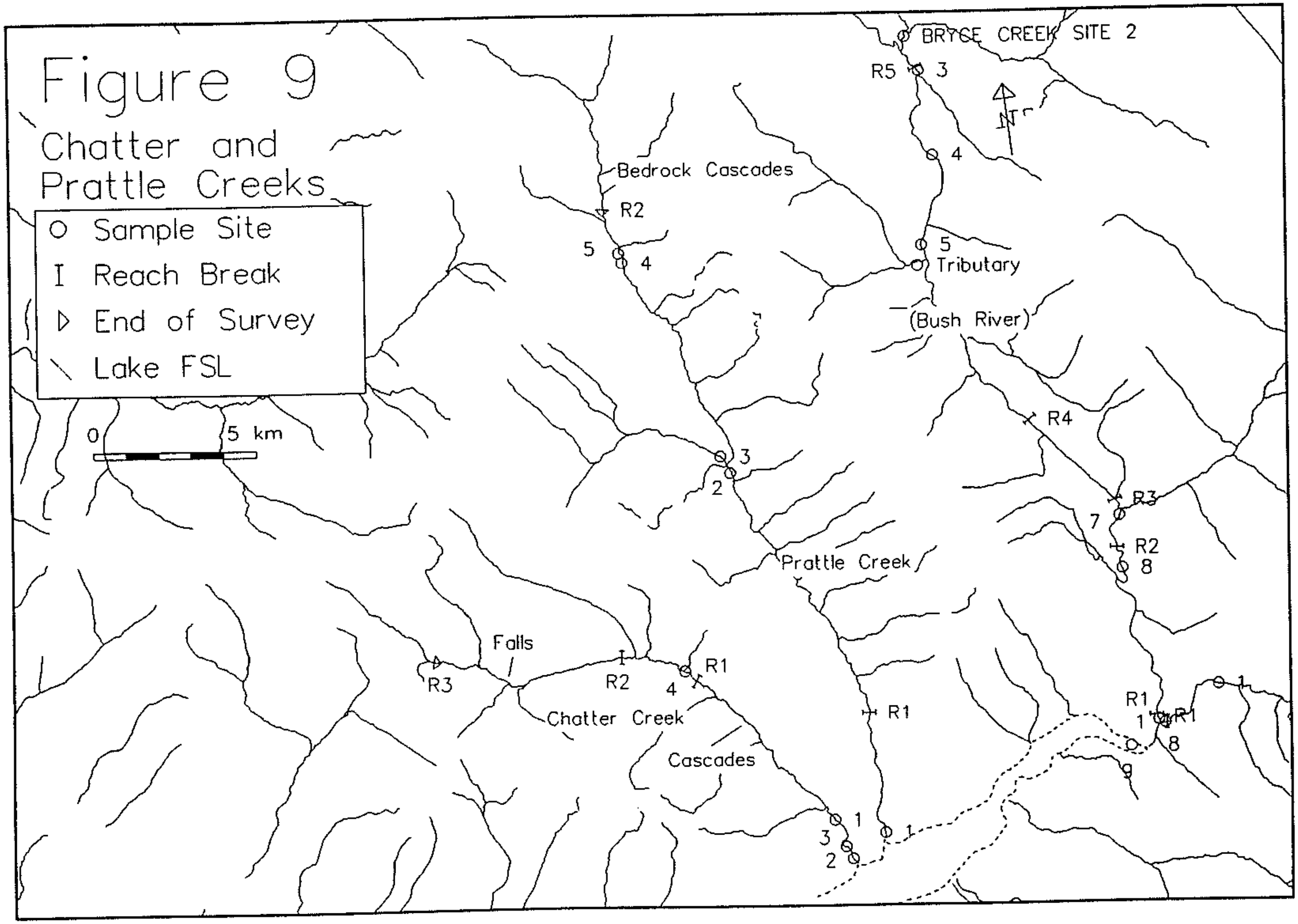


Figure 9
Chatter and
Prattle Creeks
Sample Site
Reach Break
End of Survey
Lake FSL
0
5 km
BRYCE CREEK SITE 2
R5
3
4
5
Tributary
(Bush River)
R4
R3
7
R2
8
R1
1
9
Bedrock Cascades
Prattle Creek
Falls
R3
R2
R1
Chatter Creek
Cascades
1
2
3

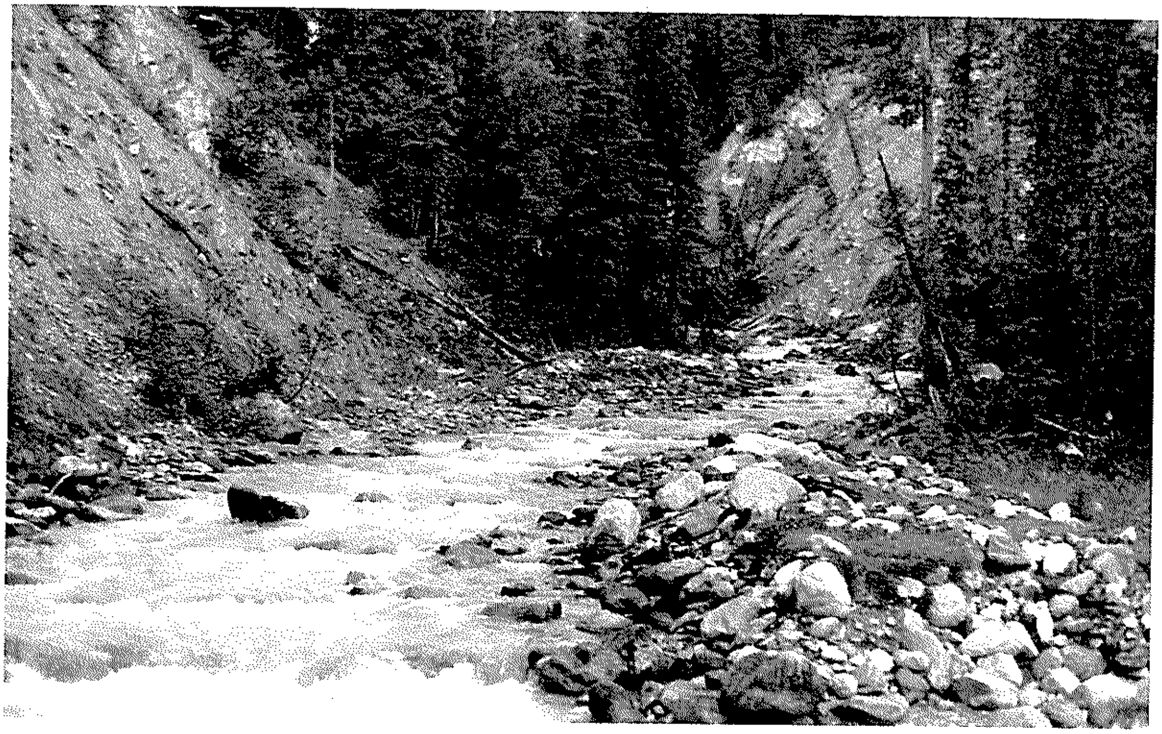
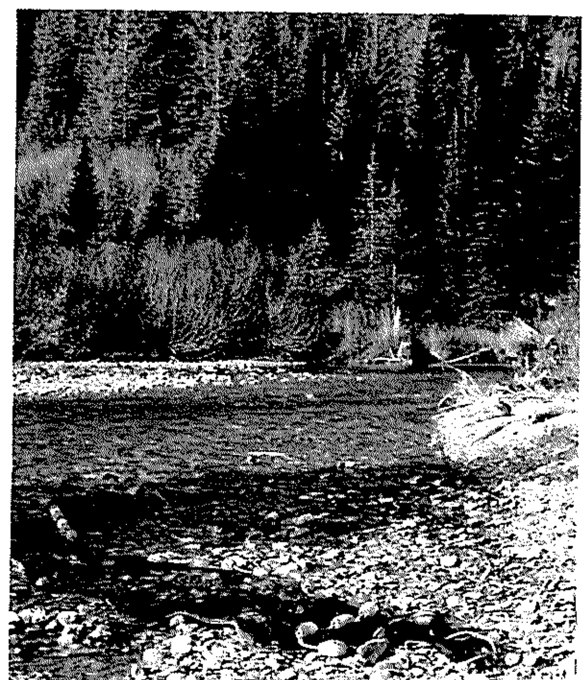


Plate 6.
Kokanee spawn in Reach 1 of Chatter Creek, although the substrate is coarse (above). The gradient is less in Reach 2 (lower right). Bull trout were found in both reaches.

Reach 2 of the Cummins River is meandering, slow flowing glide which supports both bull trout and mountain whitefish (lower left).



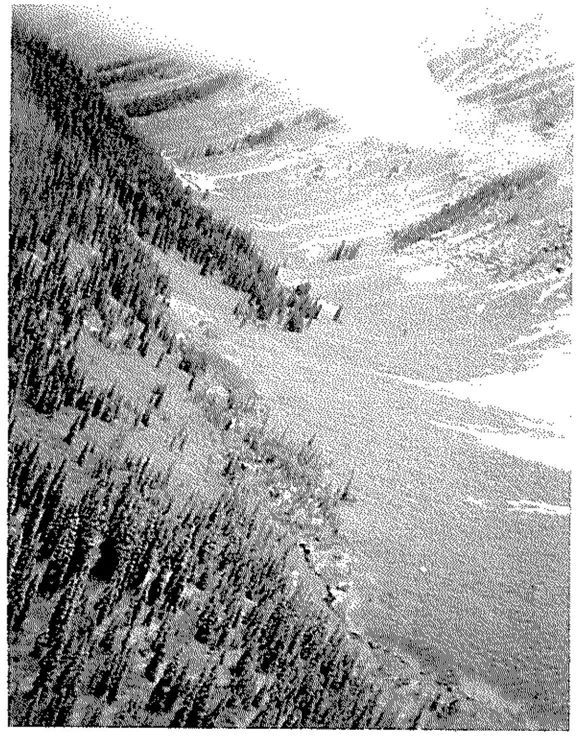


Plate 19.
Windfall Creek is composed of four reaches. The first is fast and bouldery but supports bull trout (upper left). Reach 2 has a lower gradient (below) but no fish were found. Reach 3 is again fast and bouldery (upper right). The gradient declines in Reach 4.

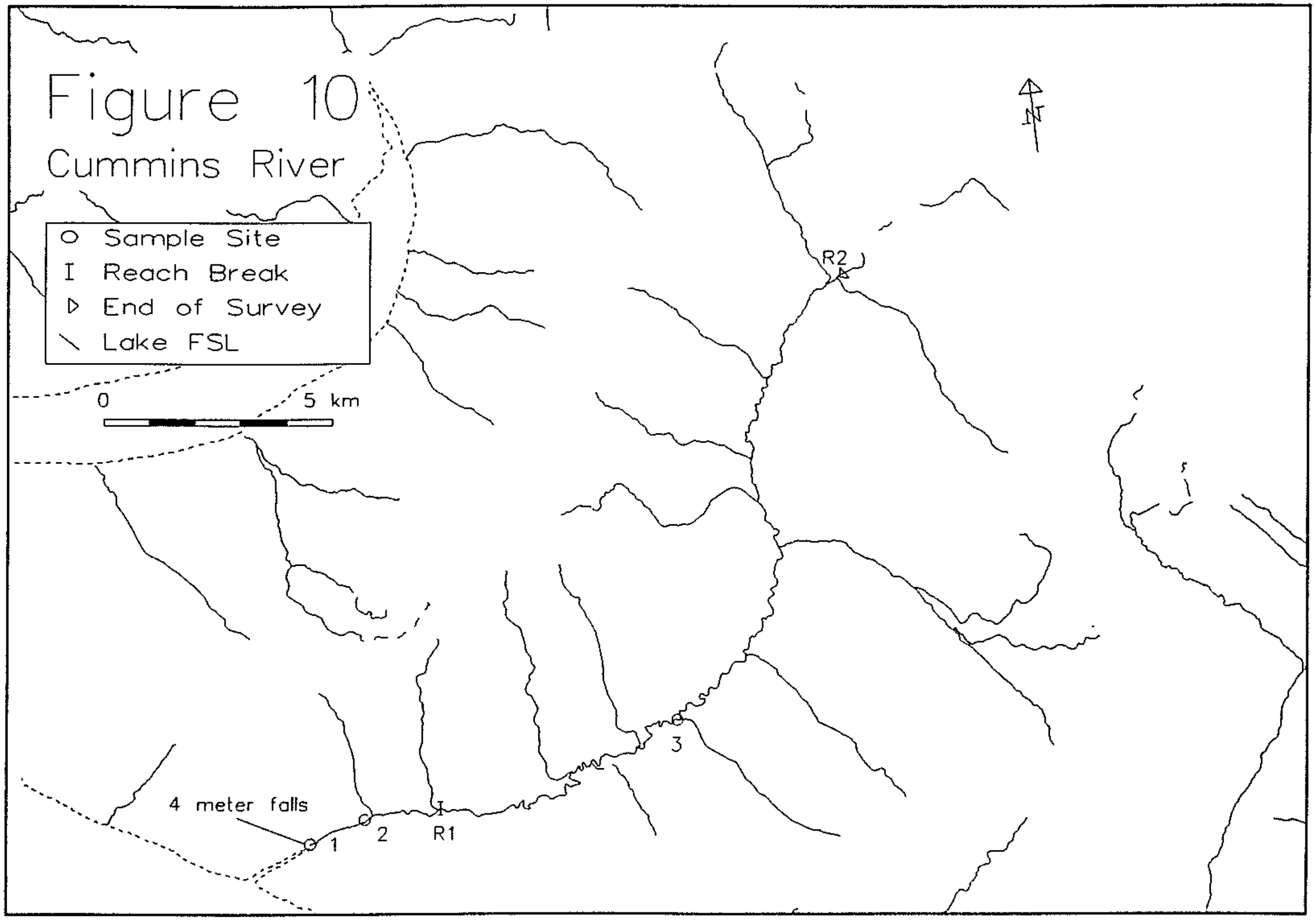


Figure 10
Cummins River
Sample Site
Reach Break
End of Survey
Lake FSL
0
5 km
N
R2
3
4 meter falls
1
2
R1

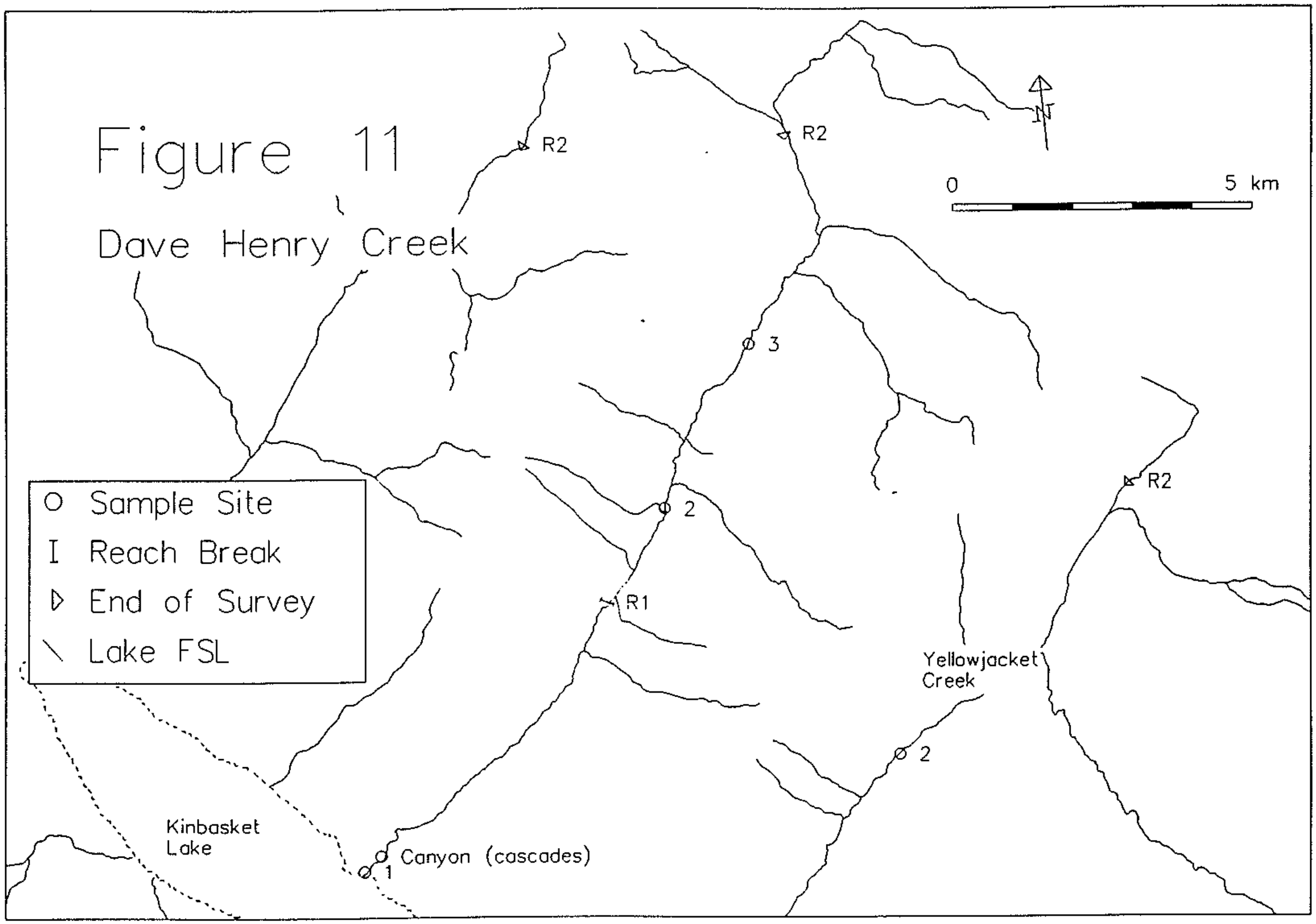


Figure 11
Dave Henry Creek
Sample Site
Reach Break
End of Survey
Lake FSL
0
5 km
N
R2
R2
R2
3
2
R1
2
Yellowjacket Creek
Kinbasket Lake
Canyon (cascades)
1

Plate 7.
The lower reach of Dave Henry Creek is primarily rapids and cascades (upper left). The habitat in Dawson Creek (upper right) and Encampment Creek (below) is mainly riffle and rapids. Bull trout were found in all three systems.

Dawson Creek
Dawson Creek flows into the east side of Canoe Reach (Figure 1). This creek is a clear water system with no glaciers and few icefields in its watershed. The valley has not been logged and there is no road access. Dawson Creek has an entrenched channel with primarily boulder riffle and rapids throughout its entire length (Figure 12, Plate 7). The gradient averages 3.8% over 13.7 km. The system was surveyed by helicopter on October 11, 1991.

Encampment Creek
Encampment Creek flows into the central basin area of the Kinbasket Reservoir (Figure 1). The lower portion of this reach was reached by boat on September 11 and the upper portion was reached by helicopter on October 11, 1991. Encampment Creek is a clear water system which derives most of is flow from surface runoff and snow melt. Only one reach was identified in this system (Figure 13). It extends for 5.2 km and has a slope of 4.5%. The single channel is entrenched and the habitat is primarily boulder rapids (Plate 7). No obstructions were observed in this portion of the stream, although the steep gradient may hamper the upstream movement of most species of fish.

Foster Creek
Foster Creek flows into the west side of Canoe Reach (Figure 1). It has not been logged and there is no road access to the system. Turbidity was very high when this fairly large glacial system was examined by helicopter on October 11, 1991. Foster Creek has one reach (Figure 14). The channel is entrenched and the habitat consists of riffle, rapids and cascades (Plate 8). The gradient averages 4.9% over 14.6 km. Only the lower 4 km of the system is accessible to fish. A canyon at 4 km and steep cascades at 7 km prevent fish from passing farther upstream.

Grouse Creek
Grouse Creek flows into the west side of Canoe Reach just north of Windfall Creek (Figure 1). This system was flown by helicopter on October 17, 1991. It has not been logged but the Canoe Reach mainline crosses the creek near its creek mouth. Snow melt, groundwater and surface runoff are the sources for this small creek. Only one reach was identified. The creek is primarily rapids with some sections of cascades (Figure 15, Plate 8) although there is some lower gradient riffle habitat about 8 km upstream. The gradient of this system averages 11.6% over 8.9 km.

Harvey Creek
Harvey Creek flows into Harvey Bay on the west side of Canoe Reach (Figure 1). This system is much like Molson and Encampment Creeks as it is a steep, entrenched, and non-glacial, although there are several small icefields in the

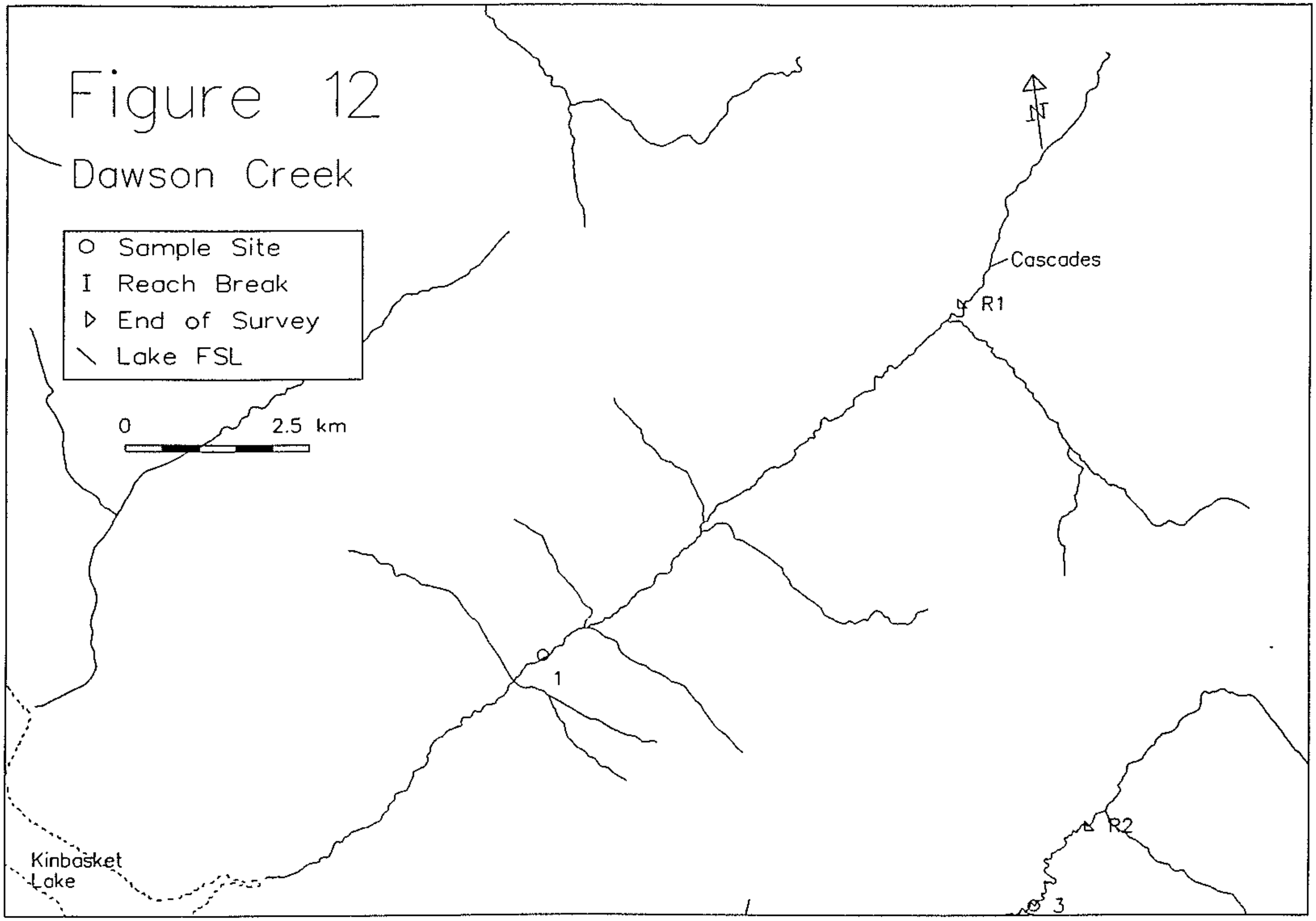


Figure 12
Dawson Creek
O Sample Site
I Reach Break
▷ End of Survey
\ Lake FSL
0
2.5 km
N
Cascades
R1
1
R2
3
Kinbasket
Lake

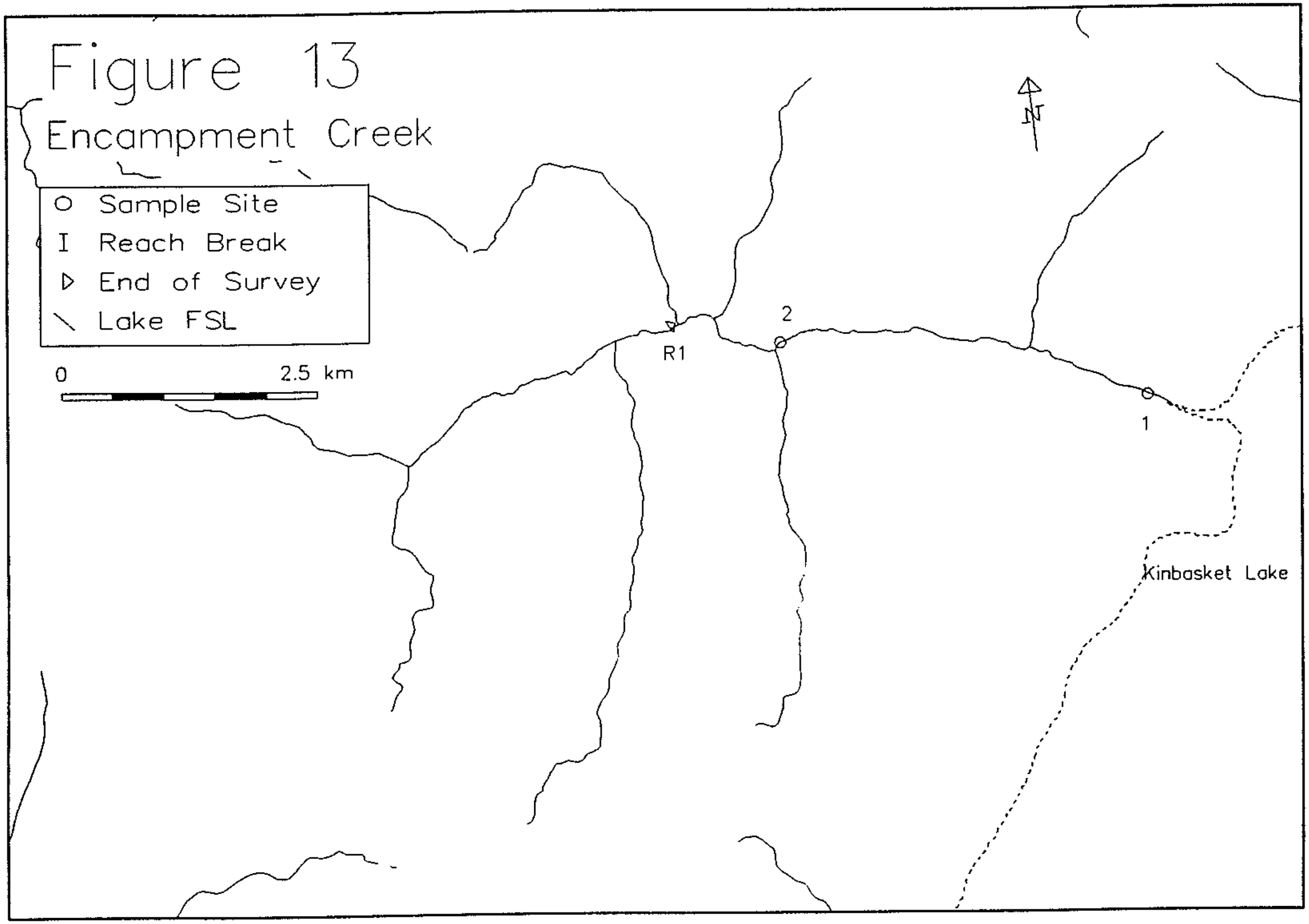


Figure 13
Encampment Creek
Sample Site
Reach Break
End of Survey
Lake FSL
0
2.5 km
N
R1
2
1
Kinbasket Lake

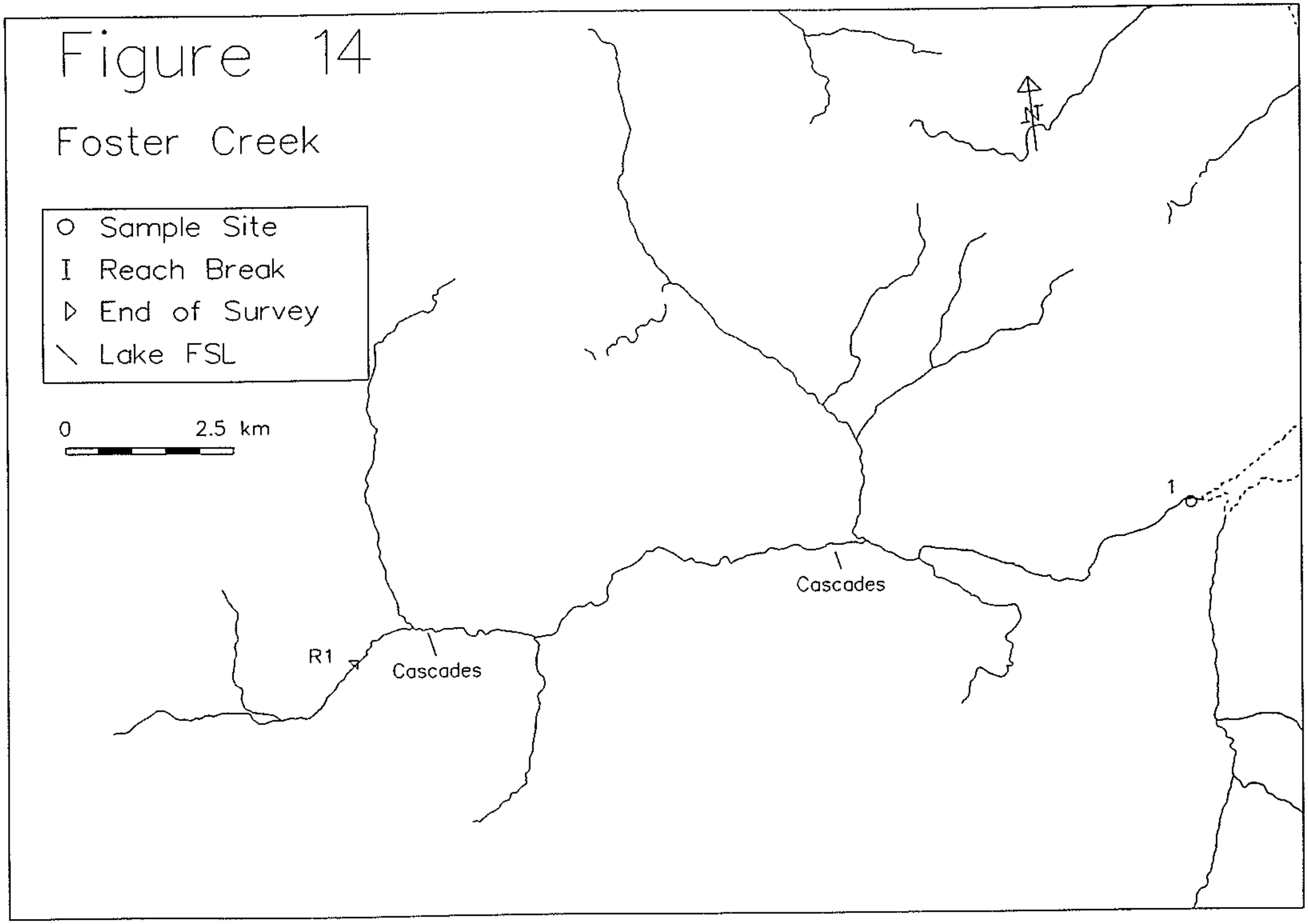
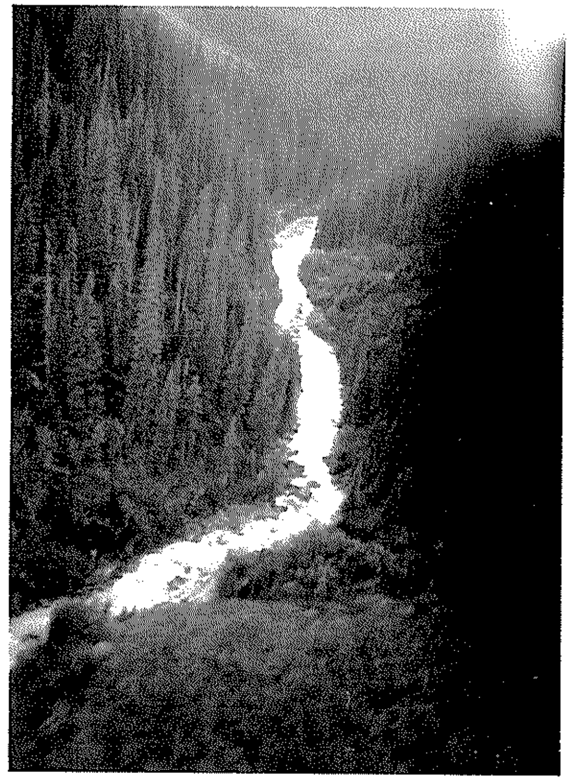
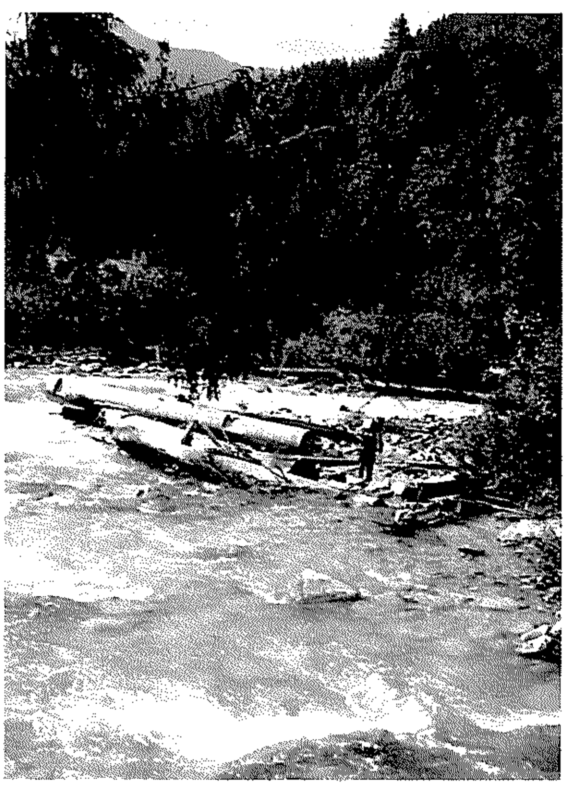
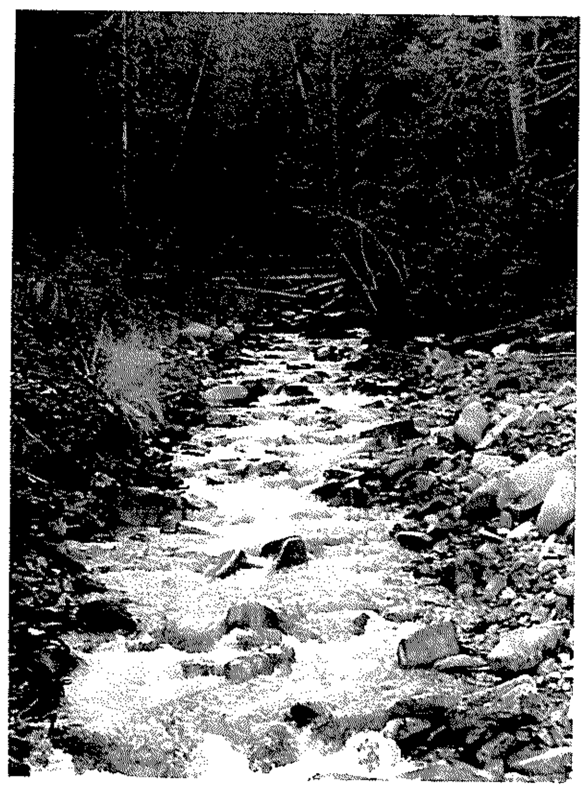


Figure 14
Foster Creek
Sample Site
Reach Break
End of Survey
Lake FSL
0
2.5 km
N
1
Cascades
R1
Cascades

Plate 8.
Foster Creek is a glacial system with high turbidity and a large bed load (upper right). Most of Grouse Creek is boulder rapids (lower right) as is the lower reach of Harvey Creek (lower left).







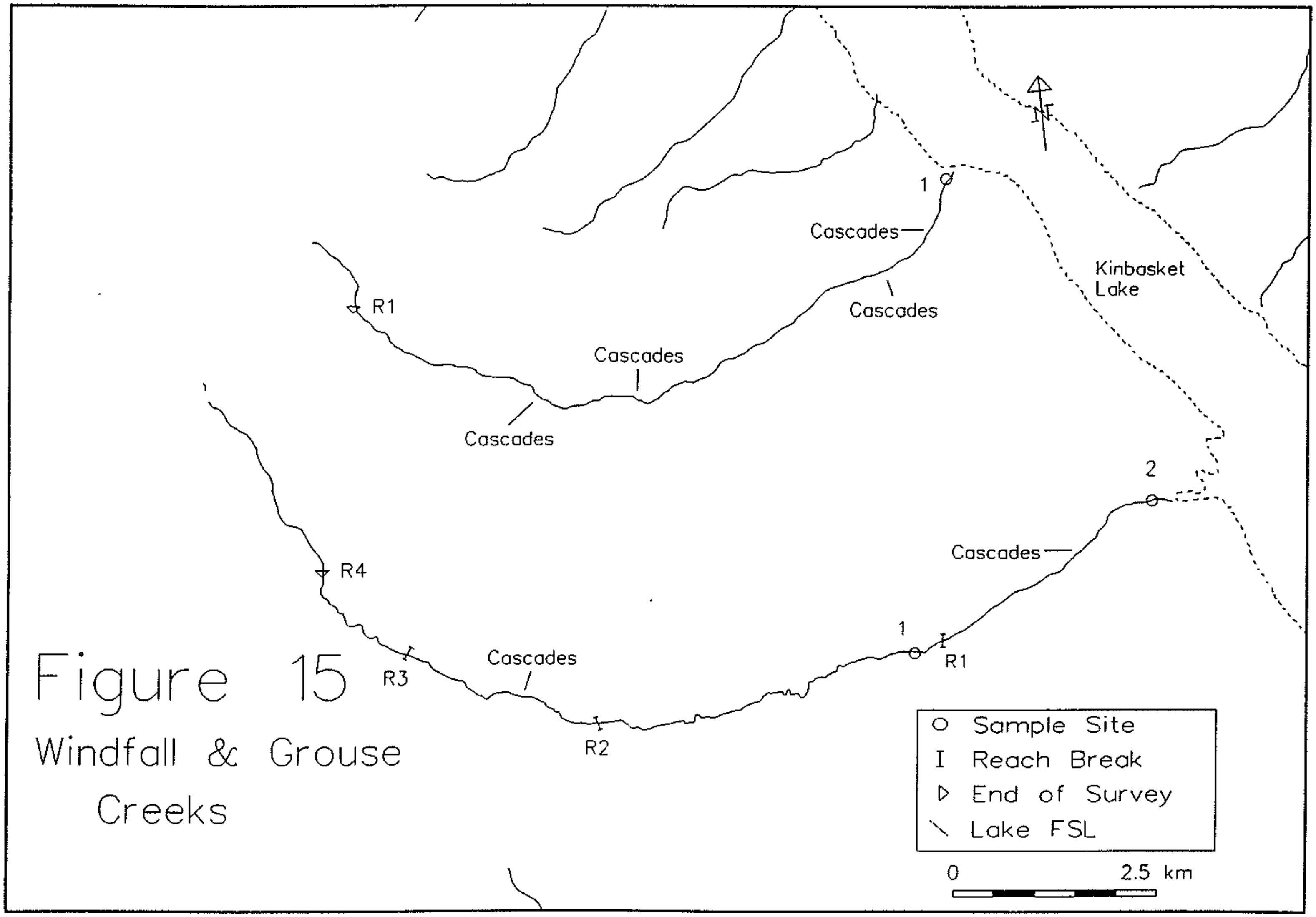


Figure 15
Windfall & Grouse Creeks

watershed. There is no road access to the system, although there has been a small amount of logging along the first few kilometres of the valley.

There are two reaches in this system (Figure 16). The first is 5.9 km long and has a gradient of 8.9%. The habitat is primarily boulder rapids (Plate 8). Fish are unable to pass more than a few kilometres up the system. At the present time kokanee are blocked from moving more than 200 m upstream due to a 2.5 m waterfall caused by a logjam.

Reach 2 is 2.4 m long and has a gradient of 0.5%. The channel in this section meanders through marsh and meadow (Plate 9). The habitat is primarily glide and pool with a cobble-gravel substrate.

Horse Creek
Horse Creek flows into the east side of Canoe Reach (Figure 1). This creek is one of the smaller systems surveyed. The watershed has not been logged and there is no road assess other than where the mainline along Canoe Reach crosses the creek 500 m upstream of the creek mouth. The lower portion of the creek was surveyed on October 15, 1991 and the remainder of the creek was surveyed by helicopter on October 18.

Horse Creek consists of three reaches (Figure 17). The first reach is 6.3 km long and has a slope of 13.1%. The creek is primarily rapids, cascades and riffle in this reach (Plate 9). The creek flows through a canyon in the lower part of the reach and the upper part has numerous windfalls across the creek. Stream gradient decreases to 2.8% for 2.2 km in Reach 2. The habitat is primarily glide and riffle in Reach 2. The elevation of this reach is over 1,500 m (5,000 ft). Above Reach 2, the gradient increases and the habitat is mainly rapids.

Howard Creek
Howard Creek flows into Howard Bay halfway along the west side of Canoe Reach (Figure 1). A portion of the valley has been logged but the road only comes to within 1 km of the stream. A few icefields at the top of the valley were responsible for water visibility of 50 cm during October. Only one 15 km long reach was identified when this system was surveyed by helicopter on October 17, 1991. This reach is entrenched, was a gradient of 4.7%, and is primarily boulder riffle and rapids (Plate 10). There is one section of cascades about 5 km up the reach (Figure 18).

Hugh Allen Creek
Hugh Allen Creek flows into the middle of Canoe Reach (Figure 1) and was surveyed by helicopter on October 17, 1991. This system has not been logged and

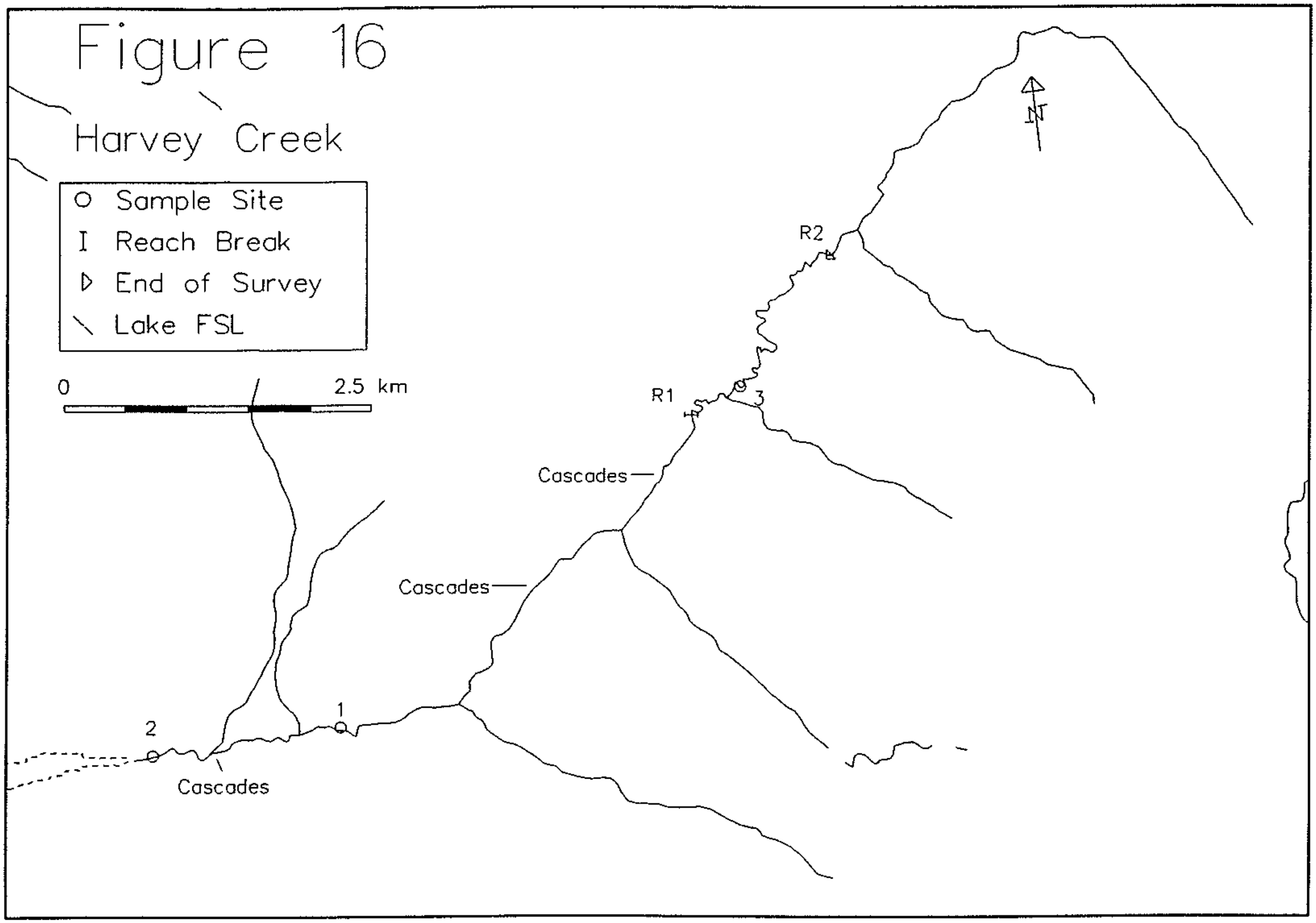
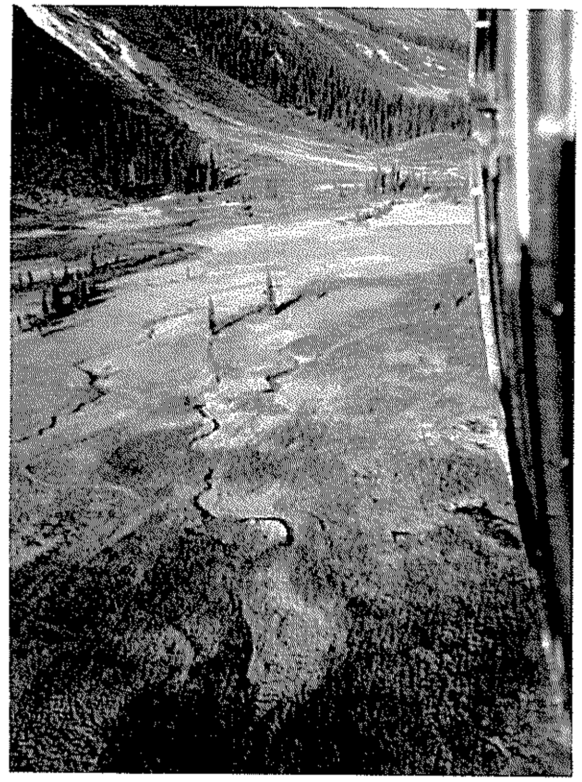
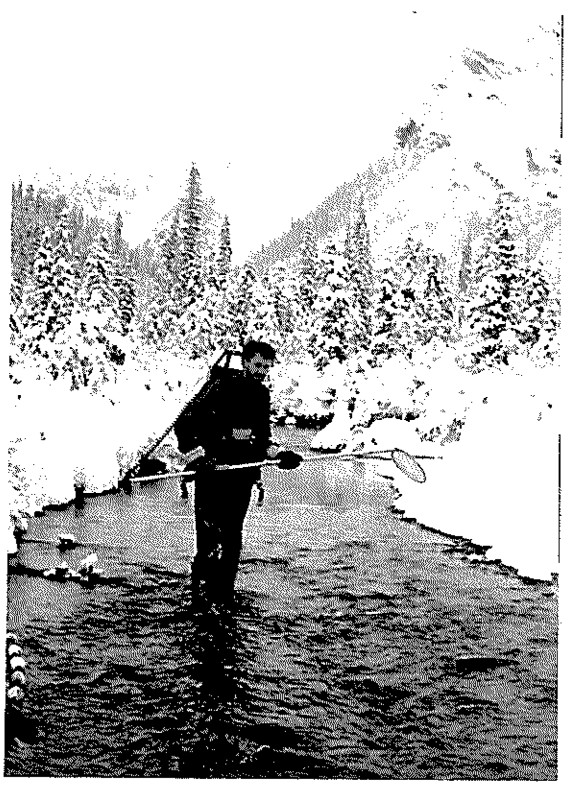


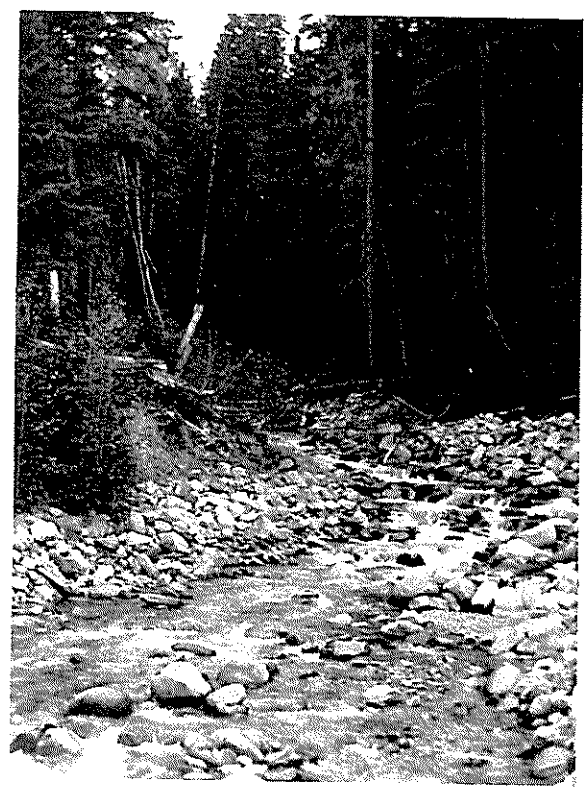
Figure 16
Harvey Creek
Sample Site
Reach Break
End of Survey
Lake FSL
0
2.5 km
R2
R1
3
1
2
N
Cascades
Cascades
Cascades

Plate 9.
No fish were found in Reach 2 of Harvey Creek which flows through low gradient meadow (upper right).

Horse Creek has a steep gradient in Reach 1 (lower right) and moderate gradient in Reach 2 (lower left). Like Harvey Creek, fish were found only in the steeper lower sections.







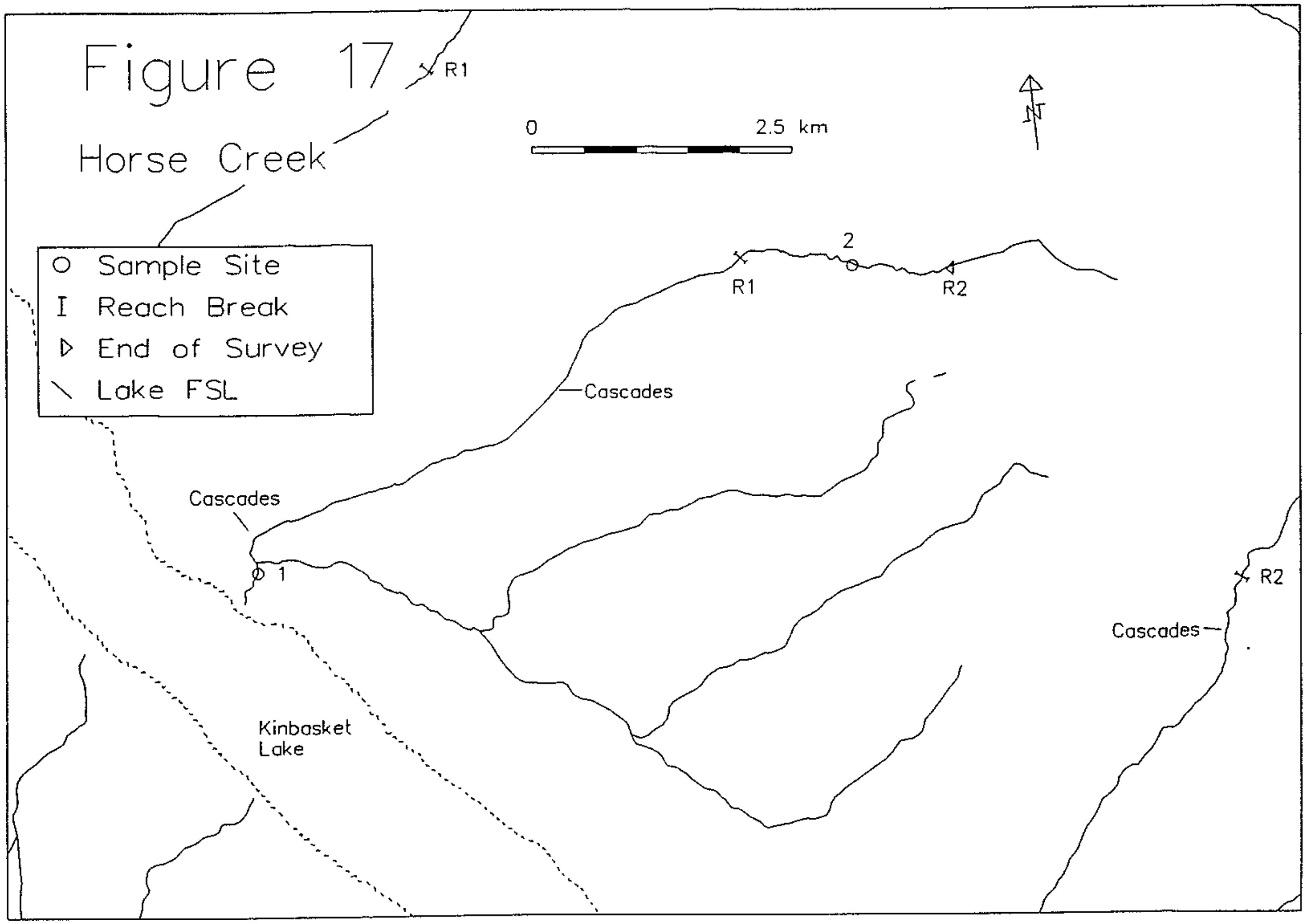
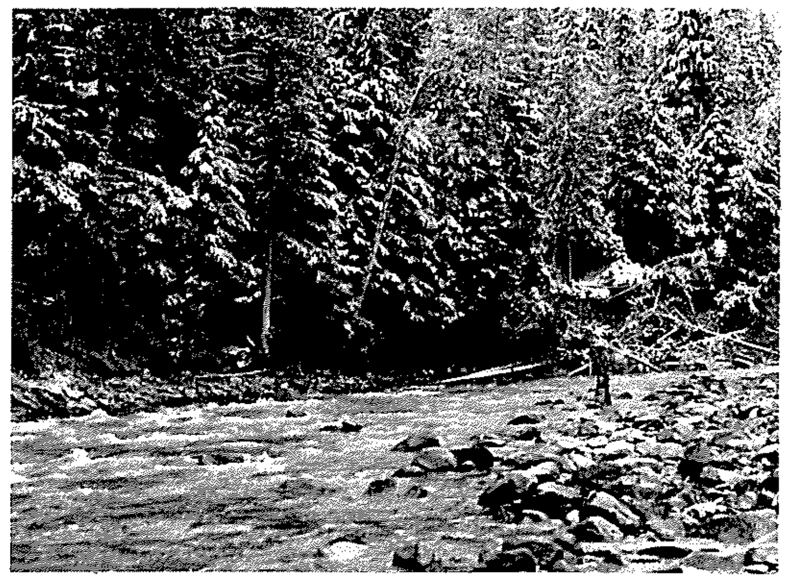


Figure 17
Horse Creek
O Sample Site
I Reach Break
▷ End of Survey
\ Lake FSL
0
2.5 km
N
R1
R2
2
1
Cascades
Cascades
Cascades
R1
R2
Kinbasket Lake

Plate 10.
Habitat throughout Howard Creek (upper right) and Reach 1 of Hugh Allen Creek (lower right) is primarily boulder rapids. Only bull trout were found in these areas. In Reach 2 of Hugh Allen Creek, the gradient is lower and larger numbers of both bull trout and mountain whitefish were sampled (below).



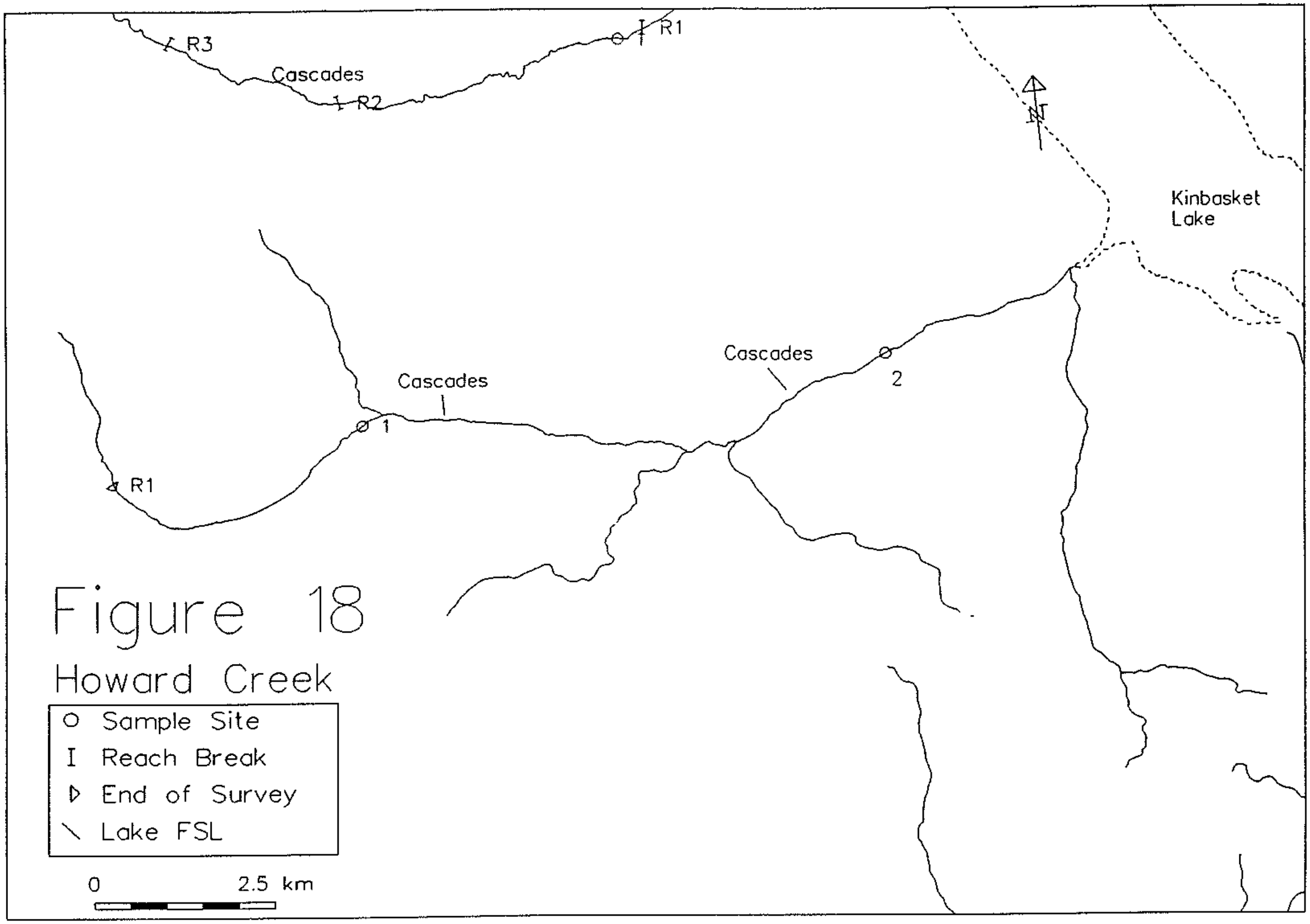


Figure 18

Howard Creek

is inaccessible by road. Water visibility varied from being clear in the upper reach to 100 cm in the lower reach. Four reaches were identified in this system (Figure 6). The first reach is 7.6 km long and has a gradient of 1.8% (Plate 10). The channel is entrenched and consists primarily of boulder rapids. Cascades along this section might make it difficult for fish to pass upstream.

Reach 2 extends for 8.6 km and has a slope of 0.5%. The creek meanders and is frequently confined in this section. The habitat is primarily glide and pool and the substrate is mainly cobble.

The gradient averaged 3.2% over 14.8 km in Reach 3. The habitat is mainly rapids in the upper portion of the reach and riffle in the lower 4 km. There are a couple of sections of cascades and a 1 km long section of glide in this reach. Iroquois Creek is a major tributary to this reach with some potential fish habitat. The gradient of the lower 5.4 km of the tributary has a gradient of 2.4%. The habitat is a mixture of glide (50%), riffle and rapids. The visibility in Iroquois Creek was approximately 1.5 m during the October survey.

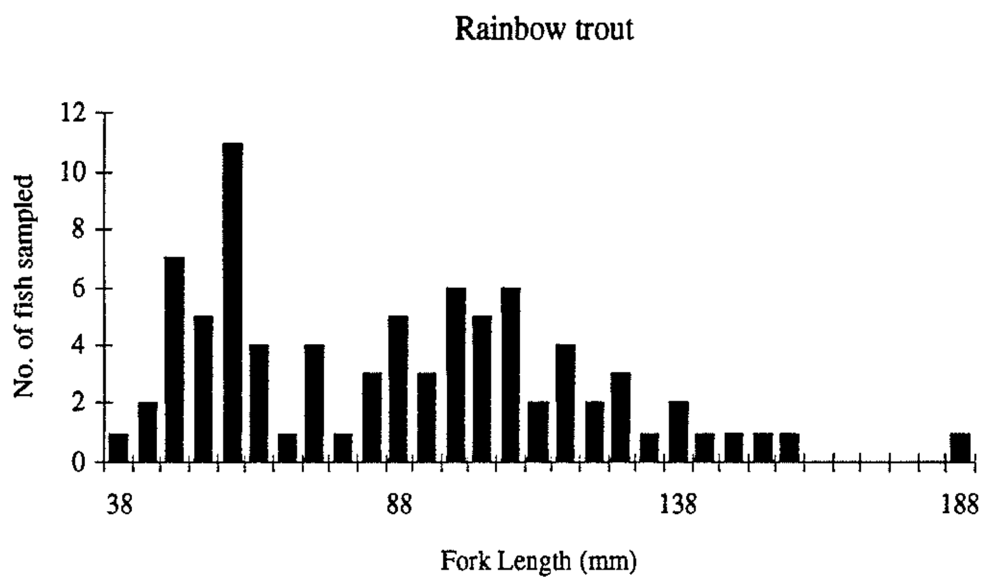
Reach 4 contains a mixture of habitat predominated by sections of boulder, riffle habitat separated by low gradient glide-pool habitat (Plate 11). The reach has a mean gradient of 2.6% over 8.4 km.

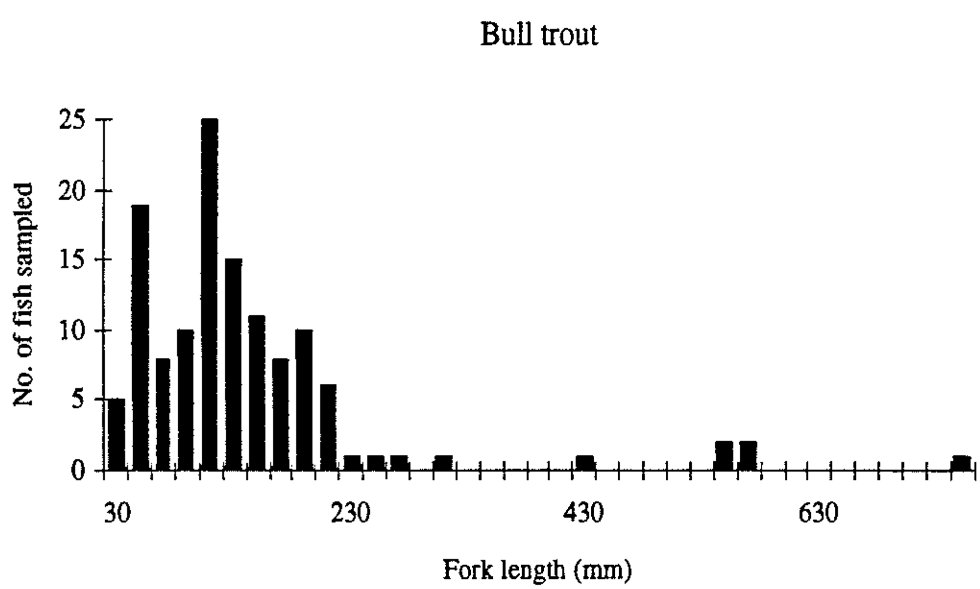
Kinbasket River
The Kinbasket River flows into the northeast side of the Columbia Reach (Figure 1). As there is no road assess, the lower reach of the system was surveyed by boat on September 2, 1991 and the remainder of the system was surveyed by helicopter on October 11. The system is glacial so the stream was quite turbid during September.

Reach 1 is 2.6 km long, is entrenched, and has a slope of 2.6%. The habitat is mainly boulder rapids. Cascades 400 m from the mouth are up to 3 m in height and prevent the passage of fish upstream (Figure 19, Plate 11). The gradient decreases to 1.5% for 3.4 km in Reach 2. The substrate is primarily cobble and the habitat is glide, rapids and some pool. Reach 3 extends for 13 km with a braided channel which is up to 900 m in width. The habitat is primarily riffle and glide with a gravel-cobble substrate. Upstream of Reach 3, the gradient increases sharply towards the end of the valley.

Molson Creek
Molson Creek flows into the middle of Kinbasket lake. It has not been logged and there is no road access. The lower reach was surveyed on September 11, 1991 by

Figure 30.
Length-frequency distribution of rainbow trout and bull trout sampled from Kinbasket Lake tributaries, Aug - Oct, 1991.





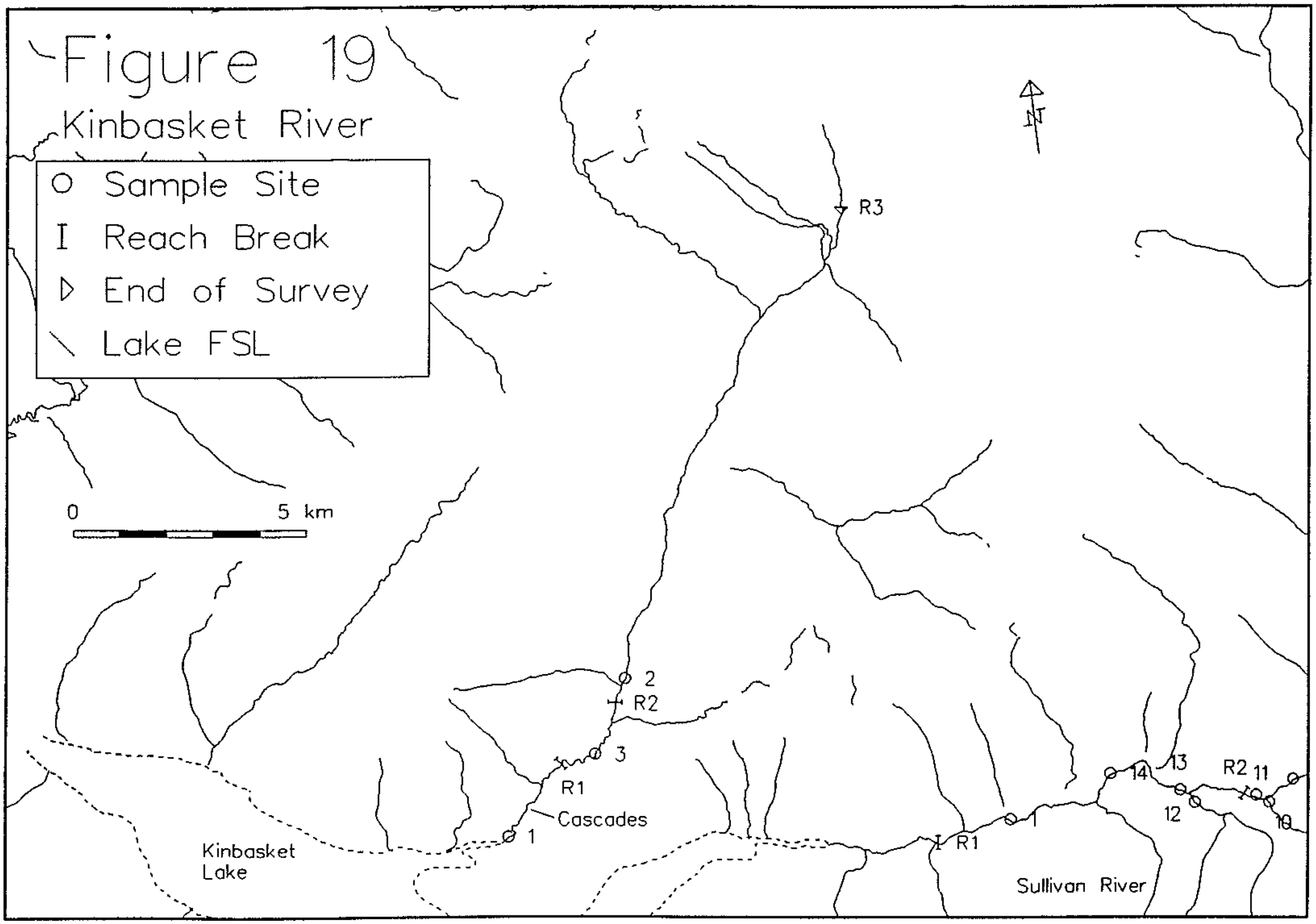


Figure 19
Kinbasket River
Sample Site
Reach Break
End of Survey
Lake FSL
0
5 km
N
R3
2
R2
3
R1
Cascades
1
Kinbasket
Lake
14
13
R2
11
12
10
R1
Sullivan River

boat and the rest of the system was surveyed by helicopter on October 11. This system is not glacial thus turbidity was low when surveyed.

Molson Creek consists of two reaches (Figure 20). Reach 1 is a steep (5% gradient) entrenched channel, 11.5 km long (Plate 12). The habitat ranges from boulder riffle at the top of the reach to cascades at the lower end where the gradient reaches 30%. Fish are only able to pass upstream a short distance from the mouth.

The gradient decreases to 1.1% for 2.8 km in Reach 2. This reach has a mixture of glide, riffle and pool habitat with a gravel-cobble substrate. Above this reach, the gradient increases as the stream nears the end of the valley.

Packsaddle Creek
Packsaddle Creek flows into east side of Kinbasket Lake at the head of Canoe Reach (Figure 1). The only road assess is where the mainline crosses the creek 1 km from the mouth of the stream. No logging has taken place in the watershed.

The first of the two reaches has a gradient of 4.5% and is 3.4 km long (Figure 21). The habitat is primarily riffle with about 10% pool (Plate 12). Water turbidity was low in October and the substrate was cobble and gravel. The gradient increases to 8.7% over 9.1 km in the next reach. The stream is entrenched and a single channel and the habitat is rapids and riffle. There are few trees along the stream in the upper part of the reach because of the numerous avalanche tracks that reach the valley bottom (Plate 13).

Prattle Creek
Prattle Creek discharges into Kinbasket Lake just east of Chatter Creek (Figure 1). Road access to Prattle Creek is limited to the Sullivan River mainline along Kinbasket Lake crosses near the mouth of the creek. The area around the mouth of Prattle Creek was examined on September 9, 1991 and the rest of the creek was surveyed by helicopter on October 7, 1991. Several icefields in the watershed help to maintain summer flows and increase the turbidity of the system.

Two reaches were identified in this system (Figure 9). The creek flows through a deep bedrock canyon for 4.5 km in the first reach (Plate 13). Upstream fish passage is blocked by the canyon just above the reservoir full supply line. There are a few hundred metres of low gradient habitat below the canyon when the lake level drops. The gradient changes from 3.8% in Reach 1 to 1.9% in Reach 2. Reach 2 extends for 19 km and is mainly boulder riffle habitat. The creek is entrenched, although there are some short sections where the channel width increases and the stream becomes braided.

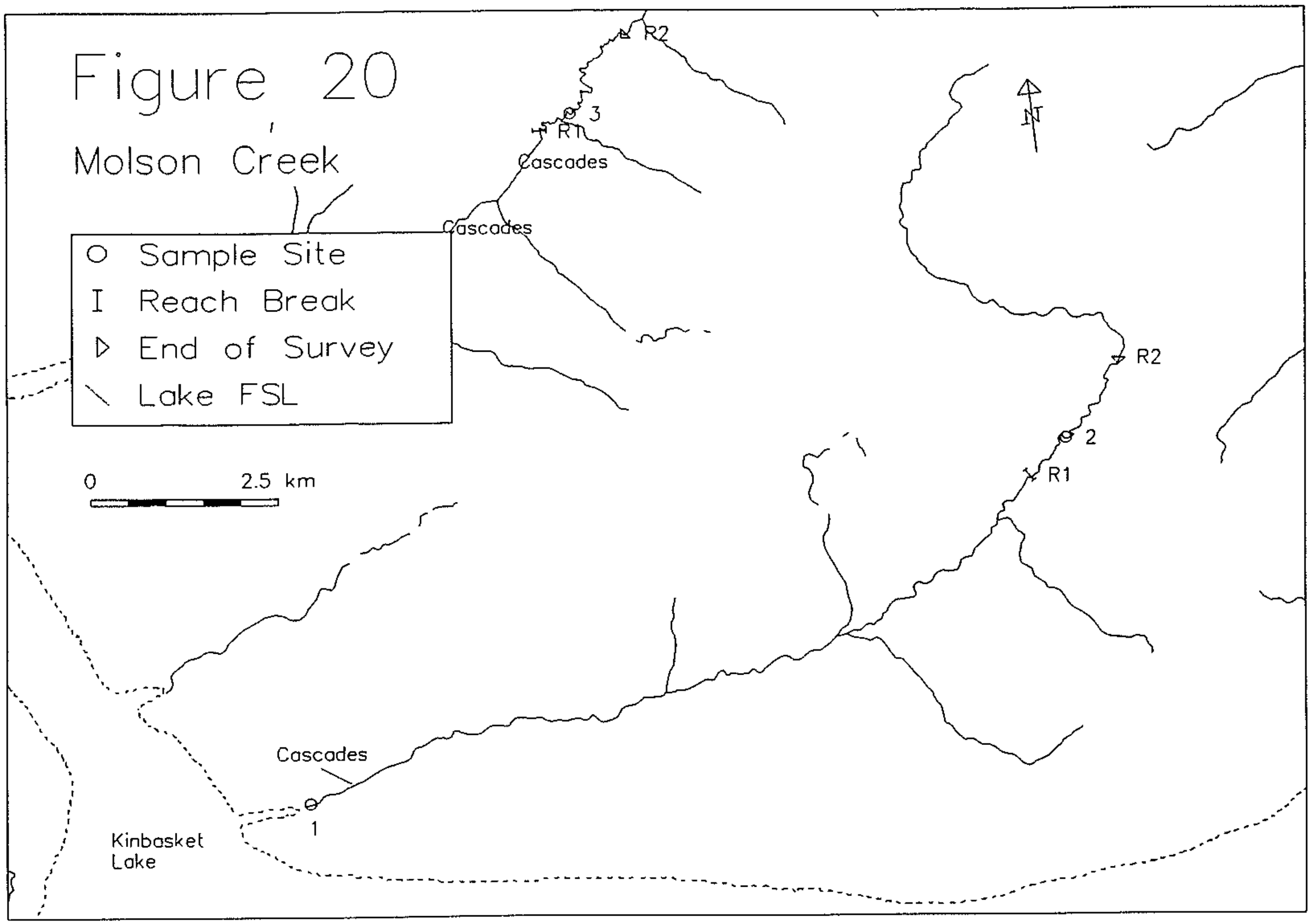
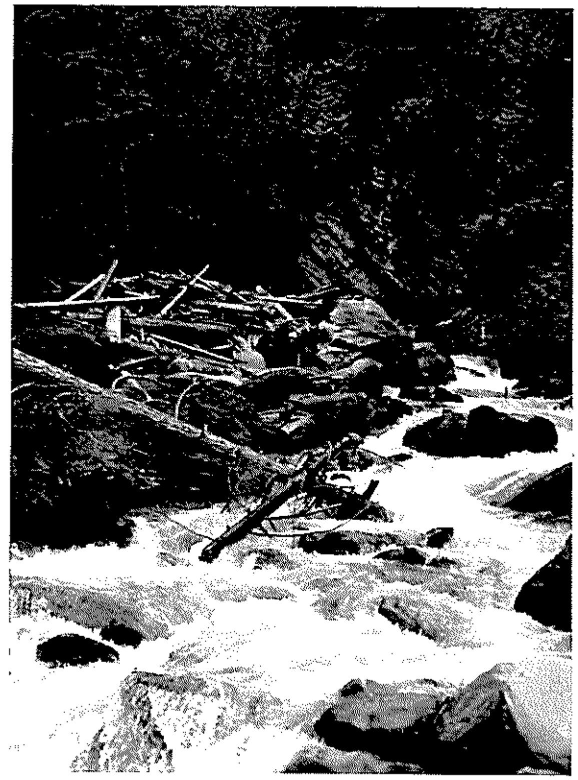
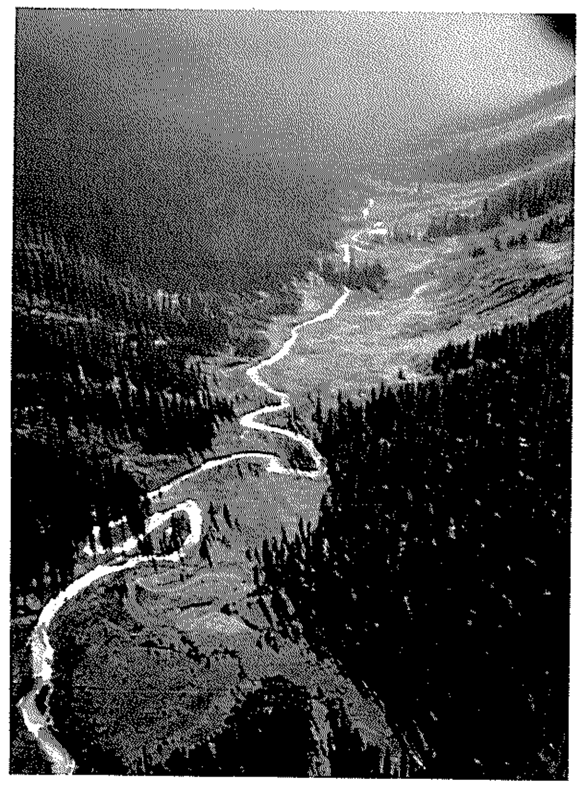


Figure 20
Molson Creek
Sample Site
Reach Break
End of Survey
Lake FSL
0
2.5 km
R2
3
R1
Cascades
Cascades
R2
2
R1
N
Cascades
1
Kinbasket
Lake

Plate 12.
No fish were found in Molson Creek Reach 1 which is steep and boulder strewn (upper right). Reach 2 (lower right) has a lower gradient and supports bull trout.

Reach 1 of Packsaddle Creek (lower left) produces bull trout and rainbow trout although it is moderately steep with riffle habitats.





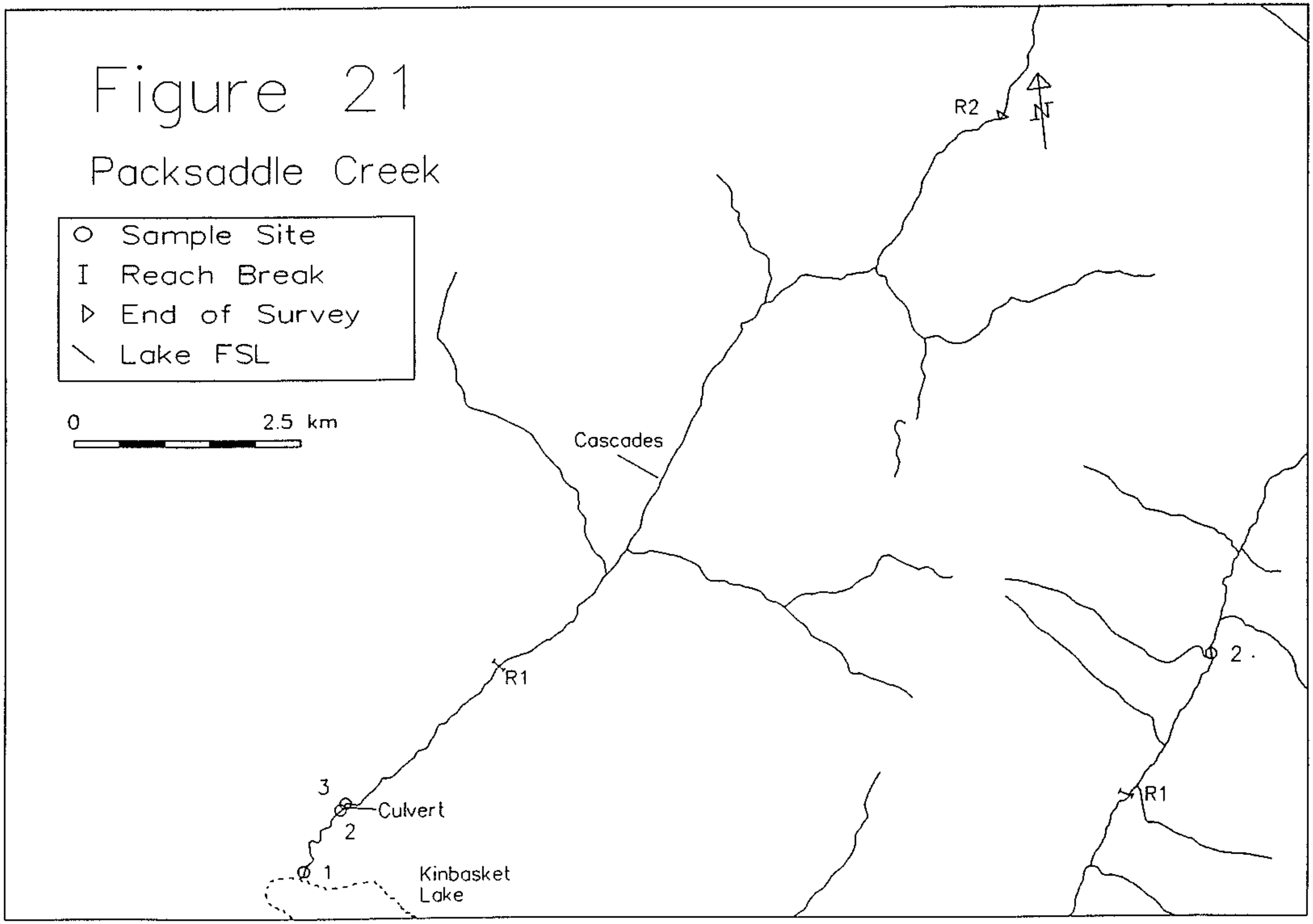
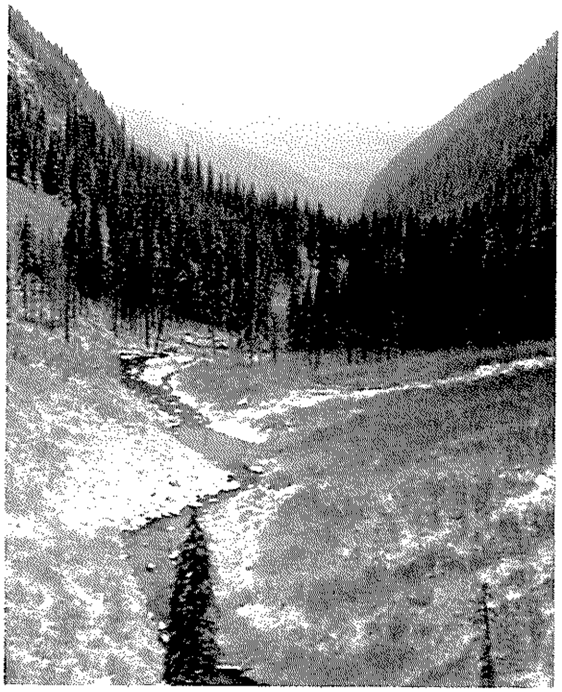


Figure 21
Packsaddle Creek
Sample Site
Reach Break
End of Survey
Lake FSL
0
2.5 km
R2
N
Cascades
R1
3
Culvert
2
1
Kinbasket
Lake
2
R1



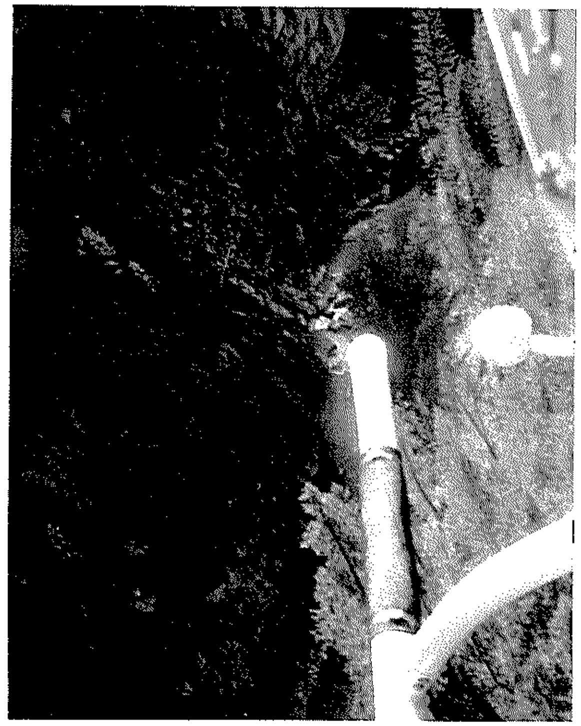
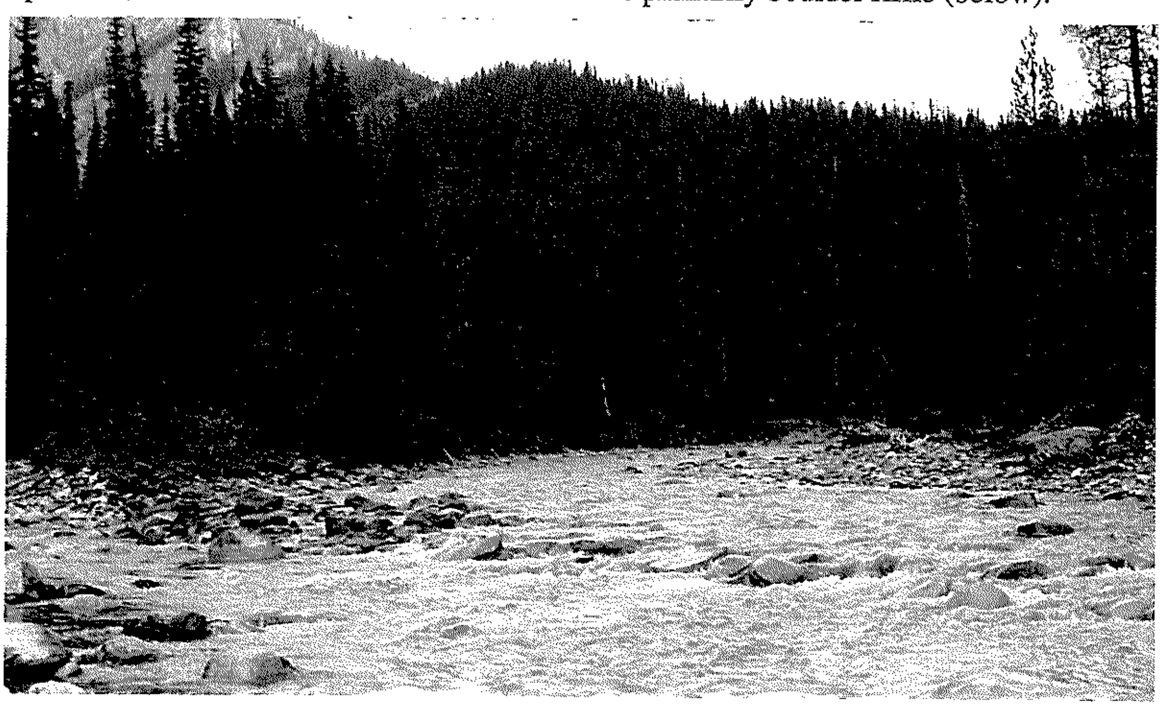


Plate 13.
Avalanche tracks lead into Reach 2 of Packsaddle Creek which is composed of shallow pools and riffles (upper left).

Bull trout were sampled in lower Prattle Creek below the canyon (upper right). Further upstream, no fish were found in Reach 2 which is primarily boulder riffle (below).



Ptarmigan Creek

Ptarmigan Creek flows into Ptarmigan Bay on the east side of Canoe Reach (Figure 1). Access to this system is good as a logging road parallels the creek almost to the end of the valley. This system was surveyed by truck on October 16, 1991 and by helicopter on October 18. Water visibility ranged from 25 cm in Reach 1 to clear at the top of the system. Icefields are the cause of the high turbidity in this system.

Ptarmigan Creek is composed of three reaches (Figure 22). The first reach is 5.5 km long and has a gradient of 3.6% (Plate 14). The channel is entrenched and the habitat is boulder rapids. The gradient decreases to 2.8% in the second reach which is 10.2 km long and is boulder riffle and glide habitat. The gradient decreases further to 1.4% in the last reach. This 12.6 km long section is occasionally confined and has an irregularly meandering channel. The habitat is primarily glide and pool with a gravel-cobble substrate.

Succour Creek

Succour Creek was sampled on August 31 and September 1, and was briefly examined again on October 6 while the kokanee were spawning. This system enters Kinbasket Lake near the midpoint of the Columbia Reach (Figure 1) and differs from most of the other systems surveyed in that it has a relatively low gradient, is lake fed, and is not glacial in origin. As a consequence, turbidity was low and water temperatures were warm. Temperatures taken on August 31 and September 1, 1991 ranged from 12 to 14.5°C and were the warmest of any of the systems measured. No barriers to fish migration were observed in the system, but the heavy overhang and crown cover in Reach 2 made observation from the air difficult.

The system consists of three reaches (Figure 23). Reach 1 is 3.2 km long and has a slope of 1.0%. The habitat in this reach is primarily pool and glide (Plate 15). The channel irregularly meanders and is occasionally confined.

Reach 2 is 5.3 km long, is primarily riffle with some glide and pool habitat, and has a cobble-gravel substrate. The stream channel is stable, has an abundance of large organic debris (LOD) and is heavily overhung with vegetation. The channel is only 5.5 m wide and depths vary between 0.25 m and 1 m at moderate water levels. Mean gradient is 1.5% in this reach.

Reach 3 makes up the remainder of the system and includes three lakes; Help, Aid and Comfort. This 5.3 km long reach has a low gradient (<0.5%) and as a consequence, most of the stream habitat is either slow flowing pool, glide or marsh. The stream channel is generally wide and has an abundance of cover,

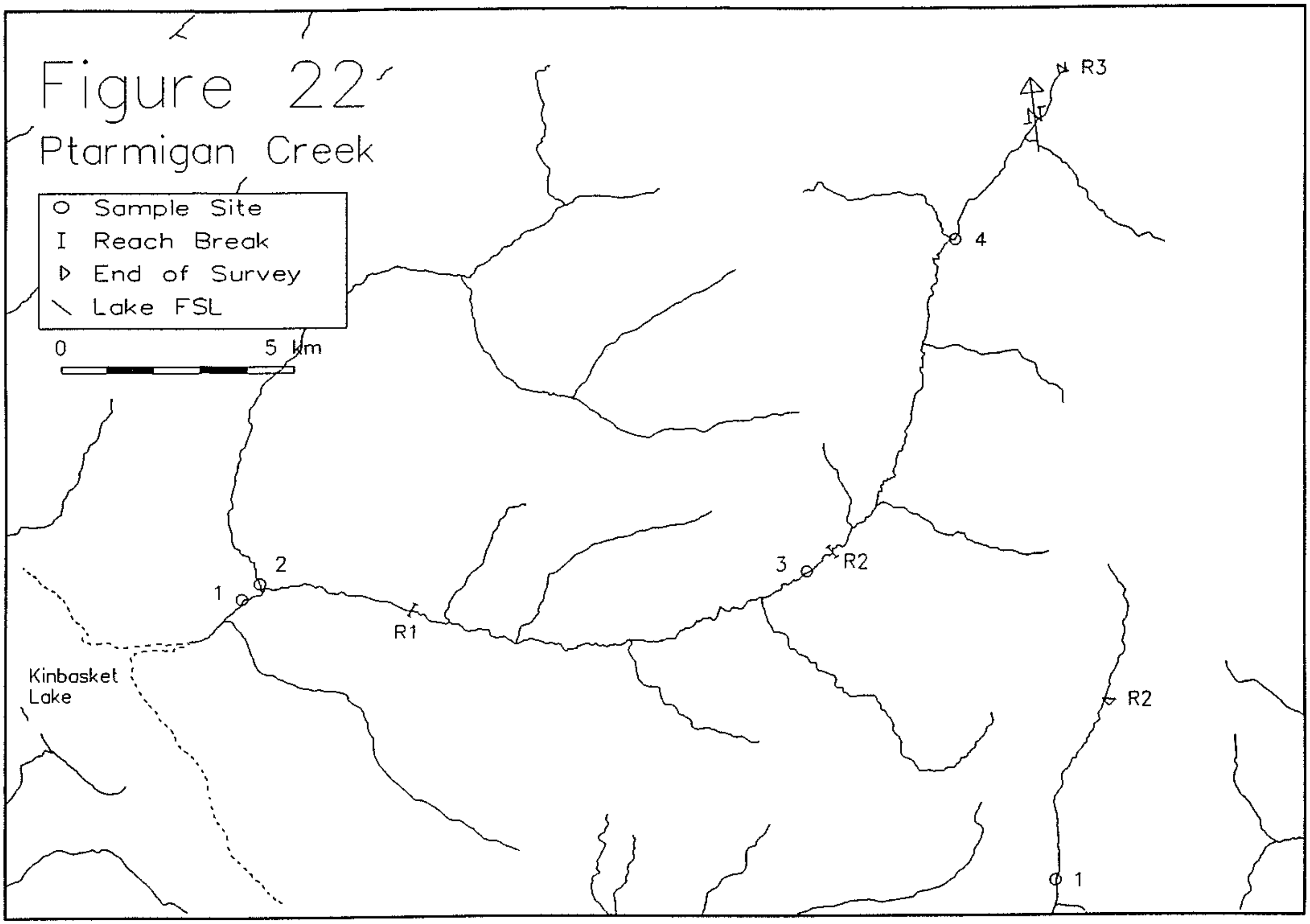
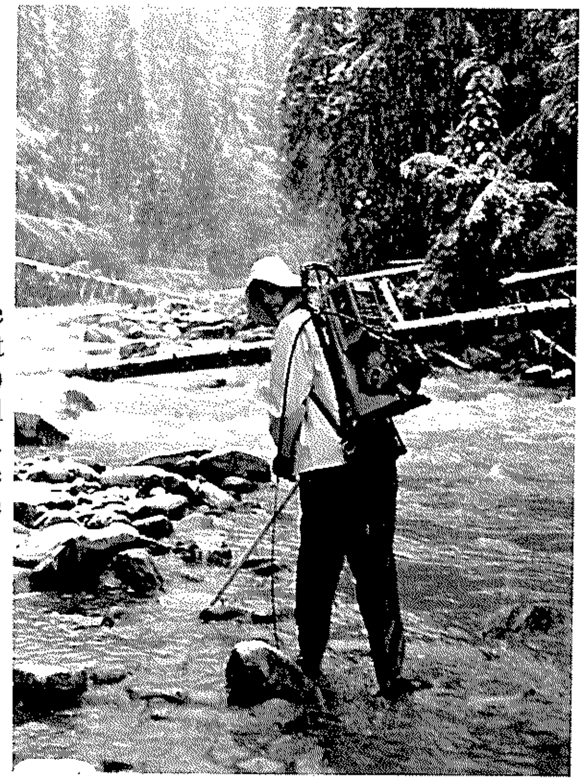
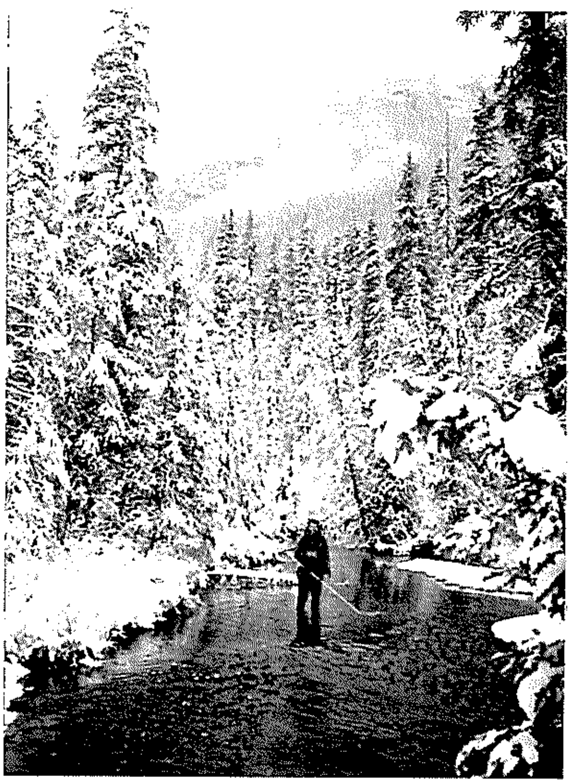
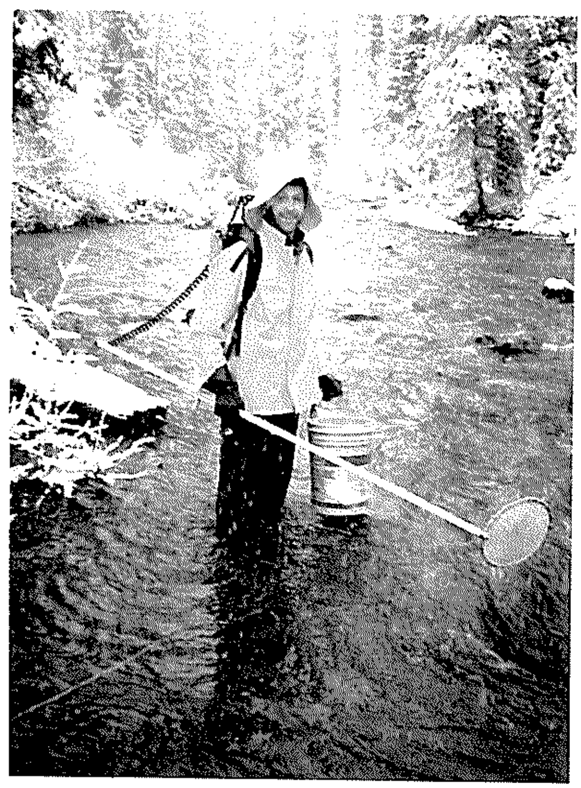


Figure 22
Ptarmigan Creek
Sample Site
Reach Break
End of Survey
Lake FSL
0
5 km
Kinbasket Lake
1
2
R1
3
R2
4
R3
R2
1
N

Plate 14.
Lower Ptarmigan Creek is steep but the gradient decreases further upstream. Habitat in Reach 1 is primarily rapids (upper right) while Reach 2 is riffle (lower right). Bull trout were found throughout these areas. Reach 3 contained a mixture of pool, riffle and glide (lower left) but no fish were observed.







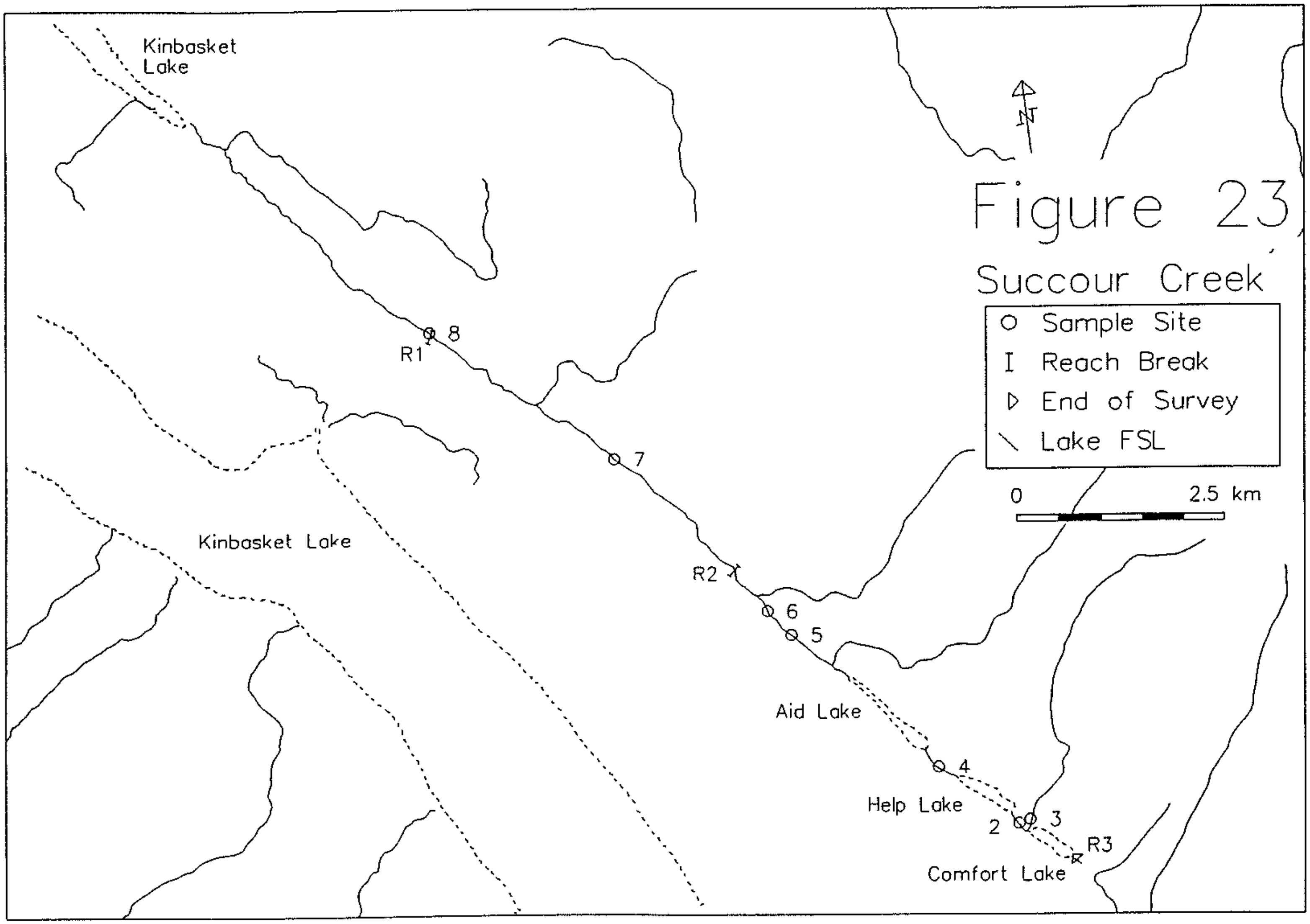


Figure 23
Succour Creek
Sample Site
Reach Break
End of Survey
Lake FSL
0
2.5 km
N
Kinbasket Lake
Kinbasket Lake
R1
8
7
R2
6
5
Aid Lake
4
Help Lake
2
3
R3
Comfort Lake

Plate 15.
Reach 1 of Succour Creek is an important spawning area for kokanee (above) while the habitat in Reach 2 supports juvenile rainbow trout (lower left). Reach 3 has a low gradient and includes several lakes and marshes (lower right).

which includes instream vegetation (pond weed, cattails and bullrushes), LOD and overhang in the form of sedges and hardhack. The three lakes appear to be fairly productive as they are shallow and have substantial amounts of submergant and immergant vegetation.

Sullivan River

The Sullivan River flows into the north east side of the Columbia Reach opposite Windy River (Figure 1). The system was surveyed on September 3, 4 and 5 by truck and examined again on October 7, 1991 by helicopter. Reach 1 is a 4.3 km long section of river below the reservoir full supply line (Plate 16). At the time of the survey in September, the habitat was slough and the current was slow. The habitat in this section would likely change to riffle and glide as the lake level dropped. Reach 2 extends for 7.3 km and has a gradient of less than 0.5% (Figure 24). This section of the river is braided and has a wide channel. The habitat is primarily riffle and glide with a cobble gravel substrate. Reach 3 extends for 7.0 km and is primarily entrenched a boulder/rapid habitat. Stream gradient ranges up to 2% and averages 0.5%.

The channel becomes less entrenched in Reach 4 and the slope is slightly less (0.4%). As a result, the substrate is finer (mainly cobble) while the habitat is primarily riffle. This reach is 6.9 km long and there appears to be little habitat suitable for fish further upstream as the river flows through a deep canyon. Fish cannot pass upstream beyond this point.

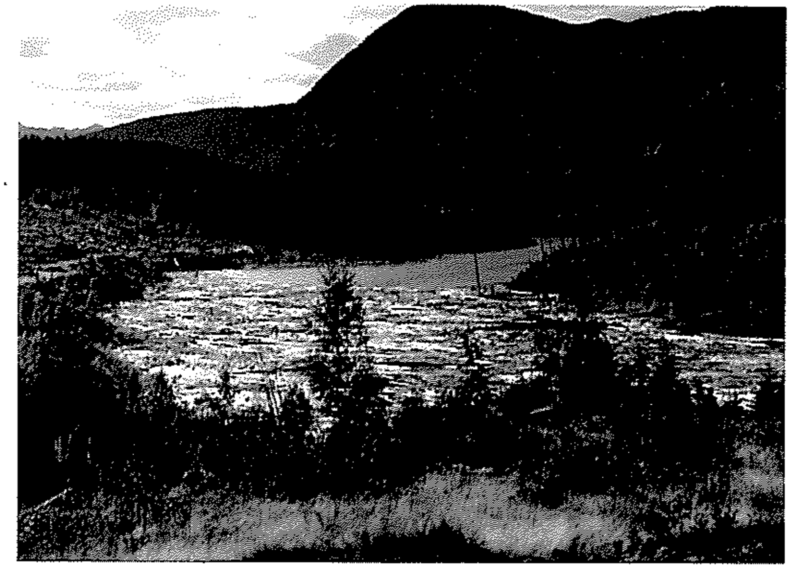
Valenciennes River

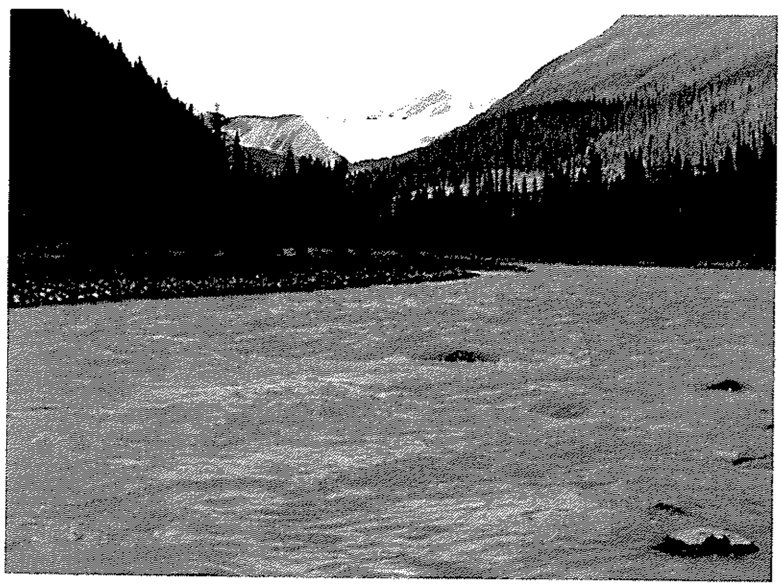
The Valenciennes River discharges into Bush River just above Kinbasket lake (Figure 1). Ground surveys were conducted on September 6 and 7, 1991 and the lower reach was flown by helicopter on October 7, 1991 to enumerate kokanee. Access was gained by a logging road that parallels the system almost to the headwaters of Icefall Brook, a major tributary that flows into the upper reaches of the system. The road is unstable and is likely to remain passable only as long as logging operations are being conducted in the valley.

Reach 1 of the Valenciennes River is short (200 m, Figure 25) and is the only portion of the river that is accessible to fish (Plate 17). In this reach the river is a single channel 28 m wide, the habitat is mainly glide and riffle, the slope is 1% and the substrate is cobble and boulder. Visibility was low in September (35 cm) due to glacial silt but it increased to approximately 2 m with the cooler weather in October.

Reach 2 is 10 km long and is a single entrenched channel with an average slope of 1.8% which is primarily boulder rapid habitat. The river flows through an

Plate 16.
The Full Supply Line lies 4.3 km up the the Sullivan River channel (upper right). Reach 2 has a wide, unstable and braided channel (lower right). Kokanee spawners were observed in side channels, tributaries throughout this reach. The gradient is steeper and the river becomes a single channel in Reach 3 (below). Bull trout and mountain whitefish were captured throughout the system.





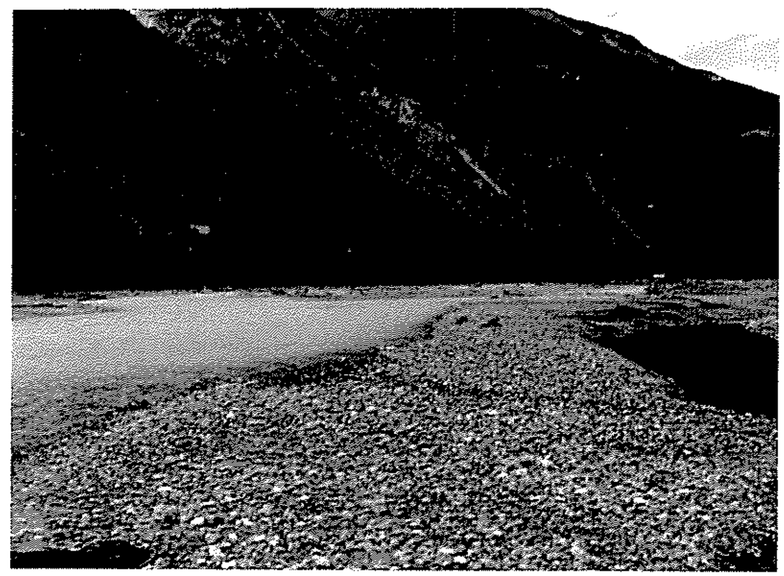
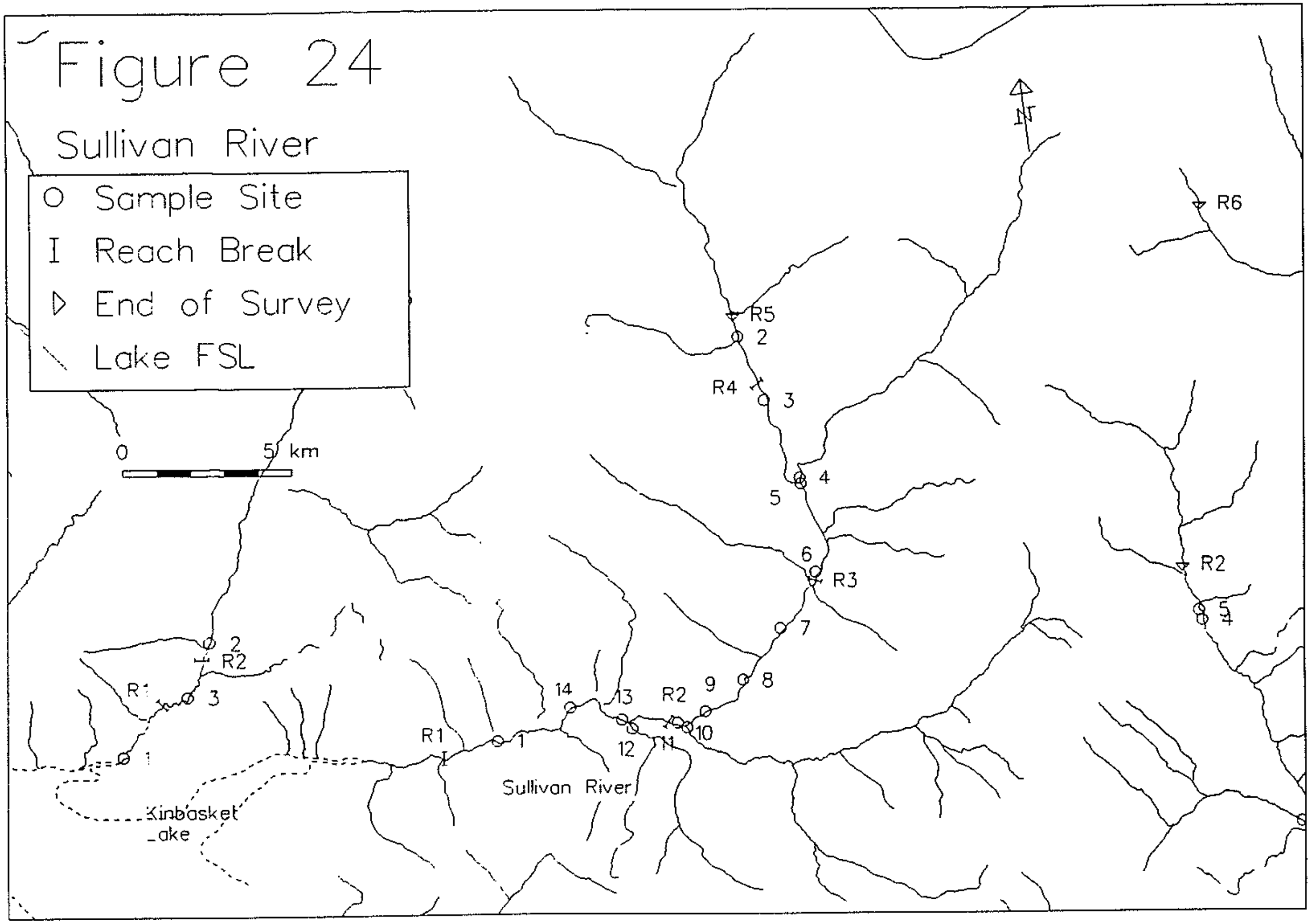


Figure 24


Sullivan River
Sample Site
Reach Break
End of Survey
Lake FSL
0
5 km
N
R6
R5
2
R4
3
4
5
6
R3
7
8
9
R2
10
11
12
13
14
R1
1
Sullivan River
R2
5
4
2
R2
3
1
Kinbasket
Lake

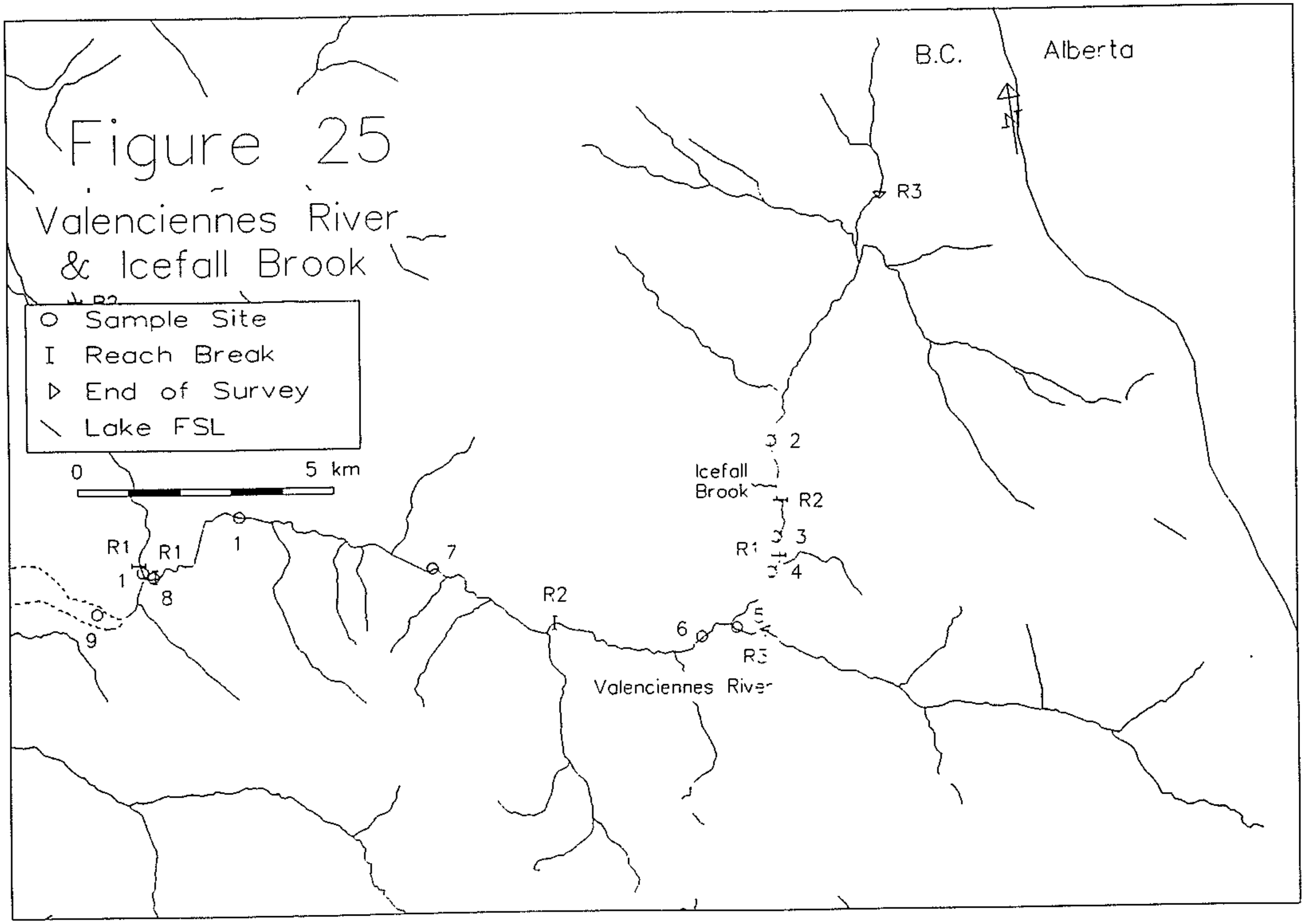
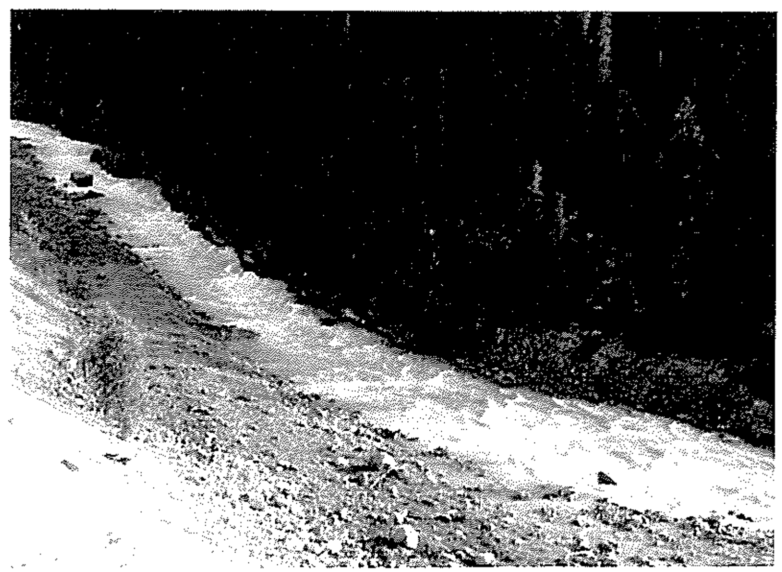


Figure 25
Valenciennes River
& Icefall Brook
Sample Site
Reach Break
End of Survey
Lake FSL
0
5 km
B.C.
Alberta
R3
Icefall
Brook
R2
R1
Valenciennes River
1
2
3
4
5
6
7
8
9

Plate 17.
Only 200 m of the Valenciennes River (Reach 1) is passable to fish moving upstream (upper right). Mountain white fish were observed in this area. Habitat in Reach 2 is primarily rapids and cascades (lower right). The third reach has a wide, braided and unstable channel (below). No fish were found in the upper reaches.



impassable deep bedrock canyon in the lower 3.5 km of the reach. The slope in this section averages 3.5%.

The slope decreases to less than 0.4 % in Reach 3. The stream channel in this section is braided with a gravel-cobble substrate and riffle-glide habitat. The channel is up to 250 m wide.

Icefall Brook is a major tributary at the top end of Reach 3. Reach 1 of the brook is 1.8 km long and is similar to Reach 3 of the Valenciennes River (Plate 18). The brook forms a single, entrenched channel in Reach 2 as the gradient increases to 2%. The habitat is glide, rapid and riffle with a cobble-boulder substrate. Reach 3 starts 2.8 km upstream from the Valenciennes River confluence and is 7 km long. The system again resumes a character similar to Reach 3 of Valenciennes River, although the discharge is less. The gradient increases sharply above Reach 3.

Windfall Creek

Windfall Creek flows into the west side of Canoe Reach (Figure 1). The valley has not been logged but the Canoe Reach mainline crosses the creek about 1 km upstream from the mouth. The visibility of this system was fairly clear when it was examined by helicopter on October 17, 1991 and by truck on October 18. Several icefields at top of the valley may increase the turbidity during warmer weather.

Four reaches were identified in this system (Figure 26). Reach 1 is steep with a gradient of 9.1% over 3.5 km (Plate 19). Much of this section is cascades and is likely impassable to fish moving upstream. The gradient decreases to 2.7% in Reach 2 which is 4.5 km long, entrenched and primarily boulder riffle habitat.

The gradient then increases to 10.6% for 2.6 km. Here, the habitat is again mainly cascades and rapids. The gradient decreases to 4.7% for 1.3 km in Reach 4. The stream channel meanders through an area devoid of trees due to numerous avalanche tracks. The stream habitat is primarily riffle in this area.

Windy Creek

Windy Creek is a glacial system situated on the west side of the Columbia reach of Kinbasket Lake (Figure 1). This system has no road access, although there is some logging activity in the vicinity of Windy Bay. The lower reach was surveyed on September 3, 1991 using a boat to gain access to the system. The rest of the system was surveyed by helicopter on October 7.

Reach 1 of Windy Creek extends for 3.5 km (Figure 26). This section is entrenched, has a gradient of 3%, and is primarily boulder rapid habitat. The slope decreases to 1.5% in Reach 2 for 3.5 km. The habitat is primarily a mixture of

Plate 18.
Reach 1 of Icefall Brook (upper right) is similar in character to Reach 3 of the Valenciennes River. In Reach 2 Icefall Brook becomes steeper and has a single confined channel (lower right). The third reach, like Reach 1, is wide, braided and unstable (below).

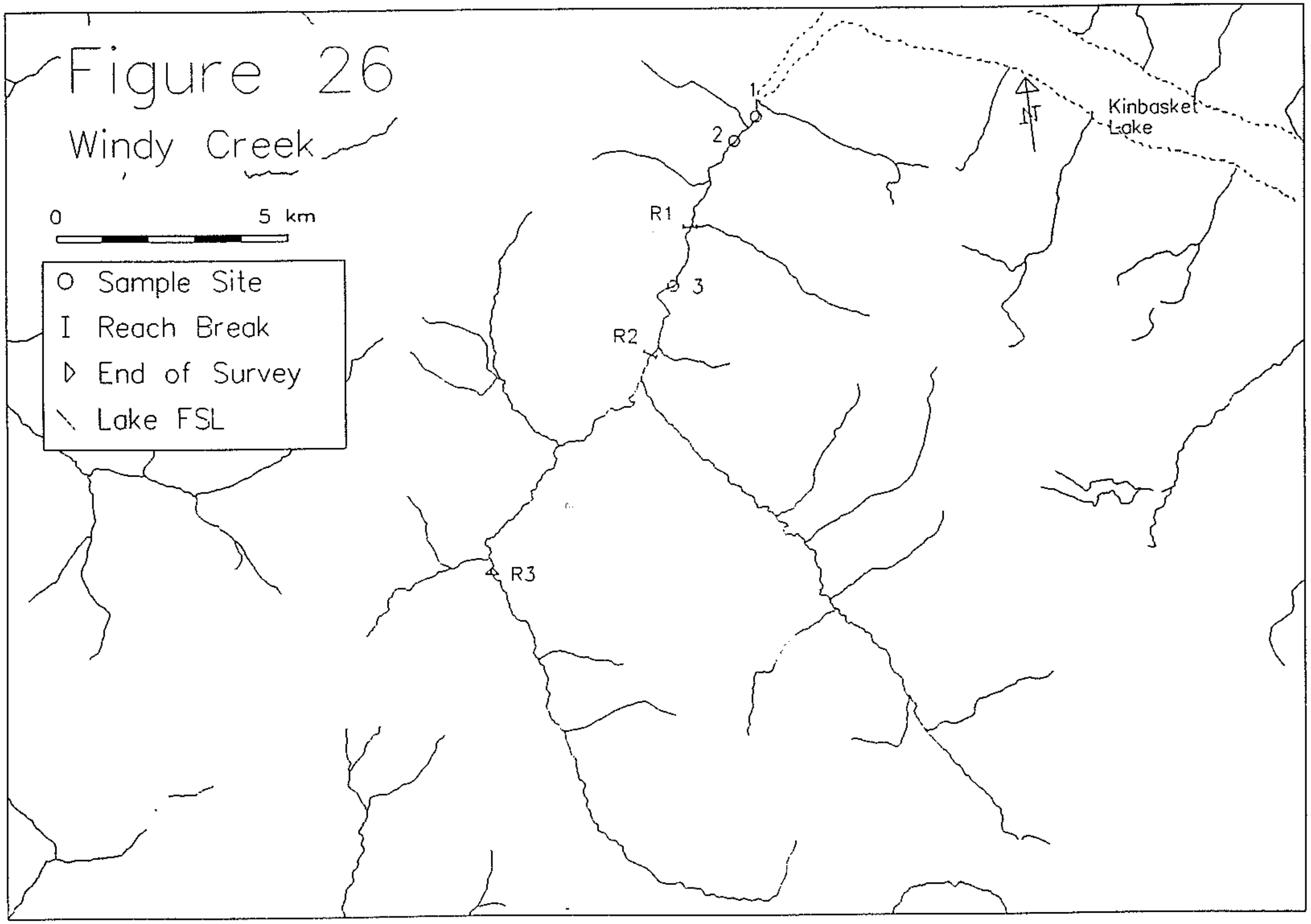


Figure 26
Windy Creek

glide and riffle with a cobble-gravel substrate in this reach (Plate 20). Above Reach 2, the gradient increases up to 5% and the habitat changes to rapids with a boulder substrate.

Wood River

The Wood River is a large glacial system that flows into the head of Wood Arm near the middle of Kinbasket lake (Figure 1). Wood Arm has been extensively logged and in recent years logging has extended into the Wood River watershed. The lower reach was surveyed on October 9 by truck, and the rest of the system was surveyed by helicopter on October 11.

Reach 1 is 9.5 km long (Figure 27) and has a gradient of less than 0.5%. The channel is wide and braided and the substrate is primarily gravel-cobble. The habitat is a mixture of glide, riffle and pool (Plate 20).

The upstream migration of fish is blocked in Reach 2 where the river flows through a bedrock canyon and the gradient increases to an average of 4.2% over a distance of 5.6 km. The habitat in this reach is primarily riffle, rapids and cascades.

Reach 3 is 8.6 km long and is very similar to Reach 1 as the channel is wide and the stream is braided (Plate 21). The gradient increases again in Reach 4 to an average of 6.1% over 6.6 km. This section is similar to Reach 2. The river flows over a series of falls up to 25 m in height.

Reach 5 lies between Reach 4 and Fortress Lake. Here the river meanders through meadows for 6.9 km. The habitat is a mixture of glide, riffle and pool. There are few bars and the banks appear stable.

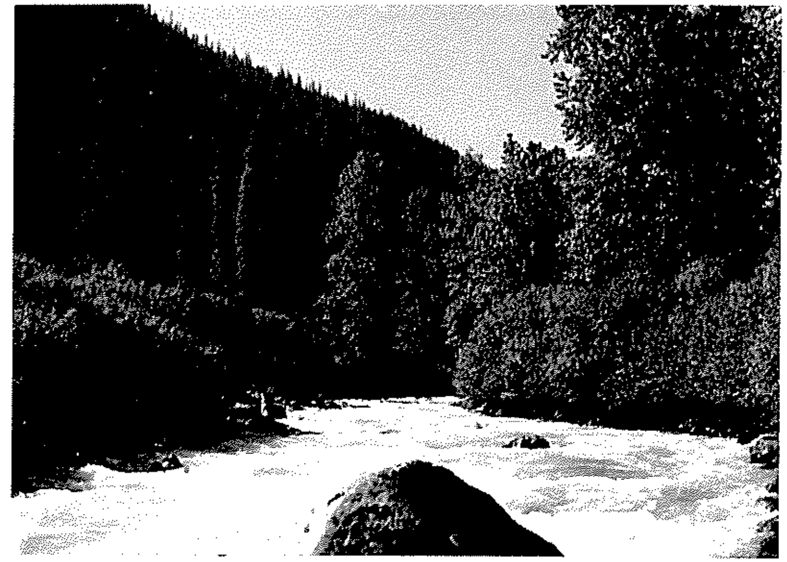
Yellowjacket Creek

The Yellowjacket Creek watershed lies just north of Horse Creek near the head of Canoe Reach (Figure 1). The watershed has not been logged. The lower section of this river was surveyed on October 15, 1991 and the rest of the system was surveyed by helicopter on October 18, 1991. Two reaches were identified (Figure 28). The first reach is 5 km long, is entrenched and has a gradient of 6.7%. Rapids were the most prevalent type of habitat but there did not appear to be any impassable sections (Plate 21). Stream gradient decreased to 4.3% for 9.9 km in the second reach where the channel is confined and the habitat is primarily riffle and glide (Plate 22).

Plate 20.

Windy Creek is a glacial system composed of two reaches. Reach 1 is mainly rapids with a boulder substrate (upper right). The gradient decreases in Reach 2, resulting in lower velocities and finer substrates (lower right).

Reach 1 of the Wood River is wide and braided. It has a gradient of <0.5% as it nears Wood Arm (below).



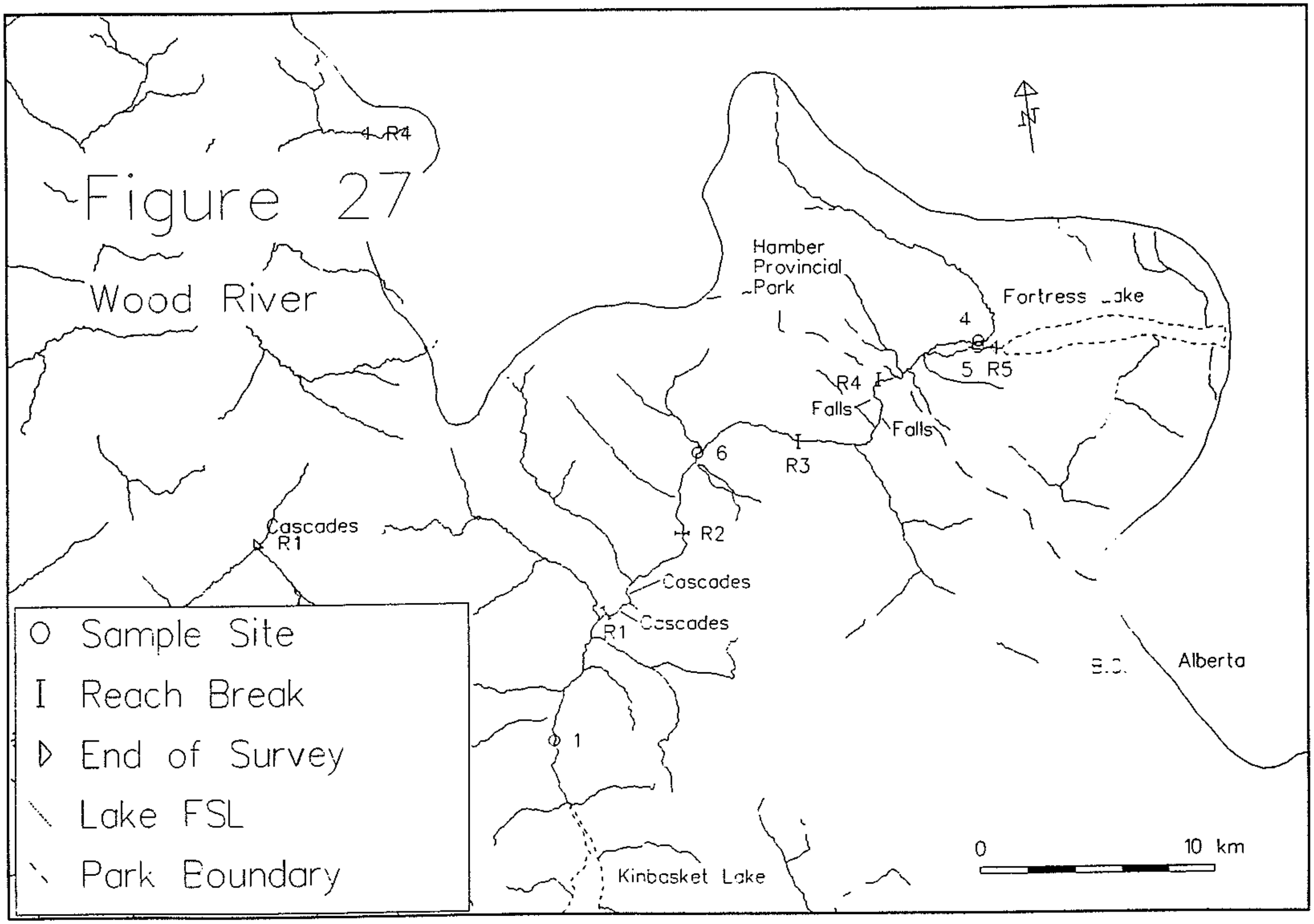
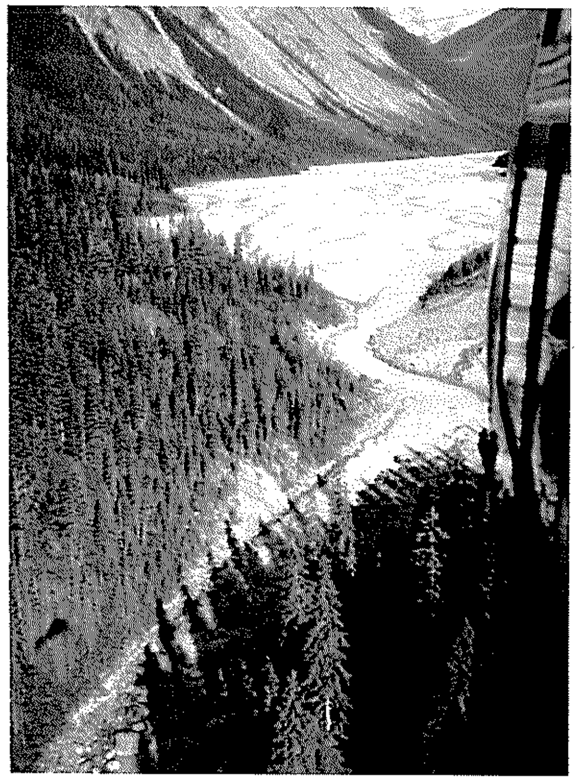
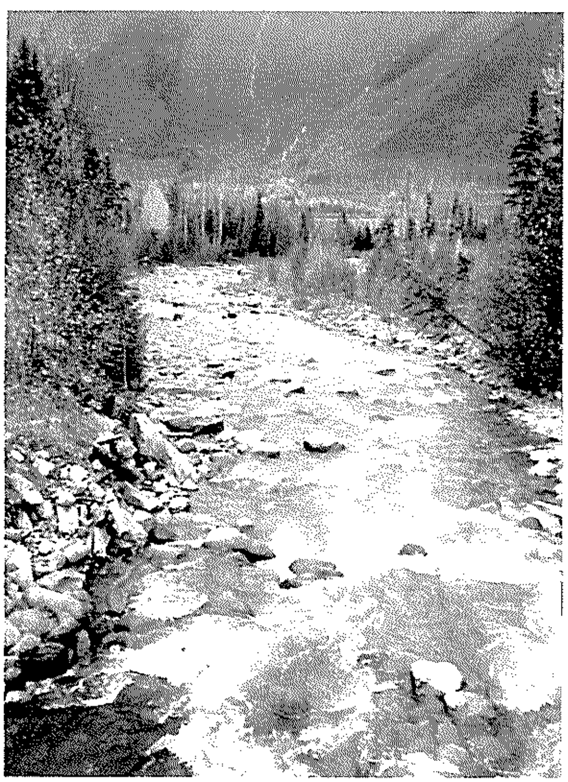


Figure 27
Wood River
R4
Cascades
R1
Hamber
Provincial
Park
Fortress Lake
4
5
R5
R4
Falls
Falls
6
R3
R2
Cascades
Cascades
R1
1
Kinbasket Lake
B.C.
Alberta
N
0
10 km
Sample Site
Reach Break
End of Survey
Lake FSL
Park Boundary

Plate 21.
Reach 2 of the Wood River is a single confined channel, while in Reach 3 it is wide, braided and unstable (upper right). Reach 5 flows through meadows just below Fortress Lake (lower right). Reach 1 of Yellow Jacket Creek is fast and bouldery (lower left).





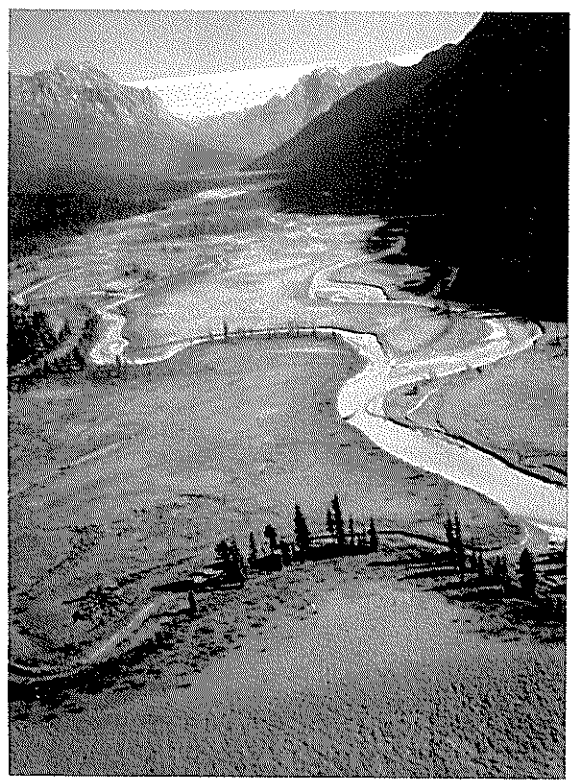


Plate 22
Gradient decreases in Reach 2 of Yellow Jacket Creek, although there are still some fast flowing and boulder strewn sections.

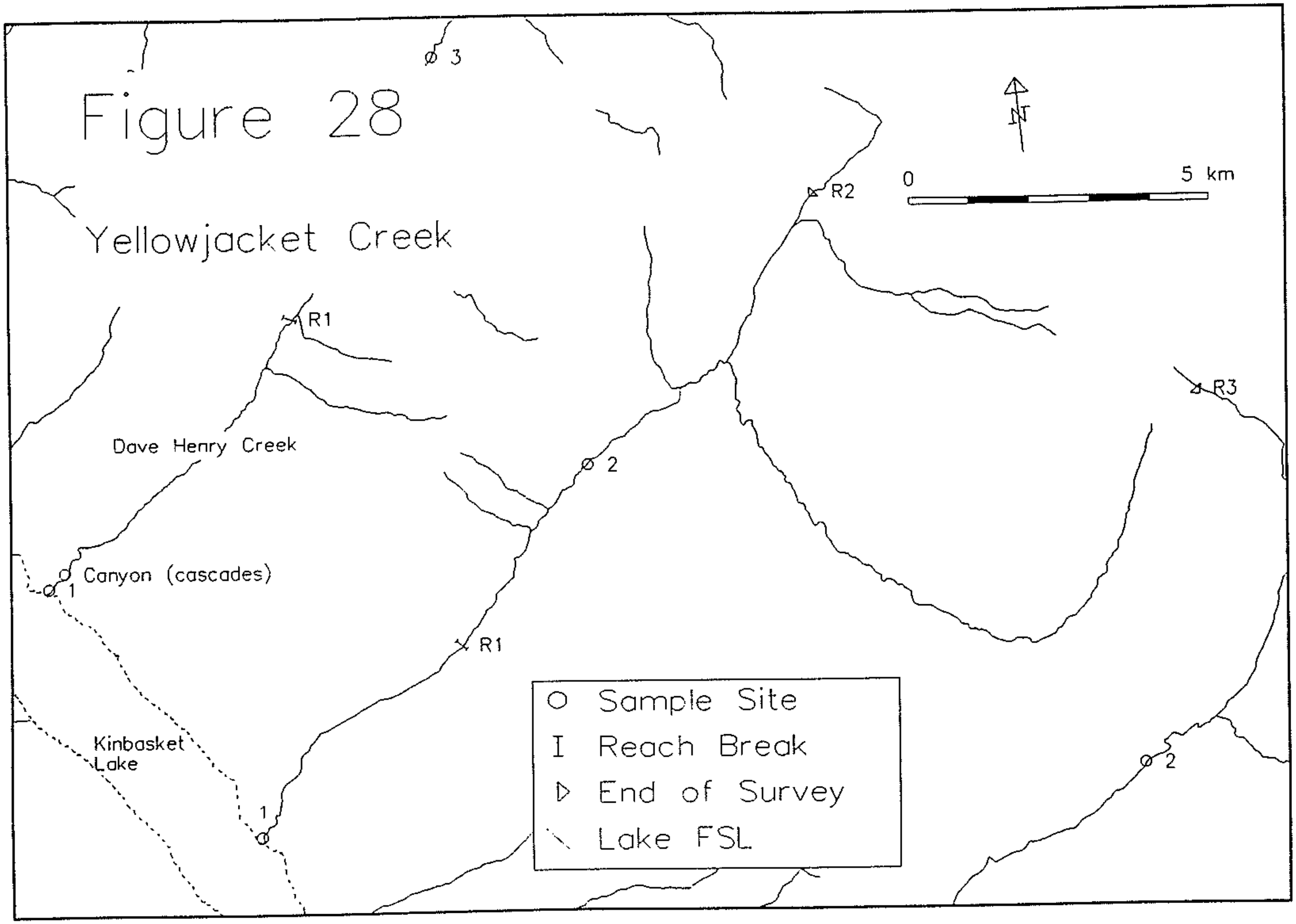


Figure 28
Yellowjacket Creek
3
R1
R2
0
5 km
N
R3
Dave Henry Creek
2
Canyon (cascades)
1
R1
Kinbasket Lake
1
2
Sample Site
Reach Break
End of Survey
Lake FSL

3.2.1 Land Use

There are potential resource conflicts from logging, mining, agriculture, hydro plants and water diversion licenses which may significantly affect enhancement potential on some systems (Table 4). Logging activity is moving towards the middle of Kinbasket Lake as accessible mature timber runs out on the north and south ends. This trend, and related construction of access roads, may lead to sedimentation and runoff problems and reduction of canopy cover, particularly along Bachelor, Bush, Cummins, Kinbasket, Sullivan and Wood Rivers and Encampment, Grouse, Howard, Prattle and Ptarmigan Creeks. While there is at present only one area of active mineral exploration (at the mouth of the Cummins River), the area is considered to have potential for precious metals, base metals, rare earth metals and industrial metals. Mineral deposits may affect water quality in any of the systems and a new mine could result in impacts on Cummins River.

Table 4
Summary of land use concerns in the Kinbasket study area.

Stream	Logging	Mining	Agriculture	Water	Roads	Other
Bachelor Ck	2	1	1	1	1	1
Beaver R	2	1	1	1	1	1
Blackman Ck	1	1	1	1	1	1
Bulldog Ck	2	1	2	1	2	1
Bush R	3	1	1	1	3	1
Chatter Ck	2	1	1	1	2	1
Cummins R	3	3	1	1	3	1
Dave Henry Ck	1	1	2	2	1	1
Dawson Ck	1	1	1	1	1	1
Encampment Ck	2	1	1	1	2	1
Foster Ck	1	1	1	1	1	1
Grouse Ck	3	1	1	1	3	1
Harvey Ck	1	1	1	1	1	1
Horse Ck	1	1	2	1	1	1
Howard Ck	3	1	1	1	3	1
Hugh Allen Ck	1	1	1	1	1	1
Kinbasket R	3	1	1	1	3	1
Molson Ck	1	1	1	1	1	1
Packsaddle Ck	1	1	2	1	1	1
Prattle Ck	3	1	1	1	3	1
Ptarmigan Ck	3	1	1	1	3	1
Succour Ck	1	1	1	2	1	1
Sullivan R	3	1	1	1	3	1
Valenciennes R	2	1	1	1	2	1
Windfall Ck	2	1	1	1	2	1
Windy Ck	2	1	1	1	2	1
Wood R	2	1	1	1	2	1
Yellowjacket Ck	1	1	2	2	1	1

1 - No conflict

2 - Some conflict

3 - Significant conflict possible

There is little agricultural or horticultural activity in the area. A few head of horse are currently grazing along Dave Henry Creek and there is some interest to put 100 head of cattle on the north east side of the lake. This may cause water quality problems and reduce canopy cover along these systems. There are no plans to build any roads in the area other than logging roads. There are water licence applications on Yellowjacket and Dave Henry Creeks for small hydro power facilities and a yearly licence to remove 50 acre feet of water from Succour Creek between April 1 and September 30. These licences could affect enhancement plans.

Bachelor Creek

Current and future logging is likely to have some impact along Bachelor Creek. Three kilometres of new roads and logging directly adjacent to a tributary may result in sedimentation and run off problems. Canopy cover may also be affected. These impacts could have an effect on any enhancement projects.

There have been seventeen blocks logged to date along Bachelor Creek and a logging road now parallels the watercourse almost to its headwaters. Four blocks were to have been logged in 1991 and four blocks are planned for 1996. These blocks look to be approximately 50 meters off the creek. In addition, there are (proposed) plans to log one block in 1994 and two in 1995 along a tributary to Bachelor Creek - Benedict Creek. These blocks are directly adjacent to the Creek. Approximately 3 km of new logging roads would be required along Benedict Creek. No new stream crossings would be required (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines or known significant mineral occurrences (J. Fontain, pers. comm., A. Whale, pers. comm.).

Beaver River

The lower 20 km of the Beaver River are paralleled by a railroad and the Trans Canada highway. However, all but 8.9 km of the system lie within Glacier National Park and there do not appear to be any current land use plans that would significantly affect enhancement opportunities along the Beaver River.

Several blocks have been logged to date along the lower Beaver River and there are plans to log an additional block in 1992. This block is approximately 500 meters from the river edge. Some new access roads will be required but will be situated well away from the river (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines or known significant mineral occurrences (J. Fontain, pers. comm., A. Whale, pers. comm.).

There are no current plans for significant railroad construction or modification along Beaver River (J. Cassie, pers. comm.).

Blackman Creek

There do not appear to be any current land use plans that would significantly affect enhancement opportunities along Blackman Creek. There has been no logging to date along this creek nor are there current plans to do so (T. Laycock, pers. comm.). There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Bulldog Creek

There is some interest in grazing approximately 100 head of cattle along the lake shore between Bulldog and Dave Henry Creeks (R. Wiltsie, pers. comm.). This may result in sedimentation, decreased water quality and reduced canopy cover unless carefully managed. These impacts would affect enhancement opportunities.

There has been no logging along this creek nor are there current plans to do so (T. Laycock, pers. comm.). There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

There has been some interest in setting up a small hydro plant on this creek. However, the stream characteristics make this very doubtful.

Bush River

There are extensive logging plans along the Bush River and logging roads now extend right into the headwaters. Sediment problems and increased recreational access could have an impact on fish populations. There is likely to be little impact from mineral occurrences.

There have been approximately eighteen blocks logged to date along the Bush River. There are current plans to log another three blocks in 1992 (proposed), five blocks in 1994 (proposed) and thirty eight blocks in 1996 (three of which are proposed). There are also (proposed) plans to log seven blocks along a tributary in 1992. Many of these blocks are directly beside the river. Most of the logging roads for these blocks have been built. However, the proposed blocks require a further 15 to 20 km of road. Much of this will be directly beside the river and its tributaries. Both Rice Brook and Lyell Creek are to be crossed twice (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

While there are no active mines in the area, it has been noted that there are two mineral occurrences of interest in the mountains between upper Icefall Brook and Lyall Creek (a tributary of the Bush River). Number 82N-75 ("Rogers Pass") contains dolomite and number 82N-88 ("Jack") contains diamond and gemstone. In addition, there is a site approximately 35 km up the Bush River, number 82N-82 ("Bush River"), that contains nepheline syenite. There are no current plans to mine any of these (J. Fontain, pers. comm., A. Whale, pers. comm.).

Chatter Creek

Chatter Creek has not been logged to date although a mainline logging road crosses the creek near its mouth. Logging plans along Chatter Creek, including a new stream crossing, may result in some sedimentation and run off problems that could impact enhancement opportunities. There are plans to log three blocks close to the mouth in 1996. These blocks are approximately 50 meters from the creek. Access roads already exist but a new crossing at the creek mouth is planned (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines or known significant mineral occurrences (J. Fontain, pers. comm., A. Whale, pers. comm.).

Cummins River

Impacts from logging could create sedimentation problems, as well as reduce canopy cover. Mineral deposits may also have water quality implications. A new mine may have other impacts on the watershed. These impacts may affect enhancement opportunities.

To date, logging has only taken place near the mouth of the Cummins River. There are plans to log six blocks in 1993, three blocks in 1994 and four blocks in 1995. The blocks are at least 50 to 100 meters from the river. Proposed logging roads will be at least 100 meters from the river except for one crossing approximately one kilometer up from the mouth (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines along the Cummins but there is current exploration being undertaken by both Cominco and Teck Corp. The occurrence of interest is 83D-1, "Bend One Canyon Zone". With known deposits of zinc, lead and silver close to the mouth of the river, it is considered "just a matter of time" before a mine is developed (J. Fontain, pers. comm., A. Whale, pers. comm.).

Dave Henry Creek

There may be some impact from sedimentation, decreased water quality and reduced canopy cover from horses grazing in Reach 2 (as well as cattle, if they are allowed to graze in the area). There may also be some impact resulting from the construction and operation of a small hydro plant. These impacts could affect enhancement opportunities.

Dave Henry Creek was logged to its upper reach during the 1970's and there are no current plans for further logging (T. Laycock, pers. comm.). There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

There is currently some horse grazing about 5 km up from the mouth and there is interest in cattle grazing near the mouth. However, these involve low stock numbers and do not present a significant conflict (R. Wiltsie, pers. comm.).

There is a water licence application for small hydro power near the mouth of this creek (L. Walters, pers. comm., G. Robinson, pers. comm.).

Dawson Creek

There appear to be no current land use impacts that would affect enhancement opportunities along Dawson Creek. Two blocks near the mouth of the system were logged by the mouth in the 1980's and are now regenerating. There are no current plans to log along this creek (T. Laycock, pers. comm.). There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Encampment Creek

Logging along Encampment Creek may result in sedimentation and run off problems which could affect enhancement opportunities. There has been substantial logging around the mouth of Encampment Creek and a logging road crosses the creek approximately 4 km from the mouth. There are plans to log four blocks in 1992, two blocks in 1993 and one block in 1994 All but one of the blocks are well off the creek except for one. The roads have been constructed (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines or known significant mineral occurrences (J. Fontain, pers. comm., A. Whale, pers. comm.).

Foster Creek

There do not appear to be any current land use conflicts that would affect enhancement projects along Foster Creek. One block by the mouth was logged in 1987 and there are no current plans for further logging (T. Laycock, pers. comm.). There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Grouse Creek

There may be some sedimentation or run off problems associated with recent logging near the mouth of Grouse Creek however these should stabilize in the next few years. Two blocks were logged close to the creek mouth during 1991 and there are no current plans for further logging (T. Laycock, pers. comm.). A mainline logging road crosses the creek near its mouth.

There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Harvey Creek

There do not appear to be any current land use conflicts that would affect enhancement projects along Harvey Creek. Three blocks were logged during the 1980's however the roads did not extend far into the system and there are no current plans for further logging (T. Laycock, pers. comm.).

There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Horse Creek

There is some interest in grazing a few head of cattle along the lake shore and creek mouth (R. Wiltsie, pers. comm.). Unless this is carefully managed, there may be some impact from sedimentation, decreased water quality and reduced canopy cover. These impacts could affect enhancement opportunities.

The Canoe Reach mainline logging road crosses Horse Creek 500 m above its mouth. The system was logged around the mouth in the 1970's and there are no current logging plans (T. Laycock, pers. comm.).

There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Howard Creek

Extensive logging plans including approximately 20 km of new roads with three creek crossings may cause sedimentation and run off problems along Howard

Creek. The new roads may also cause impacts from increased recreatioal access. These impacts could affect enhancement plans unless carefully managed.

There has been no logging to date along Howard Creek but there are plans to log one block in 1993, six blocks in 1994 and three blocks in 1995. Of these, at least four are immediately adjacent to the creek. Approximately 20 km of logging roads are to be built. Most of these roads are directly beside the creek and cross over it three times (T. Laycock, pers. comm.)

While there are no active mines, there is a known occurrence of garnet in the upper reach between Howard and Windfall creeks (number 83D-42, "Howard Creek"). There are no current plans to open a mine (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Hugh Allan Creek

There do not appear to any current land use conflicts that would affect enhancement opportunities. One block was logged near the mouth in 1986 and there are no current plans for further logging (T. Laycock, pers. comm.). There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Kinbasket River

Impacts from proposed logging and the construction of new roads could create sedimentation and run off problems along Kinbasket River. With new roads directly beside the river, canopy cover may be affected, sediment from the roads may have an impact on the water quality, and there will be increased recreational access. These impacts could affect enhancement opportunities.

No logging has taken place to date along Kinbasket River. However, there are (proposed) plans to log four blocks in 1984, three blocks in 1985 and five blocks in 1986. At least 12 to 15 km of new road would be required. The planned roads often run directly beside the river and cross it twice (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines or known significant mineral occurrences (J. Fontain, pers. comm., A. Whale, pers. comm.).

Molson Creek

There do not appear to be any current land use conflicts that would affect the enhancement potential of Molson Creek. No logging has taken place to date along Molson Creek nor are there current plans to do so (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.). There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Packsaddle Creek
There do not appear to be any current land use conflicts which would affect the enhancement potential of Packsaddle Creek. This creek has not been logged and there are no current plans for logging although a logging mainline crosses in the middle of Reach 1 (T. Laycock, pers. comm.). There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Prattle Creek
Extensive logging plans along Prattle Creek, including over 20 km of new roads with two creek crossings and many tributary crossings, could have a significant impact on enhancement opportunities due to silt and run off problems. Canopy cover may also be affected as some of the blocks are directly adjacent to the creek.

There has been no logging to date along Prattle Creek although a mainline logging road crosses the lower reach. However, there are (proposed) plans to log eleven blocks in 1996. Nine of these are directly beside the creek. The blocks extend 19 km upstream. New logging roads to access these blocks will cross the creek twice (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines or known significant mineral occurrences (J. Fontain, pers. comm., A. Whale, pers. comm.).

Ptarmigan Creek
Impacts from logging and the construction of new roads could create sedimentation and run off problems along Ptarmigan Creek. One proposed cutblock is directly beside the creek, canopy cover could be affected and there may be impacts from increased recreational access. These impacts could affect enhancement opportunities.

Seven blocks were logged in the 1980's and there are current plans to log a further 11 blocks during the coming year. One of these blocks is directly beside the river. The others are at least 50 meters from the river. Logging roads parallel the system right to its headwaters and additional roads are currently under construction. The roads are generally at least 50 meters from the river but cross it approximately three times (T. Laycock, pers. comm.)

There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Succour Creek

There is likely to be little impact in the near future from logging operations along Succour Creek as the area is currently regenerating. An existing licence for the removal of 50 acre feet of water between April and September each year may limit certain enhancement opportunities.

The Succour Creek watershed has been extensively logged to date and logging roads cover the entire watershed. However, the area is currently regenerating and there are no current plans for new logging (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines or known significant mineral occurrences (J. Fontain, pers. comm., A. Whale, pers. comm.).

There is a water licence that allows the removal of 50 acre feet of water between April 1 and September 30 each year. This licence has been granted since 1963 (L. Walters, pers. comm., G. Robinson, pers. comm.).

Sullivan River

Impacts from logging and the construction of new roads, including many stream crossings, could create sedimentation and run off problems along the Sullivan River. With roads directly beside some tributaries, canopy cover could be affected, dust from the roads may have an impact on the water quality and there may be increased access. These impacts may affect enhancement opportunities. The known mineral occurrences in the area are not expected to lead to significant impacts in the near future.

Logging roads extend well up the Sullivan Valley. Approximately eight blocks have been logged during the 1980's and another twelve blocks were scheduled to be logged in 1991. A further two blocks are to be logged in 1992 and three blocks are proposed for 1993. There is also a proposal to log along certain tributaries to the Sullivan. These include six blocks in 1993, one block in 1994, one block in 1995 and six blocks in 1996. The blocks along the river are generally at least 50 meters from the banks. However, the proposed blocks along the tributaries are often directly beside the creeks. Few new access roads are required for the blocks along the river. However the new roads required for the proposed blocks along the tributaries are often directly beside the creeks and cross them at least seven times (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines in the area but there are two known mineral occurrences - number 82N-78 ("Kinbasket Lake") and 82N-80 ("Sullivan River") which contain kyanite and nepheline syenite, respectively. There are no plans to mine these (J. Fontain, pers. comm., A. Whale, pers. comm.).

Valenciennes River and Icefall Brook

It is unlikely that current logging plans or the presence of a known mineral occurrence will have a significant impact on enhancement opportunities along the Valenciennes River. Much of the area has been logged and is currently regenerating. The extensive access roads may increase angling pressure in the area.

Approximately twenty one blocks have been logged along the Valenciennes River and Icefall Brook. There are proposals to log one block in 1995 and one block in 1996. Both blocks are approximately 50 meters off the river. The proposed block for 1995 will require 3.5 km of new road some of which will pass directly beside the river at the lower end of Reach 3 (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

While there are no active mines in the area, there are two known mineral occurrences of interest in the mountains between upper Icefall Brook and Lyall Creek (a tributary of the Bush River). Number 82N-75 ("Rogers Pass") contains dolomite and number 82N-88 ("Jack") contains diamond and gemstone. There are no current plans to mine in the area (J. Fontain, pers. comm., A. Whale, pers. comm.).

Windfall Creek

Impacts from logging one block in 1994 and the construction of 3 km of new road could create sedimentation and run off problems along Windfall Creek. With the block directly adjacent to the creek, canopy cover may be affected. These impacts could affect enhancement opportunities. A mineral occurrence has been noted but is not expected to create a significant impact in the near future.

Three large blocks were logged in the 1980's - one at the mouth and two between 3 and 9 km up from the mouth. There are plans to log one smaller block 4 km up from the mouth in 1994. The block is directly beside the creek. This will require approximately 3 km of new roads situated at least 300 meters up from the creek (T. Laycock, pers. comm.)

While there are no active mines in the area, there is a known occurrence of garnet in the upper reach between Windfall and Howard creeks. There are no plans to set up a mine (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

Windy Creek
Current logging activity along Windy Arm is not expected to have a significant impact on enhancement opportunities. Two blocks (one block on the north side and two on the south) are being logged. There are no current plans to log along the creek itself (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines or known significant mineral occurrences along Windy Creek (J. Fontain, pers. comm., A. Whale, pers. comm.).

Wood River
Impacts from logging and the construction of new roads could create sedimentation and run off problems along Wood River unless carefully managed. These impacts may affect enhancement opportunities. In the upper watershed, Alnus and Fortress Creeks lie within Hamber Provincial Park

There has been extensive logging along Wood Arm to date. There are plans to log ten blocks in 1992, two in 1993, two in 1994, six in 1995, and three in 1996. These planned blocks extend approximately 2 km above the full supply line. The twenty year plans include extensive logging for a further 8 km along the river to Pacific Creek and along Pacific Creek right up to the Alberta border. However, these plans are questionable as there is talk of redicating the area as a study zone which would preclude its logging (D. Clapperton, pers. comm., D. Thornley, pers. comm., N. Tihor, pers. comm.).

There are no active mines or known significant mineral occurrences (J. Fontain, pers. comm., A. Whale, pers. comm.).

Yellowjacket Creek
There is some interest in grazing a low number of cattle along the lake shore and near the mouth of Yellowjacket Creek (R. Wiltsie, pers. comm.).This could result in sedimentation, decreased water quality and reduced canopy cover if the cattle are not carefully managed. There may also be some impact resulting from the construction and operation of a small hydro plant proposed near the mouth of this creek (L. Walters, pers. comm., G. Robinson, pers. comm.). These impacts could affect enhancement opportunities.

The creek mouth was logged in the 1970's and there are no current logging plans (T. Laycock, pers. comm.). There are no active mines or known significant mineral occurrences (R. Arksey, pers. comm., J. Fontain, pers. comm., T. Hancock, pers. comm., R. Meyer, pers. comm.).

3.3 FISH DISTRIBUTION

Five sport fish and five coarse fish species were captured in the Kinbasket tributaries surveyed (Table 5). Most of the tributaries had few coarse fish species. Sculpins were the most common and were captured in seven systems. Small numbers of longnose dace, and longnose suckers were captured in Succour Creek and one northern squawfish was captured in Packsaddle Creek.

Table 5
List of fish species captured in Kinbasket Lake tributaries, August-October, 1991.

Common Name	Type	Proper Name
Rainbow trout	sport fish	*Oncorhynchus mykiss*
Bull trout	sport fish	*Salvelinus confluentus*
Kokanee	sport fish	*Oncorhynchus nerka*
Brook trout	sport fish	*Salvelinus fontinalis*
Mountain whitefish	sport fish	*Prosopium williamsoni*
Longnose Dace	minnow	*Rhinichthys cataractae*
Northern squawfish	minnow	*Ptychocheilus oregonensis*
Longnose sucker	sucker	*Catostomus catostomus*
Torrent sculpin	sculpin	*Cottus rhotheus*
Mottled sculpin	sculpin	*Cottus bairdii*

Sport fish were captured in every tributary except Bulldog and Bachelor Creeks (Table 6). Bull trout were the most ubiquitous species and were captured in 21 of the 28 study systems. Mountain whitefish were captured in 13 systems, kokanee in nine, rainbow trout in four, and brook trout in two.

The study systems can be divided into three groups: glacial systems, which have high suspended sediment levels; systems fed by icefields, which have moderate suspended sediment levels; and clear systems derived from snow melt, groundwater and surface runoff. Each of the five sport fish species appeared to have preferences for particular types of habitat. Kokanee were found to utilize the low gradient habitat of all three types of systems for spawning. Rainbow trout were only found in four streams. All of which were clear water systems or systems with small icefields. Only a few rainbow trout were found in the lower sections of steeper gradient streams. Mountain whitefish were found mainly in the low gradient areas of glacial systems and in smaller numbers in the lower reaches of some of the other systems. Bull trout occupied all types of habitat and where often found above barriers. The greatest bull trout densities were found in boulder riffle habitat. Brook trout were found in low gradient habitat of some clear water systems.

Table 6
Sport fish species composition of the Kinbasket Lake tributaries.

System	Mountain whitefish	Kokanee	Bull trout	Brook trout	Rainbow trout
Bachelor Creek	-	-	-	-	-
Beaver River	+	-	+	-	-
Blackman Creek	-	-	+	-	-
Bulldog Creek	-	-	-	-	-
Bush River	+	+	+	-	-
Chatter Creek	+	+	+	-	-
Cummins River	+	+	+	-	-
Dave Henry Creek	+	-	+	-	-
Dawson Creek	-	-	+	-	-
Foster Creek	+	-	-	-	-
Grouse Creek	-	-	+	-	-
Harvey Creek	-	+	+	-	+
Horse Creek	-	-	+	-	+
Howard Creek	-	-	+	-	-
Hugh Allen Creek	+	-	+	-	-
Kinbasket River	-	+	-	-	-
Molson Creek	-	-	+	-	-
Packsaddle Creek	-	-	+	-	+
Prattle Creek	+	-	+	-	-
Ptarmigan Creek	-	-	+	-	-
Succour Creek	+	+	-	+	+
Sullivan River	+	+	+	+	-
Valenciennes River	+	+	-	-	-
Windfall Creek	-	-	+	-	-
Windy Creek	-	-	+	-	-
Wood River	+	+	+	+	-
Yellowjacket Creek	+	-	+	-	-

3.3.1 Kokanee

A total of 42,000 kokanee were estimated to be spawning or holding in nine of the Kinbasket tributaries during the first two weeks of October (Table 7). Each system was only enumerated once by helicopter. No kokanee were observed in any of the systems during the first two weeks in September, although some kokanee were observed jumping at the head of Sullivan Bay on September 2.

Table 7
Kokanee counts and dates of observations in nine Kinbasket Lake Tributaries.

System	Date	Number estimated
Bush River	October 7	10,000
Chatter Creek	October 7	500
Cummins River	October 11	500
Harvey Creek	October 11	750
Kinbasket River	October 7	2,000
Succour Creek	October 7	10,000
Sullivan River	October 7	7,500
Valenciennes River	October 7	750
Wood River	October 11	10,000
Total		42,000

Bush River

About 8,500 kokanee were observed in Reach 1 of the Bush River and 1,500 were observed in Reach 2. Reach 1 has an unstable, wide, braided channel (Plate 4). The majority of spawners were observed in the side channels, back channels and tributaries to this reach. Approximately 3,000 kokanee were observed spawning in a small tributary draining a large swamp on the south side of the river. Kokanee were scattered in schools of 50 to 200 along the mainstem and side channels of Reach 2. Spawning had not reached a peak when this system was surveyed on October 7, 1991 as none of the 20 fish sampled had started to spawn. Twenty-five percent of the samples were in a transitional state of maturity and 75% were mature (Table 8). Few carcasses were observed and all of the fish were in good condition.

Table 8
Kokanee maturity in eight Kinbasket Lake tributaries, October 6-11, 1991.

		Maturity				
System	Sex	Bright	Transitional	Mature	Part spent	Spent
Bush R.	Male	0	2	5	9	0
	Female	0	2	3	3	1
Chatter C.	Male	0	0	5	3	0
	Female	0	0	1	3	3
Cummins R.	Male	0	0	10	0	0
	Female	0	1	10	0	0
Harvey C.	Male	0	0	10	0	0
	Female	0	0	5	1	0
Kinbasket R.	Male	0	0	11	0	0
	Female	0	2	7	0	0
Succour C.	Male	0	0	0	8	18
	Female	0	0	0	6	18
Sullivan R.	Male	0	0	9	4	4
	Female	0	0	0	1	2
Wood R.	Male	0	0	10	0	0
	Female	0	5	5	0	0

Chatter Creek
Five hundred kokanee were scattered throughout the lower 2 km of Chatter Creek. The habitat in this area is mainly boulder riffle habitat with little gravel for spawning. Spawning was probably close to its peak when a sample was collected on October 7, 1991. Of the 15 fish collected, 40% were mature, 40% were partially spent, and 20% were spent (Table 8).

Cummins River
Approximately 500 kokanee were observed in the 100 m of habitat between the lake and the 4 m high falls on the Cummins River. Most of the habitat in this 100 m section is riffle and rapids. There appeared to be little spawning habitat. All of the 20 kokanee sampled were mature except one which was transitional (Table 8). Most of the kokanee had not started to spawn on October 11, 1991 in this system.

Harvey Creek
Seven hundred fifty kokanee were spotted in the lower 500 m of Harvey Creek. The fish were prevented from going farther upstream by a logjam. This system has poor spawning habitat. Most of the creek is rapids and riffle with little gravel substrate. Spawning had just started in this creek on October 11, 1991. All of the 16 samples collected were mature except for one partially spawned female (Table 8).

Kinbasket River
Approximately 2,000 kokanee were observed holding in large schools in the lower 400 m of Reach 1 of the Kinbasket River. The fish were prevented from going further upstream by a set of cascades. This section of the river is primarily rapids and has little spawning habitat. It is therefore surprising that so many kokanee were found in this system. None of the 20 kokanee collected showed any sign of spawning. Ninety percent of the fish were mature and the rest were in a transitional state of maturity (Table 8).

Succour Creek
Heavy concentrations of kokanee were observed spawning throughout Reach 1 of Succour Creek although the steep gradient of Reach 2 prevented them from spawning further upstream. Kokanee were also observed in a small tributary on the north-east side of Succour Arm. The numerous carcasses, the poor condition of the spawners, and the lack of unspawned fish indicated that spawning had peaked before October 6, 1991 when the kokanee were sampled. Of the thirty live fish sampled, 53% were spent and 47% were partially spent (Table 8). Spawning in Succour Creek was the most advanced of the nine stocks sampled.

Valenciennes River

Approximately 500 - 1,000 kokanee were observed in the first 200 m of the Valenciennes River. The substrate in this reach is mainly cobble and boulder and would not likely be ideal spawning habitat. The state of spawning appeared to be much the same as the Bush River fish.

Sullivan River

An estimated 5,000 - 10,000 kokanee were spawning throughout Reach 2 of the Sullivan River. Only 2,000 to 3,000 kokanee were actually observed in the system, but due to the high water turbidity on October 7, 1991 the actual number estimated to be in the system was much higher. Many of the kokanee were observed in the side channels, back channels and small tributaries of this braided reach (Plate 16). A thousand kokanee were observed in a small tributary at site 15 near the top of the reach (Figure 24). Spawning appeared to be close to peaking on October 7, 1991. Of the 23 samples collected, 45% were mature, 25% were partially spent and 30% were spent (Table 8).

Wood River

Most of the 10,000 kokanee in the Wood River were in the upper half of Reach 1 which is a wide, unstable and braided channel like the main spawning areas of the Bush and Sullivan Rivers. Approximately 4,000 fish were spawning in a 3 km long side channel of Jeffery Creek which flowed across the Wood River flood plain. The rest of the kokanee were mainly spawning in the back channels, side channels and tributaries to the mainstem. A sample of 20 kokanee were collected from the lower part of Reach 1. All of them were mature except for five transitional fish (Table 8). Despite the unspawned condition of these fish, the peak of spawning must have been close to October 11, 1991 as the fish in the upper part of the reach appeared to be spawning. Few carcasses were evident.

3.3.2 Rainbow trout

Juvenile rainbow trout were captured in four of the 28 tributaries. No adults were found. The largest numbers of rainbow were encountered in Succour Creek. This creek is unlike most of the other systems in that it is a small non-glacial, lake fed system. The environment is probably more favorable for rainbow as the system is stable with low turbidity levels and relatively warm water temperatures. Catches of 250 fish·1000 m^{-2} (Table 9) were made in Reach 2 of Succour Creek where slopes averaged 3.2%. Catches were lower in Reaches 1 and 3 where slopes decreased to 1% and 0.5% respectively (Plate 15).

Table 9
Sport fish catches (fish·1000 m^{-2}) from sites in
Kinbasket Lake tributaries, August-October 1991.

System	Reach number	Sample area (m^2)	Mountain whitefish	Bull trout	Brook trout	Rainbow trout
Bachelor Creek	1	168	0	0	0	0
	2	1350	0	0	0	0
Beaver River	4	639	25	5	0	0
Blackman Creek	1	136	0	22	0	0
	2	224	0	27	0	0
Bulldog Creek	3	496	0	0	0	0
Bush River	1	709	20	0	0	0
	2	322	31	3	0	0
	5	1039	42	0	0	0
	6	24	0	0	0	0
Chatter Creek	1	600	13	2	0	0
	2	315	0	10	0	0
Cummins River	1	96	0	0	0	0
	2	308	153	3	0	0
Dave Henry Creek	1	631	3	0	0	0
	2	1245	0	10	0	0
Dawson Creek	1	48	0	104	0	0
Encampment Creek	1	150	0	47	0	0
Foster Creek	1	100	50	0	0	0
Grouse Creek	1	248	0	16	0	0
Harvey Creek	1	195	0	56	0	5
	2	200	0	0	0	0
Horse Creek	1	395	0	15	0	18
	2	228	0	0	0	0
Howard Creek	1	54	0	74	0	0
	2	315	0	0	0	0
Hugh Allen Creek	1	234	0	30	0	0
	2	377	438	5	0	0
	4	75	0	0	0	0
Kinbasket River	2	130	0	0	0	0
	3	208	0	0	0	0
Molson Creek	1	30	0	0	0	0
	2	95	0	32	0	0
Packsaddle Creek	1	681	0	4	0	13
Ptarmigan Creek	1	100	0	30	0	0
	2	328	0	18	0	0
	3	200	0	0	0	0
Prattle Creek	1	96	21	21	0	0
	2	280	0	0	0	0
Succour Creek	1	95	11	0	0	147
	2	100	0	0	10	250
	3	423	0	0	0	43
Sullivan River	2	1625	21	4	0	0
	3	96	21	21	0	0
	4	612	18	8	0	0
Valenciennes River	1	500	16	0	0	0
	3	88	0	0	0	0
	Ice Brook	166	0	0	0	0

Table 9 (continued)
Sport fish catches (fish·1000 m^{-2}) from sites in
Kinbasket Lake tributaries, August-October 1991.

System	Reach number	Sample area (m^2)	Mountain whitefish	Bull trout	Brook trout	Rainbow trout
Windfall Creek	1	390	0	15	0	0
	2	244	0	0	0	0
Windy Creek	1	212	0	0	0	0
	2	224	0	0	0	0
Wood River	1	1385	6	1	0	0
	3	324	19	0	0	0
	Alnus Creek.	158	0	0	13	0
	Fortress Creek.	250	0	0	92	0
Yellowjacket Creek	1	778	4	5	0	0
	2	272	0	15	0	0

Rainbow trout catches of only 5, 18 and 13 fish·1000 m^{-2} were made in Harvey, Horse and Packsaddle Creeks, respectively. These creeks are high gradient systems where water temperatures are likely to be much cooler and flows less stable than Succour Creek.

3.3.3 Bull trout

Bull trout were captured in 21 of the 28 systems sampled (Table 6). Catches were greatest in boulder riffle habitat and least in low velocity habitat with finer substrates. At sites where bull trout were captured, catches averaged 6 fish·1000 m^{-2} in glacial systems, 29 fish·1000 m^{-2} in systems with icefields, and 22 fish·1000 m^{-2} in clear water systems. Bull trout were found above barriers or above sections of steep gradient in the Beaver River, Bush River, Cummins River, Chatter Creek, Encampment Creek, Molson Creek, Hugh Allen Creek, Blackman Creek, Yellowjacket Creek, and Dave Henry Creek. Bull trout were the only species captured in many areas.

Eight adult bull trout over 300 mm long were captured. These fish were generally captured in the lower reaches of the larger systems such as Reach 2 of the Bush and Sullivan Rivers and Reach 1 of the Wood River. A 577 mm spawning male bull trout was captured in the lower reaches of Grouse Creek on October 19, 1991.

3.3.4 Mountain whitefish

Mountain whitefish was the second most prevalent species and was captured in 11 of the 28 study systems. This species was most common in areas with high turbidity and low current velocities. Few mountain whitefish were captured in areas with steep gradients. The largest catches were made in Reach 2 of Hugh Allen Creek (438 fish·1000 m^{-2}) and Reach 2 of Cummins River

(153 fish·1000 m^{-2}). Both these reaches had a large proportion of slow flowing glide habitat.

3.3.5 Brook Trout

Brook trout juveniles were captured in Succour Creek and in tributaries to the Wood River. Only one juvenile was captured in Reach 2 of Succour Creek while fairly substantial catches (92 fish·1000 m^{-2}) were made in Fortress Creek which flows from Fortress Lake at the head of the Wood River (Plate 21). Smaller catches (13 fish·1000 m^{-2}) were made in Alnus Creek which is a glacial tributary to Fortress Creek. Brook trout typically prefer cool non-glacial systems with lower gradient habitat (Carl et al. 1977). Only small numbers were captured in Succour Creek probably due to the presence of rainbow trout. Populations of brook trout have declined in some parts of the United States due to competition with rainbow trout (Elsen D.S. et al. 1986). No other species were captured in Fortress Creek which may account for the relatively high densities of brook trout in this system.

3.4 MORPHOLOGICAL CHARACTERISTICS

3.4.1 Kokanee

3.4.1.1 Sex ratio

Only 64 of 209 kokanee (31%) sampled from seven tributaries were females. Catches of kokanee in all the tributaries contained high numbers of females (Table 10).

Table 10.
Sex composition in kokanee samples
from Kinbasket Lake tributaries, October, 1991.

System	Males	Females	Total sample	Percent females
Bush River	16	9	25	36
Chatter Creek	8	7	15	47
Harvey Creek	12	7	19	37
Kinbasket River	32	12	44	27
Sullivan River	17	6	23	26
Wood River	50	20	70	28
Total	145	64	209	(average) 31

3.4.1.2 Size and age composition.

A total of 189 kokanee were sampled from eight Kinbasket Lake tributaries between October 6 and 11, 1991. These fish ranged in POH length from 198 to 251 mm and ranged in weight from 157 g to 355 g. Mean POH length was 228 mm (n = 189, s = 9 mm, Table 11). All of the samples were three years old. The single age class is illustrated by a unimodal length-frequency distribution, although the female length-frequency distribution was slightly bimodal (Figure 29).

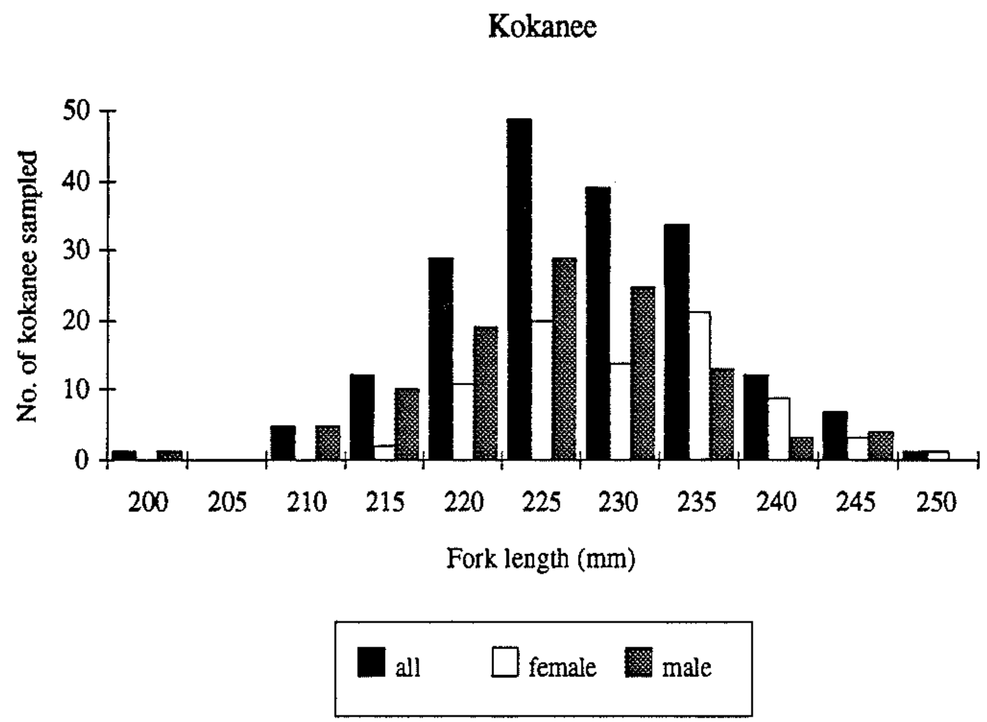
Table 11
Size of kokanee in eight Kinbasket Lake tributaries, October, 1991.

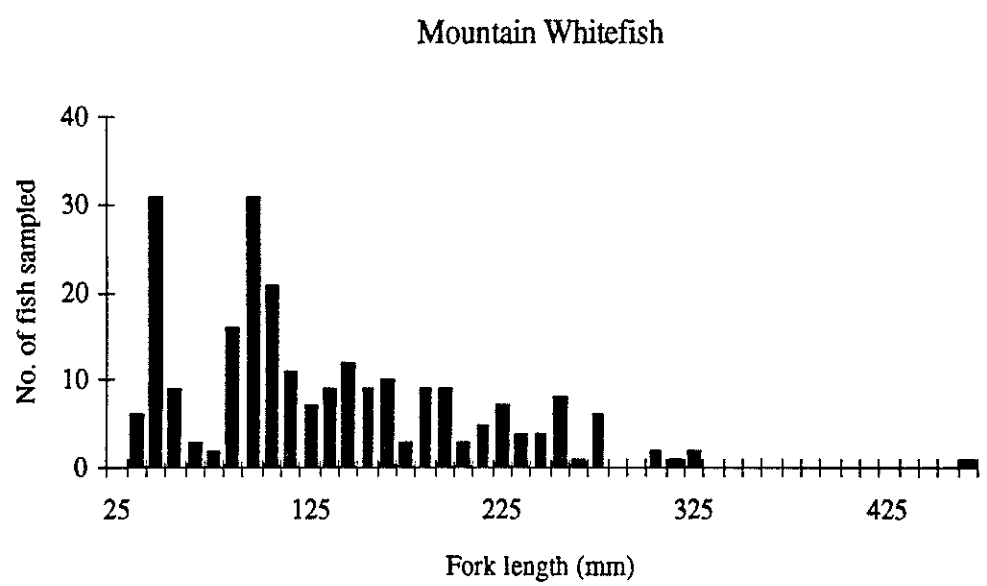
System	Sex	POH Length (cm)			Weight (kg)		
		Mean	n	Stdev	Mean	n	Stdev
All	All	228	189	9	251	182	40
	Female	230	81	8	231	81	35
	Male	226	108	9	268	101	36
Bush River	All	226	25	9	265	25	34
	Female	230	9	10	244	9	33
	Male	224	16	8	277	16	28
Chatter Creek	All	227	15	9	235	15	36
	Female	227	7	6	208	7	16
	Male	228	8	11	259	8	31
Cummins River	All	231	20	8	245	20	33
	Female	230	10	5	233	10	24
	Male	231	10	10	256	10	38
Harvey Creek	All	225	16	7	271	16	35
	Female	227	6	6	247	6	33
	Male	223	10	7	285	10	29
Kinbasket River	All	232	20	8	264	20	31
	Females	237	9	6	255	9	32
	Males	228	11	7	271	29	11
Succour Creek	All	225	50	9	232	50	46
	Female	229	24	8	201	24	26
	Male	223	26	9	260	26	42
Sullivan River	All	228	23	9	241	16	32
	Female	228	23	9	241	16	32
	Males	226	17	10	245	10	37
Wood River	All	230	20	8	280	20	23
	Female	232	10	6	269	10	19
	Males	228	10	5	292	10	22

There was very little difference between the mean POH lengths of kokanee sampled from the different tributaries. Means ranged from 225 mm to 231 mm. The similarity in size may indicate that there is little genetic difference between the different stocks.

The mean POH length of females was slightly larger than males in the samples from every system except the Cummins River where the males were 1 mm longer. Overall, the females averaged 4 mm longer than the males (Males = 226 mm, n =

Figure 29.
Length-frequency distribution of kokanee and mountain whitefish sampled from Kinbasket Lake tributaries, August - September, 1991





108, s = 9 mm; females = 230 mm, n = 81 mm, s = 8; Table 11) although the difference was not significant (t test $P \leq 0.001$).

Fork lengths were measured on 147 of the samples. Some of the samples could not be measured for fork length due to tail erosion from spawning. The overall fork length was 280 mm (n = 148, s = 10 mm). The Kinbasket Lake kokanee were smaller than those collected in 1990 from the Finlay River which is a tributary to the Williston Lake reservoir. (Fielden, 1991). The Finlay River fish were 98% age 3 and 2% age 2 and had a mean fork length of 302 mm (n = 101, s = 13 mm) 22 mm longer than the Kinbasket fish.

Fork length and post-orbital hypural lengths are related by the equation:

$$\text{Fork length} = b(\text{POH length}) + a$$

Regression parameters are summarized in Table 12. A significant correlation exists between fork length and length for both sexes at $P \leq 0.001$.

Table 12.
Linear regression parameters for fork and POH length for kokanee by sex.

Sex	n	a	b	r
All	147	71.67	0.91	0.84
Males	87	68.05	0.93	0.82
Females	60	57.62	0.81	0.90

3.4.1.3 Fecundity, egg size and gonadosomatic indices

Nine female kokanee, ranging in length (POH) from 221 mm to 244 mm were sampled for fecundity. These fish had an mean POH length of 234 mm (s = 7 mm) and a mean fecundity of 588 eggs (s = 124 eggs). Fecundities ranged from 445 eggs to 807 eggs. POH length and fecundity were related ($P \leq 0.05$) by the equation:

$$\text{Log10(fecundity)} = 4.25(\text{Log10(POH length)}) - 7.31$$

$$r_s = 0.65 \; (r_{0.05(2),7} = 0.786)$$

Using the POH length-fecundity equation, the average fecundity for the population with a mean female POH length of 230 mm is 534 eggs. The total egg deposition in the nine tributaries with kokanee with an escapement of 42,000 of which 31% were females would be 6.95 million eggs.

Water hardened egg diameters were measured from 66 females. The egg diameters averaged 4.8 mm (s = 0.3 mm). Eggs were smaller and fecundities were higher than for kokanee sampled from the Finlay River in 1991 (Egg diameter = 5.4 mm, n = 2, s = 0; fecundity = 496, n = 25, s = 111; Fielden 1991)

The average gonad weight of transitional females (females with 100% of their eggs) was 40.9 g (n = 5, s = 4.2 g). For males, average gonad weight was 5.7 g (n = 101, s = 4.2 g). The gonadosomatic index for transitional females was 15.1 (n = 5, s = 0.6) and 2.05 (n = 101, s = 1.4) for males. The overall gonadosomatic index for male kokanee was 2.05 (n = 101, s = 1.42) (Table 13). The index varied with maturity and between systems. Transitional males had a low GSI due to immature gonads. Mature males had the highest index and spent fish the lowest. The GSI indicates the state of spawning in the various systems. Succour Creek male kokanee had the lowest GSI as the fish in this system had started spawning earlier than kokanee in other systems. Systems in which spawning started later had high GSI's.

Table 13
Gonadosomatic Index for male kokanee
from eight Kinbasket Lake tributaries, October 1991.

System	Maturity	mean	Number	Stdev
All	All	2.05	101	1.42
All	Transitional	0.84	2	0.20
All	Mature	2.91	54	1.36
All	Part spent	1.50	23	0.56
All	Spent	0.62	22	1.11
Bush River	All	2.25	16	1.36
Chatter Creek	All	1.57	8	0.43
Cummins River	All	1.98	10	0.52
Harvey Creek	All	3.08	10	1.32
Kinbasket River	All	1.95	11	0.73
Succour Creek	All	0.91	26	0.59
Sullivan River	All	1.54	10	1.23
Wood River	All	4.73	10	0.74

3.4.2 Rainbow trout

The 88 rainbow trout sampled from four systems ranged in size from 40 mm to 186 mm, and in age from 0 to 3 years (Table 14). Fifty-six percent of the samples analyzed were 1 year old. The length-frequency distribution of rainbow trout from all four tributaries reflects the three different age classes of fish (Figure 30). The major mode at 56 - 60 mm represents the peak of the 0 age class, the mode at 96 - 110 represents the peak of the 1 year age class and the bar at 186 - 190 mm represents the 3 year age class.

Table 14
Summary of length data collected from rainbow trout
from various Kinbasket Lake tributaries, August-October, 1991.

System	Age	Length (mm)	n	Stdev.	max (mm)	min (mm)
All	All	88	83	32	186	40
Harvey Creek	All	117	1	-	117	117
Horse Creek	All	128	7	36	186	88
Packsaddle Creek	All	115	9	16	146	91
Succour Creek	All	80	66	29	155	40
All	0	56	22	11	88	42
Horse Creek	0	88	1	-	88	88
Succour Creek	0	55	21	9	74	42
All	1	104	35	17	139	72
Horse Creek	1	108	3	13	123	98
Packsaddle Creek	1	111	8	12	126	91
Succour Creek	1	102	23	19	139	72
All	2	148	5	8	157	140
Horse Creek	2	150	2	10	157	143
Packsaddle Creek	2	146	1	-	146	146
Succour Creek	2	148	2	11	155	140
All	3	186	1	-	186	186
Horse Creek	3	186	1	-	186	186

3.4.3 Bull Trout

A total of 128 bull trout were sampled from 21 systems (Table 15). These fish ranged in size from 35 mm to 760 mm and had a mean fork length of 146 mm (s = 124 mm). The length-frequency distribution (Figure 30) has three modes possibly indicating different age classes. Modes occur at 41-60, 101-120, and 181-200 mm possibly representing 0, 1, and 2 year old age classes, respectively. Aging information was not available from the bull trout as this would have entailed destructive sampling.

Table 15
Summary of size data collected from bull trout
from various Kinbasket Lake tributaries, August-October, 1991.

System	Length (mm)	n	Stdev.	Max (mm)	min (mm)
All	146	128	124	760	35
Beaver River	239	3	55	302	201
Blackman Creek	191	9	57	261	102
Bush River	547	1	-	547	547
Chatter Creek	76	4	31	121	50
Dave Henry Creek	129	12	60	196	43
Dawson Creek	112	5	38	148	53
Encampment Creek	101	7	60	213	36

Table 15 (continued)
Summary of size data collected from bull trout
from various Kinbasket Lake tributaries, August-October, 1991.

System	Length (mm)	n	Stdev.	Max (mm)	Min (mm)
Grouse Creek	181	4	264	577	43
Harvey Creek	79	8	34	116	36
Horse Creek	108	6	37	144	45
Howard Creek	122	3	60	191	77
Hugh Allen Creek	79	8	35	135	45
Molson Creek	143	8	38	203	98
Packsaddle Creek	59	4	30	102	36
Prattle Creek	107	2	10	114	100
Ptarmigan Creek	132	9	22	167	106
Sullivan River	235	20	222	760	35
Windfall Creek	114	6	39	152	42
Wood River	430	1	-	430	430
Yellowjacket Creek	122	8	58	220	40

3.4.4 Mountain Whitefish

A total of 241 mountain whitefish were sampled from 12 systems. These fish had a mean fork length of 133 mm (s = 73 mm) and ranged in age from 0 to 7 years (Table 16) although most were 1 year old. The modes of the length-frequency distribution of mountain whitefish sampled (Figure 29) generally reflect the different age classes.

Table 16.
Size of mountain whitefish in Kinbasket Lake tributaries, August-October,1991.

System	Age	Length	n	Stdev.	Max	min
All	All	133	241	73	470	34
Beaver River	All	114	13	54	229	50
Bush River	All	137	61	56	272	54
Chatter Creek	All	173	5	32	230	153
Cummins River	All	83	47	45	216	37
D. Henry Creek	All	106	2	5	109	102
Foster Creek	All	155	10	51	248	101
H. Allen Creek	All	102	42	48	197	45
Prattle Creek	All	86	1	-	86	86
Succour Creek	All	75	1	-	75	75
Sullivan River	All	197	36	98	470	34
Valenciennes River	All	150	8	81	271	47
Wood River	All	198	13	63	275	77

Table 16 (continued)
Size of mountain whitefish in Kinbasket Lake tributaries, August-October,1991.

System	Age	Length	n	Stdev.	Max	Min
All	0	50	19	9	68	37
Beaver River	0	58	4	8	65	50
Bush River	0	54	3	1	55	54
Cummins River	0	42	9	4	48	37
H. Allen Creek	0	56	3	11	68	86
Sullivan Creek	0	41	4	5	46	34
All	1	100	64	12	138	81
Beaver River	1	93	3	8	98	84
Bush River	1	101	20	7	115	88
Cummins River	1	94	16	10	113	81
Foster Creek	1	121	6	12	138	101
H. Allen Creek	1	92	11	4	98	86
Prattle Creek	1	86	1	-	86	86
Sullivan River	1	107	6	8	117	97
Wood River	1	133	1	-	133	133
All	2	142	37	15	168	102
Beaver River	2	137	4	13	150	121
Bush River	2	144	10	5	153	134
Chatter Creek	2	157	3	4	161	153
Cummins River	2	130	6	11	143	114
D. Henry Creek	2	106	2	5	109	102
Foster Creek	2	161	1	-	161	161
H. Allen Creek	2	139	6	12	161	128
Sullivan Creek	2	167	2	1	168	166
Wood River	2	154	3	2	155	152
All	3	184	29	20	231	133
Beaver River	3	188	1	-	188	188
Bush River	3	186	7	9	198	173
Cummins River	3	195	2	8	201	189
Foster Creek	3	191	1	-	191	191
H. Allen Creek	3	163	9	14	182	133
Sullivan River	3	196	4	3	201	193
Wood River	3	200	3	27	231	182
All	4	241	22	21	275	197
Beaver River	4	229	1	-	229	229
Bush River	4	238	7	20	260	212
Chatter Creek	4	230	3	-	230	230
Cummins River	4	216	1	-	216	216
Foster Creek	4	238	2	14	248	228
H. Allen Creek	4	197	1	-	197	197
Sullivan River	4	244	5	12	255	225
Wood River	4	268	4	9	275	254
All	5	299	6	20	322	272
Bush River	5	272	1	-	272	272
Sullivan River	5	304	5	17	322	278
Sullivan River	8	470	1	-	470	470

3.4.5 Brook Trout

Brook trout were sampled from Succour Creek and from Alnus and Fortress Creeks at the head of the Wood River system. Brook trout sampled from the Wood River system had a mean fork length of 74 mm (n = 25, s = 19). The sole sample collected from Succour Creek was 112 mm long. The predominate size class was from 71 - 75 mm (Figure 31).

3.5 ENHANCEMENT OPPORTUNITIES.

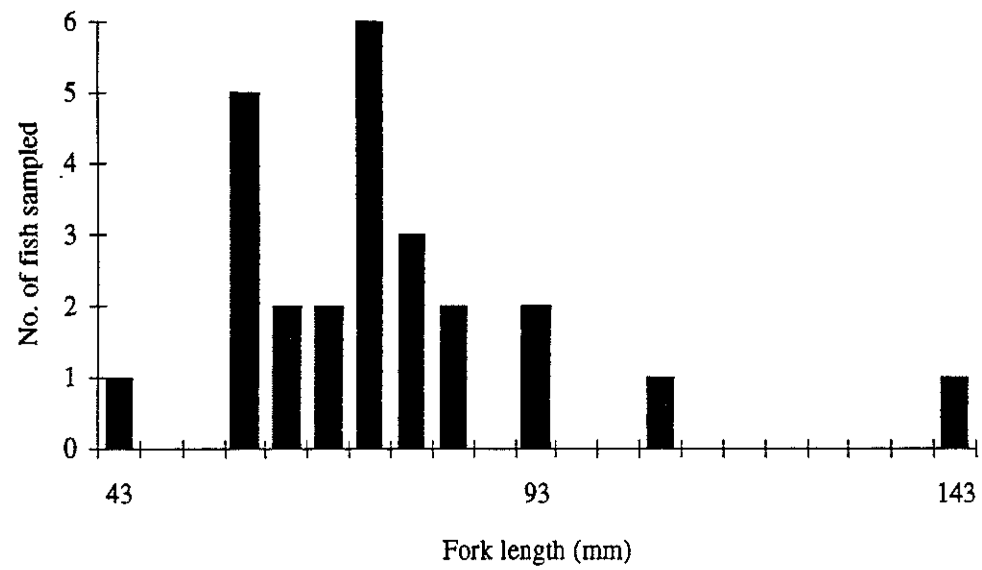
Opportunities for the enhancement of sport fish within many of the Kinbasket Lake tributaries are limited due to steep gradients and poor water quality. Table 17 lists all of the systems, their general characteristics, species suitabilities and enhancement potentials. Half of the systems have some enhancement potential with the best opportunities lying in Succour Arm and Packsaddle Creek. The remainder of the systems are generally steep with little fish habitat, although there may be potential for channel rehabilitation below the present reservoir full supply level.

Table 17
Kinbasket Lake tributaries and the potential for enhancement

System	Type of system[a]	Species suited to system[b]	Enhancement opportunities[c]
Bachelor Creek	lg&hg icefields	DV EB RB	outplant
Beaver Creek	lg glacial	KO MW DV	barrier removal, outplant
Blackman Creek	hg icefields	DV	limited
Bulldog Creek	hg icefields	DV	limited, FSL
Bush River	lg&hg glacial	MW DV KO	spawning chan.
Chatter Creek	hg icefields	DV	outplant, FSL
Cummins River	hg&lg glacial	DV MW	barrier removal, outplant
Dave Henry Creek	hg non-glacial	DV	FSL, rearing chan.
Dawson Creek	hg icefields	DV	limited, FSL
Encampment Creek	hg non-glacial	DV	limited, FSL
Foster Creek	hg glacial	DV	limited
Grouse Creek	hg non-glacial	DV	limited, FSL
Harvey Creek	hg icefields	DV	outplant, FSL
Horse Creek	hg icefields	DV	limited, FSL
Howard Creek	hg icefields	DV	limited, FSL
Hugh Allen Creek	hg&lg icefields	MW DV	outplant
Kinbasket River	hg&lg glacial	MW DV	outplant
Molson Creek	hg&lg non-glacial	DV	limited, FSL
Packsaddle Creek	hg non-glacial	DV	culvert, rearing chan, outplant
Prattle Creek	hg icefields	DV	limited, FSL
Ptarmigan Creek	hg&lg icefields	MW DV	outplant
Succour Creek	lg non-glacial	RB,EB,KO	instream, sub/basin, FSL
Sullivan River	lg&hg glacial	KO MW DV	spawning chan.
Valenciennes River	lg&hg glacial	MW DV	limited
Windfall Creek	hg icefields	DV	limited, FSL
Windy Creek	hg glacial	DV	limited
Wood River	hg&lg glacial	KO DV MW EB	spawning chan.
Yellowjacket Creek	hg icefields	DV	limited, FSL

[a]hg = high gradient lg = low gradient.
[b]RB = rainbow trout DV = bull trout EB = brook trout.
[c]FSL = rehabilitation of spring spawning habitats below the reservoir full service level.

Figure 31.
Length-frequency distribution of brook trout sampled from Kinbasket Lake tributaries September - October, 1991.



Each of the five sport fish species have preferences for particular types of habitat. Kokanee were found in low gradient habitat of clear water, glacial and systems fed by icefields. Rainbow trout were only found in clear water systems or systems with small icefields. Only small numbers were found in the lower sections of steeper gradient streams. Mountain whitefish were found mainly in the glacial systems and in smaller numbers in the lower reaches of some of the other systems. Bull trout occupied all types of habitat and where often found above barriers. The greatest densities were found in boulder riffle habitat. Brook trout were found in low gradient habitat of some clear water systems.

3.5.1 Kokanee

Significant numbers of kokanee were found spawning in the Succour, Bush, Sullivan, and Wood systems and additional kokanee were found in the Chatter, Cummins, Kinbasket, Harvey and Valenciennes systems. Total escapement in all of these systems was roughly estimated to be 42,000 kokanee. Given this existing population, and the suggestion that the Kinbasket Lake kokanee population may already exceed optimal density (J. Hammond MOEPL, pers. comm.), there may not be a need for additional spawning habitats. The following paragraphs are therefore presented to outline system potential rather than as recommended enhancement steps.

The Bush, Sullivan and Wood Rivers offer the best opportunities for enhancement of this species through the development of groundwater-fed side channels. The Salmonid Enhancement Program of Fisheries and Oceans Canada has constructed a number of small groundwater-fed spawning channels for coho, chum and sockeye. These channels are constructed from side channels that are graded below the water table. As a result, groundwater, which is relatively warm in the winter and cool in the summer, percolates through the gravel. Dykes are usually constructed to prevent the channels from becoming destroyed during freshets. Improved groundwater-fed channels in British Columbia are typically 300 - 1,000 m long, 5 - 6 m wide, 20 - 40 cm deep and have discharges ranging from 0.085 to 0.14 $m^3 \cdot s^{-1}$ (Sheng et al. 1990). The timing of fish that spawn in groundwater channels is often later than stocks that spawn in the main river because of warmer sub-gravel temperatures. Assessments indicated that these spawning channels were highly productive compared to natural streams (Lister et al. 1980; King and Young 1986 and 1986b; Bonnell 1990; Sheng et al. 1990).

Kokanee were found spawning in Reach 1 of the Bush and Wood Rivers and Reach 2 of the Sullivan River. These three reaches had wide, unstable, braided channels, with low gradients and primarily gravel substrates. All three reaches are near roads suitable for access by heavy equipment. The highest concentration of kokanee spawners was found in smaller side channels, groundwater-fed side channels and in small clear water tributaries were they flowed across the flood plain. Kokanee were observed in the mainstem of these glacial systems, but densities appeared lower. The distribution of spawners may indicate that they preferred warmer flows and/or cleaner gravel. The construction of groundwater-fed side channels would provide high quality spawning habitat that would be stable, have gravel low in fines, and would provide warm groundwater for incubation. These factors have led to high egg to fry survivals in other channels (Bachen 1984).

The side channels are often armored with rip rap for stability. This has the added advantage of providing cover for rainbow and bull trout juveniles.

There is only one prospect for developing a new kokanee run as most of the systems that do not already have kokanee have steep gradients in the lower reaches and therefore little habitat suitable for spawning. The one possible exception is the Beaver River. This system has extensive amounts of lower gradient habitat in Reach 3, 6.6 km above a 100 - 200 m long section of rapids and cascades, that prevent kokanee from migrating up the river. Providing access to Reach 3 would likely be expensive due to the length of the section that would have to be improved for fish passage. In addition, most of the Beaver River lies within Glacier National Park thus any enhancement project on this system could also impact on the park. Spawning in other glacial systems such as the Bush, Sullivan and Wood Rivers occurred primarily in the back channels and smaller groundwater tributaries of these systems. Reach 3 of the Beaver River is mainly a single meandering channel although there are a few side channels and tributaries that may provide kokanee spawning habitat. This reach should be assessed in more detail to determine the amount of potential kokanee spawning habitat if enhancement is proposed for the area.

3.5.2 Rainbow Trout

The best opportunities for rainbow trout enhancement appear to lie at the outlet of Succour Creek and in Packsaddle Creek. Rainbow trout were found throughout the Succour Creek system but the prospects for very large population increments within this system may be limited as it is already well utilized. However, Succour Arm could provide opportunities for sub basin catchment development and increased rearing habitat. At the north end of the lake, Packsaddle Saddle Creek has acceptable water quality and could produce additional rainbow trout if the culvert/fish passage problems can be elevated and low velocity rearing habitat provided. The other clear water systems (Encampment, Dawson, Grouse, Molson, and Dave Henry) all have steep gradients and therefore limited rainbow trout habitat although it may be possible to rehabilitate spring spawning habitat below the reservoir's full supply line. The upper reaches of Bachelor, Chatter, Hugh Allen, Harvey, and Ptarmigan Creeks have some lower gradient habitat where turbidity appeared to be low and that could be suitable trout habitat, however all of these areas are above barriers or sections with steep gradients. If resident populations of rainbow were established in these areas, some out migration may contribute to the stocks in Kinbasket Lake, but all of these areas are high in elevation and likely have cool water temperatures that would possibly be sub-optimal for trout.

Rainbow trout were found throughout the Succour Creek system. This creek has high quality trout habitat as it is a relatively warm, stable, non-glacial system with an abundance of cover (Plate 15). However, the prospects for large rainbow trout population increments within in this system may be limited as it is already highly utilized. More detailed assessments will be needed to determine system carrying capacity and the potential for habitat optimization.

The lower reaches of Succour Creek appear to offer greater potential. First, it may be possible to rehabilitate spring spawning habitats in the stream segment below the reservoir full supply line. John Addison (pers. comm.) reported seeing concentrations of adult rainbow below the FSL in Succour Creek during the spring. Although this has not been substantiated, these fish may have been utilizing low gradient habitat below the FSL for spawning. If rainbow do spawn below the FSL in Succour Creek, a similar situation may occur in some of the other clear water systems that have low gradient habitat below the FSL. The amount and quality of this type of habitat should be investigated in April and May when reservoir levels expose these watercourses.

Second, it may be possible to take advantage of a natural sill and dyke the mouth of Succour Arm (Plate 23). This would provide a large area of stable rearing habitat fed by Succour Creek as well as two smaller, clear water creeks which enter the arm near its mid point. Important features of this sub-basin catchment would include:

- about 75 ha of clear water habitat would be created.
- the stabilized area would have a very productive littoral zone, well suited to rearing juvenile rainbow trout.
- spring water levels could be manipulated slightly to reduce incubation success in squawfish and pea mouth (Jeppson 1957).

Plate 23.
Rainbow trout juveniles in Packsaddle Creek were restricted to the area below the culvert (right).

Stabilizing water levels in Succour Arm (below) could increase rainbow trout production as well as benefitting wildlife and waterfowl.

- wetlands at the south end of the arm are also likely to attract wildlife and water fowl.

This technique has proven successful in several applications in eastern Canada (J. Meher pers. comm., Hill 1984) The feasibility of sub-basin catchment development in Succour Arm will depend to a large extent on the nature of the natural sill at the outlet and the cost of building a dyke. This should be investigated in April or May while water levels are down and the sill is exposed.

Packsaddle Saddle Creek, at the north end of the lake, has acceptable water quality and could produce additional rainbow trout if the culvert/fish passage problems can be alleviated and low velocity rearing habitat provided. Rainbow trout were found rearing in the portion of Reach 1 below the road culvert but it appears to be a barrier to fish passage as no trout were found in samples taken above the road (Plate 23). There is almost as much habitat above the road, so the feasibility of improving this culvert should be investigated. However, densities below the culvert were low as the reach has a mean slope of 4.5% which is higher than optimal (Plate 12). Most of the reach lies on an alluvial fan, and it may be possible to develop groundwater fed rearing channels and increase trout numbers. This possibility should be investigated during September and October while water levels are low.

Dave Henry Creek is steep and confined all the way down to a terrace by the beach (Plate 7). However, with the proposed reservoir coordination, lake levels will not rise quite as far as they have in the past and there may be room for spawning or rearing channel development in the lower 100 - 200 m of this system.

The other clear water systems (Encampment, Dawson, Grouse, and Molson Creeks) all have steep gradients and therefore limited rainbow trout habitat although it may be possible to rehabilitate spring spawning habitat below the reservoir's full supply line. This option may become more attractive as reservoir coordination is likely to reduce maximum water levels in the lake and leave more of these streams exposed. These areas should be investigated in April and May while reservoir levels are down.

The upper reaches of Bachelor, Chatter, Hugh Allen, Harvey, and Ptarmigan Creeks have some lower gradient habitat where turbidity appeared to be low enough to provide suitable rainbow trout habitat, however all of these areas are above barriers or sections with steep gradients. If rainbow trout were stocked in these areas, some out migration may contribute to the stocks in Kinbasket Lake, but all of these areas are high in elevation and likely have cool water temperatures that may be sub-optimal for rainbow trout.

3.5.3 Bull Trout

Bull trout were found in almost all of the systems below and often above barriers. This species occupied both clear water and glacial systems and was found in habitat ranging from low gradient to very steep gradients. The highest concentrations were found in boulder riffle habitat. Of all the sport fish, bull trout appear to be the most able to ascend areas of steeper gradient. Most of the Kinbasket Lake tributaries likely contribute to the population of bull trout in the lake.

The spawning habitat for Kinbasket Lake bull trout could be increased by removing obstructions near the mouths of the Beaver and Cummins Rivers. The 2 m high cascades at the lower end of Reach 2 of the Beaver River probably block the passage of bull trout at most water levels. Removal of this barrier would allow access to over 35 km of mainstem as well as some tributary habitat (Plate 2). A 4 m high falls at the mouth of the Cummins River blocks bull trout from accessing 25 km of good rearing habitat (Plate 6). Bull trout juveniles were captured above these two barriers but if spawners from the lake were allowed to reach these areas for spawning, there would be much a higher recruitment of juveniles to the lake.

No fish were found in Bachelor Creek which has 7.5 km of low gradient habitat separated from the lake by 14.5 km of cascades and rapids (Plate 1). The introduction of bull trout into the upper reaches of this system could help contribute to populations in the lake. Once the population in Bachelor Creek reached capacity, excess fish would be forced downstream. However, these fish would not be able to return to spawn due to obstructions in the lower part of the reach. Continued stocking would be necessary. Additional sampling should be conducted to determine the capacity and potential benefit of stocking bull trout in this area.

As noted in 3.6.1.3 above, the upper reaches of Bachelor, Chatter, Hugh Allen, Harvey, and Ptarmigan Creeks all have some lower gradient habitat where turbidity appeared to be low and rainbow trout stocking should be investigated. However, if water quality or temperature limit the suitability of these systems for rainbow trout, they may be better suited to bull trout stocking.

3.5.4 Brook trout

Brook trout were captured near Fortress Lake in the Wood River system and in Succour Creek. This species prefers cool non-glacial systems with lower gradient habitat (Carl et al. 1977). There appears to be little opportunity for the enhancement of brook trout due to the lack of this type of habitat in the Kinbasket area.

High concentrations of brook trout were found in Fortress Creek below the outlet to Fortress Lake where no other species were captured. It may be possible increase the productivity of Fortress Creek by re-routing Alnus Creek, which is a glacial tributary. However, this is likely to impact severely on other natural resources. As Fortress Creek lies within Humber Provincial Park, these changes are not likely to be acceptable.

Only a few brook trout were captured in Succour Creek probably due to the presence of rainbow trout. Populations of brook trout have declined in some parts of the United States due to competition with rainbow trout (Elsen D.S. et al. 1986). Reach 2 of Bachelor Creek, Reach 3 of Ptarmigan Creek and Reach 4 of Hugh Allen Creek are areas that brook trout could possibly be introduced. These reaches had lower gradients, had a mixture of pool, riffle and glide habitat and had substantial amounts of cover. There are some icefields in these systems but turbidity appears to be low in the upper reaches. No fish were captured in these areas so competition with other species would not be a problem.

PART IV

SUMMARY

4.1 Background

B.C. Hydro and B.C Ministry of the Environment have undertaken a program to increase fish production and recreational fishing opportunities in the upper Columbia River area. The program is designed to compensate for lost fish production due to habitat changes brought about by the construction of the Mica and Revelstoke dams. Aquatic Resources Ltd. was retained to assess the opportunities for the enhancement of stream resident and migratory sport fish in 28 tributary streams to the Mica Reservoir (Kinbasket Lake).

A biophysical survey of the 28 tributaries was conducted between August 29 and October 19, 1991. Stream habitat parameters were surveyed following methods described by the Fish Habitat Inventory and Information Program (DFO/MOEP 1987). Beach seines and an electroshocker was used to determine fish species composition and fish densities. Samples were collected for morphometric and age data.

4.2 Habitat and Land Use

Higher than average temperatures and precipitation during the spring and summer of 1991 led to higher than average discharge rates on the rivers and creeks around Kinbasket Lake during July and August. Therefore the systems were at a higher stage and more turbid during the first part of the field work conducted in August and September. During the second stage of field work, in October, conditions had returned to their normal seasonal levels.

Nine of the 28 systems were glacial, 12 were fed by icefields and seven were clear water systems fed by snow melt, groundwater and runoff. Many of the 75 reaches identified were steep and bouldery with primarily riffle, rapids or cascades.

There are plans to log extensively along some of the rivers and creeks towards the middle of Kinbasket Lake. These particularly include Bush, Sullivan, Kinbasket and Cummins Rivers and Prattle, Howard, Grouse and Ptarmigan Creeks. These plans may affect sedimentation and runoff, canopy cover, and recreational access all of which may affect enhancement opportunities along these systems.

The only area of active mineral exploration is at the mouth of the Cummins River, where it may be "only a matter of time" before a mine is commissioned. If a mine is developed\in this area, there may be impacts that would affect enhancement plans.

There is little agricultural/horticultural activity in the area with the exception of the north east side where there are a few horses grazing alongside Dave Henry Creek and there is some interest in putting 100 head of cattle along the shoreline. There may be some impact from sedimentation, decreased water quality and reduced canopy cover from the horses and cattle which may affect enhancement plans.

There is a water licence to remove 50 acre feet annually from Succour Creek between April 1 and September 30. There are also two water licence applications to set up small hydro plants on Yellowjacket and Dave Henry Creeks. These may also impact enhancement opportunities.

4.3 Existing fish populations

Five sport fish and five coarse fish species were captured in the 28 Kinbasket tributaries surveyed. Bachelor and Bulldog Creeks were the only systems where sports fish were not captured or observed in at least one reach. Bull trout was the most ubiquitous species as it was captured in 21 of the 28 systems. Mountain whitefish were captured in 13 systems, kokanee in nine, rainbow trout in four and brook trout in two.

An estimated 42,000 kokanee were spawning or holding in nine systems between October 6-11, 1991. The Bush River, Sullivan River, Wood River and Succour Creek appeared to be the most important spawning areas. Smaller numbers were found in Kinbasket River, Chatter Creek, Cummins River, Harvey Creek, and Valenciennes River.

Succour Creek had the highest densities of rainbow trout. Catches averaged 250 fish·1000 m^{-2} in Reach 2. Small catches were made in Harvey, Packsaddle, and Harvey Creeks as well. Succour Creek appears to be good rainbow trout habitat because turbidity is low, water temperatures are relatively warm, gradients are moderate, and the creek appears stable.

Bull trout were found in a variety of habitat with steep to low gradients and high to low turbidity levels. The highest densities were encountered in boulder riffle areas. This fish was the only species encountered in many areas.

Mountain whitefish was the second most prevalent species and was captured in 11 of the 28 systems. This species was most common in systems with high turbidity and low current velocities.

Brook trout were captured in Succour Creek and in the upper reaches of the Wood River. The highest densities were encountered in the outlet to Fortress Lake where water turbidities and the gradient were low and no other species were caught. Brook trout do not appear to do well when there is competition from other species such as rainbow trout.

4.3 Fish morphology

A total of 189 kokanee were sampled from eight systems. All of the samples were similar in size with a mean POH length of 228 mm (s = 9 mm). Thirty-one percent of the fish captured were females. All of the fish were age three. The average fecundity of nine females was 588 eggs.

All of the 88 rainbow trout sampled were juveniles ages one to three. Sizes ranged from 40 to 186 mm. The 128 bull trout sampled ranged in size (fork length) from 35 mm to 760 mm. The average size was 146 mm (s = 124 mm). The mean fork length of brook trout sampled from the Wood River was 74 mm ((n = 25, s = 19).Mountain whitefish sampled averaged 133 mm long (fork length, n = 241, s = 73 mm). Sizes ranged from 34 mm to 470 mm long and ages ranged from 0 to 7 years.

4.5 Enhancement implications

The best opportunities for rainbow trout enhancement in the Kinbasket study area appear to lie in habitat development projects in Succour and Packsaddle Creeks. Bull trout production could be increased by providing access to spawning and early rearing habitats in the Beaver, Bachelor and Cummins systems. In addition, it may be possible to stock rainbow trout or bull trout in productive but isolated upper reach habitat of Bachelor, Chatter, Hugh Allen and Ptarmigan Creeks. Opportunities for kokanee, brook trout and mountain whitefish enhancement are less attractive.

The best opportunities for rainbow trout enhancement appear to lie at the outlet of Succour Creek and in Packsaddle Creek. Succour Arm near the south end of Kinbasket Lake may provide opportunities for sub basin catchment development and increased rearing habitat. At the north end of the lake, Packsaddle Saddle Creek has acceptable water quality and could produce additional rainbow trout if the culvert/fish passage problems can be elevated and low velocity rearing habitat provided. These system should be examined further. The other clear water systems (Encampment, Dawson, Grouse, Molson, and Dave Henry) all have steep gradients and therefore limited rainbow trout habitat although it may be possible to rehabilitate spring spawning habitat below the reservoir's full supply line. The upper reaches of Bachelor, Chatter, Hugh Allen, Harvey, and Ptarmigan Creeks have some lower gradient habitat above barriers where turbidity appeared to be low and that may be suitable trout habitat. These are also worthy of further investigation.

Bull trout were found throughout the Kinbasket system and in all types of water. The spawning and early rearing habitat for these fish could be increased by removing obstructions near the mouths of the Beaver and Cummins Rivers, by planting fish in Bachelor Creek, or by stocking them in other isolated upper reaches. Barrier removal in the Beaver River would allow access to over 35 km of productive mainstem as well as some tributary habitat. In the Cummins River, it would make an additional 25 km of good habitat available to spawners from the lake. Bull trout juveniles were captured above these two barriers but if spawners from the lake were allowed to reach these areas for spawning, there would be much higher recruitment of juveniles to the lake. No fish were found in Bachelor Creek which has 14.5 km of high gradient and 7.5 km of low gradient habitat. The introduction of bull trout into this system could possibly help contribute to populations in the lake. Finally, as noted above, the upper reaches of Bachelor, Chatter, Hugh Allen, Harvey, and Ptarmigan Creeks all have some lower gradient habitat where turbidity appeared to be low and rainbow trout stocking should be investigated. However, if water quality or temperature limit the suitability of these systems for rainbow trout, they may be better suited to bull trout stocking.

There are opportunities for side channel development in the Bush, Sullivan and Wood Rivers. This would result in increased spawning habitat and incubation success for kokanee. However, as the Kinbasket kokanee population may already exceed the lake's capacity, these do not appear to be useful.

4.6 Future Studies

None of the enhancement possibilities have been developed to a point where we can offer either a cost estimate, or an estimate of the size of potential benefits. The following programs are suggested to provide the necessary cost and benefit information. Due to decreased travel costs, etc., some economies should be possible if more than one of the engineering programs are undertaken together.

Draw down survey
Trout spawning habitat below FSL in those systems with acceptable water quality should be investigated. This includes the Bulldog, Chatter, Dave Henry, Dawson, Encampment, Grouse, Harvey, Horse, Howard, Molson, Packsaddle, Prattle, Succour, Windfall, and Yellowjacket systems. This program should be conducted during April or May before reservoir water levels start to rise.

Packsaddle engineering
Investigation and preliminary engineering for culvert upgrading and spawning/rearing channel development. This program would require summer water temperature information. However, the bulk of the work would be conducted in fall.

Obstruction removal
The cost and feasibility of removing fish passage obstructions from the Beaver, Bachelor and Cummins systems should be investigated. This work is mainly an engineering problem. Field work should be completed in late fall

Sub-basin catchment
The natural sill at the outlet of Succour Arm should be investigated to determine the feasibility of constructing a dyke across the mouth of the arm. Fish passage up the lower portion of the sill and over the dyke should also be considered. Field work should be completed in April or May while the sill is above water and snow free.

Capacity survey
Our 1991 surveys identified opportunities for stocking or introductions in specific reaches of the Succour, Bachelor, Beaver, Ptarmigan, Packsaddle, Hugh Allan, and Cummins systems. However, reconnaissance surveys are insufficient to precisely evaluate system capacity or existing populations. As a result, the magnitude of potential population increments and enhancement benefits can not be determined. Key reaches in these systems should be re-evaluated using more precise techniques. This work should be conducted during the fall base flow period.

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APPENDICES

APPENDIX 1: Habitat point samples

Stream Name	Stream Code	NTS Map No.	U.T.M. reference	Reach No.	Site No.	Sample date	Fish Present	M. Chan. Width (m)	Mean Wet Width (m)	Mean Max. Rif. Depth (cm)	Mean Max. Pool (cm)	Gradient %	Pool %	Riffle %	Run %	Other %	Side Chan % (%)	Debris Area % (%)	Stable Debris % (%)	Total Cover % (%)
Alder Ck	300-8857	82 N/6	11.4660.57028			91.08.30		8.0	5.8			6				100 Rapids	0			3
Bachelor Ck	300-8722-342	82 N/12	11.4438.57085	1	2	91.09.10		18.0	11.5	100		3				100 Rapids	0	2	0	20
Bachelor Ck	300-8722-342	82 N/12	11.4460.57118	1	3	91.09.10		30.0	18.0	80		2				100 Rapids	0	0		20
Bachelor Ck	300-8722-342	82 N/12	11.4473.57132	1	4	91.09.10		27.0	17.0	80	200	1	10	20	70		10	3	0	15
Bachelor Ck	300-8722-342	82 N/12	11.4473.57134	1	5	91.09.10		17.0	12.0	120		2				100 Rapids	0	0		20
Bachelor Ck	300-8722-342	82 N/12	11.4488.57167	1	6	91.09.10		20.0	17.0	120		2				100 Rapids	0	3	0	20
Bachelor Ck	300-8722-342	82 N/12	11.4487.57178	1	7	91.09.10		18.0	14.0	120		2				100 Rapids	0	3	0	20
Bachelor Ck	300-8722-342	82 N/12	11.4395.57063	2	1	91.09.10		24.0	15.0	50	200	1	50	25	25		10	10	90	20
Beaver R	300-8857	82 N/11	11.4693.57075	1	1	91.08.29	(DV,EB,KO,MW,RB)	34.0	34.0		77	0	100				0	3		10
Beaver R	300-8857	82 N/11	11.4687.57070	2	2	91.08.29		33.0	28.0	180		2		80	20		0	0	0	
Beaver R	300-8857	82 N/11	11.4680.57065	3	3	91.08.29		54.0	52.0	100		1		40	60		0	3	0	
Beaver R	300-8857	83 N/6	11.4659.57039	3	4	91.10.06		37.5	32.0	70	250	1	10	50	40		0	2	0	30
Beaver R	300-8857	82 N/6	11.4663.57025	4	5	91.08.29	CC,MW,DV	58.0	42.0			1			100					5
Beaver R	300-8857	82 N/6	11.4667.56995	4	6	91.08.30		38.0	34.0			1			100		0			3
Beaver R	300-8857	82 N/6	11.4658.57022	4	7	91.08.30	CC,DV,MW	48.0	30.5			1		50	50		20			4
Beaver R	300-8857	82 N/6	11.4662.57015	4	8	91.08.30	DV,MW	48.0	40.0			1		50	50		20			3
Beaver R	300-8857	82 N/6	11.4688.56924	4	11	91.08.30		51.0	39.0			1		30	70		0			5
Blackman Ck	300-8343-010	83 D/7	11.3874.58148	1	2	91.10.17	DV	13.0	9.5	60		2				100 Rapids	0	0		30
Blackman Ck	300-8343-010	83 D/10	11.3939.58195	2	1a	91.10.17	DV	13.0	8.0	40		1		50	50		0	3	50	80
Blackman Ck	300-8343-010	83 D/10	11.3939.58195	2	1b	91.10.17		8.0	8.0			3				100 Rapids	0	2	50	
Bulldog Ck	300-8331	83 D/10	11.3664.58345	1	1	91.10.16		6.0	5.0	100		4				100 Rapids	0	2	0	0
Bulldog Ck	300-8331	83 D/10	11.3761.58400	3	2	91.10.18		11.0	8.2	100		1			100		0			20
Bush R	300-8700	82 N/14	11.4795.57405	1	1	91.09.07		78.0	70.0	150		0		30	70		0	0	0	5
Bush R	300-8700	82 N/14	11.4790.57455	2	8	91.09.08	DV,KO,MW	37.0	28.5	200		0		50	50		0	1	0	12
Bush R	300-8700	82 N/14	11.4793.57471	3	7	91.09.08		15.0	15.0	300		3				100 Rapids	0	0		5
Bush R	300-8700	83 C/3	11.4750.57620	5	3	91.09.07	MW	30.0	21.0	125		1		80	20		20	5	0	10
Bush R	300-8700	82 N/14	11.4749.57594	5	4	91.09.07	MW	52.0	44.0	110		1		50	50		30	5	0	10
Bush R	300-8700	82 N/14	11.4743.57566	5	5	91.09.08	MW	112.0	42.0	100		1		30	70		40	5	0	10
Bush R	300-8700	83 C/3	11.4709.57665	6	2	91.09.07		27.5	21.3	125		2		80	20		30	2	0	3
Bush R	300-8700	82 N/14	11.4787.57398		9	91.09.08	CC,(DV),KO,MW	235.0	100.0	175		0		40	60		70	5	0	15
Bush R Rice Bk	300-8700	83 C/3	11.4747.57631			91.09.07		25.0	20.0	150		2				100 Rapids	0	1	0	2
Bush R Rice Trib	300-8700	83 C/3	11.4746.57643			91.09.07		15.0	11.0	150		2				100 Rapids	0	2	0	15
Bush R Trib 2	300-8700	82 N/14	11.4741.57558			91.09.08		10.0	8.0	80		3				100 Rapids	0	5	0	20
Bush R Trib Upper	300-8700	83 C/3	11.4711.57665			91.09.07		18.0	14.0	100		4				100 Rapids	0	0		10
Chatter Ck	300-8692	82 N/14	11.4690.57389	1	1	91.09.09		14.0	12.0	80	150	4	10			90 Rapids	0	5	0	30
Chatter Ck	300-8692	82 N/14	11.4695.57375	1	2	91.09.09	CRH,DV,MW	22.0	18.0	80	150	2	10			90 Rapids	0	2	0	20
Chatter Ck	300-8692	82 N/14	11.4695.57375	1	3	91.10.07	KO,MW		14.0											
Chatter Ck	300-8692	82 N/13	11.4650.57442	2	4	91.10.07	DV	21.0	9.0	30	70	1	15	55	30		5	3	30	30
Cummins R	300-8447	83 D/1	11.4165.57674	1	1	91.10.10	KO	20.0	11.0	100		4				100 Rapids	0	2	0	40
Cummins R	300-8447	83 D/11	11.4177.57677	1	2	91.10.11		18.0	16.0	100		3				100 Rapids	0	2	0	40
Cummins R	300-8447	83 D/11	11.4250.57691	2	3	91.10.11	DV,MW	20.0	11.0	100	250	1	20	10	70		0	5	50	20
Cupola Ck	300-8857	82 N/6	11.4660.57042			91.08.29		20.0	16.0			3		100			20			5
Dave Henry Ck	300-8328	83 D/11	11.3585.58456	1	1	91.10.14	CC,MW	12.9	7.4	50		3		10	90		0	1	50	30
Dave Henry Ck	300-8328	83 D/14	11.3643.58510	2	2	91.10.14	DV	13.0	12.5	30	40	3		50	50		0	5	0	50
Dave Henry Ck	300-8328	83 D/15	11.3660.58536	2	3	91.10.15	DV	17.0	7.2	50		2		95	5		0	5	0	40
Dave Henry Ck	300-8328	83 D/11	11.3588.58458			91.10.15		7.0	7.0	40	200	15	40	20		40 Cascades	0	3		30
Dawson Ck	300-8353	83D/8	11.4017.57939	1	1	91.10.11	DV	20.0	16.0	50		3		90	10		0	3	0	40
Encampment Ck	300-8284	83 D/2	11.3962.57783	1	1	91.09.11		14.5	7.0	100		6				100 Rapids	0	5	0	30
Encampment Ck	300-8284	83 D/2	11.3926.57793	1	2	91.09.11	DV	12.0	10.4	90	200	9	30			70 Cascades	0	10	0	20
Encampment Ck	300-8284	83 D/2	11.3927.57793	1	2	91.10.11	DV	9.0	7.5	50		3		80	20		0	2	0	40
Foster Ck	300-8293	83 D/7	11.3888.57907	1	1	91.10.11	MW	25.0	21.0	100		2		100			0	3	0	40
Grouse Ck	300-8302	83 D/7	11.3793.58144	1	1	91.10.19	DV	7.0	4.4	20		7				100 Rapids	0	10	0	50
Harvey Ck	300-8356	83 D/1	11.4044.57873	1	1	91.09.11	DV	12.6	10.6	80		3				100 Rapids	0	5	0	10
Harvey Ck	300-8356	83 D/1	11.4029.57873	1	2	91.09.11	(KO,RB on Oct.11)	14.0	13.0	80		5				100 Rapids	0	10	0	20
Harvey Ck	300-8356	83 D/8	11.4080.57897	2	3	91.10.11		10.0	5.0	40	200	1	40	20	40		0	5	100	40
Horse Ck	300-8330	83 D/11	11.3629.58392	1	1	91.10.15	DV,RB	12.0	6.0	70	90	4	10		90		0	2	0	30
Horse Ck	300-8330	83 D/10	11.3689.58418	2	2	91.10.18		4.3	4.3	20	80	1	20	50	30		0	4	100	20
Howard Ck	300-8298	83 D/7	11.3738.58036	1	1	91.10.17		17.0	8.0	30		2		100			0	10	50	30
Howard Ck	300-8298	83 D/7	11.3812.58036	1	2	91.10.17	DV	10.0	8.0	100		5				100 Rapids	0	5	50	40
Hugh Allen Ck	300-8343	83 D/7	11.3905.58080	1	3	91.10.17	DV	20.0	15.0	100		2				100 Rapids	0	2	20	30
Hugh Allen Ck	300-8343	83 D/7	11.3976.58069	2	2	91.10.17	MW	34.0	20.0	50	200	1	40	10	50		0	5	60	40

APPENDIX 1: Habitat point samples

Stream Name	Stream Code	NTS Map No.	U.T.M. reference	Reach No.	Site No.	Sample date	Fish Present	M. Chan. Width (m)	Mean Wet Width (m)	Mean Max. Rif. Depth (cm)	Mean Max. Pool (cm)	Gradient %	Pool %	Riffle %	Run %	Other %	Side Chan % (%)	Debris Area % (%)	Stable Debris % (%)	Total Cover % (%)
Hugh Allen Ck	300-8343	83 D/8	11.4107.58142	4	1a	91.10.17		8.5	6.0	30	200	1	20	20	60		0	3	80	20
Hugh Allen Ck	300-8343	83 D/8	11.4107.58141	4	1b	91.10.17		11.5	8.0	50		7				100 Rapids	0	1	50	40
Icefall Brook	300-8700-021-492	82 N/14	11.4917.57387	1	4	91.09.06		30.0	14.0			1		60	40		30	1	0	0
Icefall Brook	300-8700-021-492	82 N/14	11.4921.57395	2	3	91.09.06		19.0	16.0			2		30	50	20 Rapids	0	3	0	5
Icefall Brook	300-8700-021-492	82 N/14	11.4923.57413	3	2	91.09.06		194.0	67.5			1		30	70		100	1	0	0
Kisbasket R	300-8535	82N/13	11.4321.57576	1	1	91.09.02		20.9	20.0			3				100 Rapids	0	0		0
Kisbasket R	300-8535	82 N/13	11.4320.57575	1	1	91.10.11	KO	15.0	9.0	80		3				100 Rapids	0	0		15
Kisbasket R	300-8535	82 N/13	11.4342.57592	2	3	91.10.11		34.0	25.0	100	150	2	10		45	45 Rapids	5	2	0	30
Kisbasket R	300-8535	82 N/13	11.4350.57608	3	2	91.10.11		200.0	32.5	40	150	1	5	50	45		100	4	0	20
Molson Ck	300-8359	83 D/1	11.4034.57807	1	1	91.09.11		14.0	8.0	100		8				100 Rapids	0	10	0	20
Molson Ck	300-8359	83 D/1	11.4142.57844	2	2	91.10.11	DV	11.0	6.5	30	100	1	20	30	50		0	3	50	20
Packsaddle Ck	300-8326	83 D14	11.3538.58500	1	1	91.10.14	NSC	22.0	9.5	30	70	2	10	70	20		0	2	50	20
Packsaddle Ck	300-8326	83 D14	11.3543.58507	1	2	91.10.14	DV,CC,RB													
Packsaddle Ck	300-8326	83 D14	11.3543.58506	1	3	91.10.14	DV													
Prattle Ck	300-8693	82 N/14	11.4705.57382	1	1	91.09.09	CRH,DV,MW	20.0	15.0	80	250	1	30	70			0	5	0	20
Prattle Ck	300-8693	82 N/14	11.4673.57504	2	2	91.10.07		42.0	12.2	100		1		100			0	3	0	25
Prattle Ck	300-8693	82 N/13	11.4649.57586	2	4	91.10.07		12.0	6.5	30	60	1		80	20		0	2	0	25
Prattle Ck	300-8693	82 N/13	11.4648.57586	2	5	91.10.07		20.0	9.0	50	60	1		80	20		30	2	0	5
Prattle Ck Trib.	300-8693	82 N/14	11.4673.57506	2	3	91.10.07		30.0	6.6	60		1		100			0	5	0	20
Ptarmigan Ck	300-8333	83 D/10	11.3773.58282	1	1	91.10.16	DV	29.0	14.0	100		3				100 Rapids	0	4	0	20
Ptarmigan Ck	300-8333	83 D/10	11.3937.58338	2	3	91.10.16	DV	14.0	13.0	70		3				100 Rapids	0	5	50	40
Ptarmigan Ck	300-8333	83 D/10	11.3936.58338	3	4	91.10.18		8.0	4.8	180	40	1	40	30	30		0	5	100	25
Ptarmigan Ck Trb	300-8333	83 D/10	11.3776.58284	1	2	91.10.16		10.0	9.0	60		4		40	10	50 Rapids	0	3	50	30
Succour Ck	300-8714	82 N/12	11.4633.57293	1	8	91.09.01	CRH,LSU,MW,RB	5.5	5.5			2	10	90			0	20	100	50
Succour Ck	300-8714	82 N/11	11.4660.57267	2	7	91.09.01	EB,LSU,RB	5.0	5.0			2	10	70	20		0	20	100	50
Succour Ck	300-8714	82 N/11	11.4700.57219	3	2	91.08.31	LSU	6.0	6.0			0				100 Marsh	0	5	100	40
Succour Ck	300-8714	82 N/11	11.4693.57226	3	4	91.08.31	LSU,RB	7.3	7.3			0	20		80		0	20	100	6
Succour Ck	300-8714	82 N/11	11.4676.57247	3	5	91.09.01		33.0	33.0			0				100 Marsh/Glide	0	50	100	100
Succour Ck	300-8714	82 N/11	11.4674.57249	3	6	91.09.01	LNC,RB	10.0	10.0			1				100 Glide	0	30	100	80
Sullivan R	300-8566	82 N/13	11.4463.57574	2	1	91.10.07	KO,(DV),(MW)	400.0	34.0	60	80	1		40	60		20	5	0	50
Sullivan R	300-8566	82 N/13	11.4472.57565	2	12	91.09.05		6.0	6.0			1		10	90		0	10	100	30
Sullivan R	300-8566	82 N/13	11.4470.57566	2	13	91.09.05	DV,MW	75.0	42.0			1		40	60		50	2	0	3
Sullivan R	300-8566	82 N/13	11.4453.57571	2	14	91.09.05	DV,MW	225.0	50.0			1		40	60		75	5	0	3
Sullivan R	300-8566	82 N/13	11.4523.57590	3	7	91.09.04		45.0	30.0			2	40	20		40 Rapids	0	0		20
Sullivan R	300-8566	82 N/13	11.4507.57574	3	8	91.09.04		22.0	16.0			2				100 Rapids	0	0		0
Sullivan R	300-8566	82 N/13	11.4493.57565	3	9	91.09.05	DV,MW	42.5	39.5			1		30	70		2	0		10
Sullivan R	300-8566	82 N/13	11.4488.57563	3	10	91.09.05		13.0	9.5			5				100 Rapids	0	2	0	20
Sullivan R	300-8566	82 N/13	11.4484.57565	3	11	91.09.05		75.0	32.0			3				100 Rapids	2	0		2
Sullivan R	300-8566	83 C/4	11.4526.57655	4	3	91.09.04		33.0	28.5			2		100			0	1	0	30
Sullivan R	300-8566	83 C/4	11.4534.57633	4	4	91.09.04	DV	20.5	20.5			1		100			0	0		10
Sullivan R	300-8566	83 C/4	11.4534.57631	4	5	91.09.04	MW	50.0	49.0			2		100			0	1	0	5
Sullivan R	300-8566	82 N/13	11.4535.57604	4	6	91.09.04	DV,MW	84.0	33.0			2		50		50 Rapids	20	2	0	. 10
Sullivan R	300-8566	83 C/4	11.4520.57677	5	2	91.09.04		6.0	6.0				50			50 Rapids	0	0		0
Summit Ck	300-8714	82 N/11	11.4672.57219		3	91.08.31	RB	2.5	2.5			3	20		80		0	10	100	30
Valenciennes R	300-8700-021	82 N/14	11.4798.57404	1	8	91.09.07		28.0	26.0			1		20	80		0	0		15
Valenciennes R	300-8700-021	82 N/14	11.4816.57414	2	1	91.09.06										100 Rapids	0	0		10
Valenciennes R	300-8700-021	82 N/14	11.4852.57397	2	7	91.09.06		23.0	23.0			2				100 Rapids	0	0		2
Valenciennes R	300-8700-021	82 N/14	11.4908.57378	3	5	91.09.06		85.0	25.0			2		50	50		100	5	0	3
Valenciennes R	300-8700-021	82 N/14	11.4901.57375	3	6	91.09.06		245.0	140.0			2		75	25		400	5	0	10
Windfall Ck	300-8301	83 D/7	11.3812.58102	1	2	91.10.19	DV	10.0	7.0	40		4				100 Rapids	0	5	0	40
Windfall Ck	300-8301	83 D/7	11.3781.58087	2	1	91.10.17		11.0	8.0	30		1		100			0	0		15
Windy Ck	300-8554	82 M/16	11.4300.57484	1	1	91.09.03		21.0	15.0			3				100 Rapids	0	0		0
Windy Ck	300-8554	82 M/16	11.4294.57478	1	2	91.09.03		90.0	25.0			3				100 Rapids	10	5	0	20
Windy Ck	300-8554	82 M/16	11.4294.57478	1	2	91.10.07	(MW)	90.0	12.0	60		3		80	20		10	5	0	40
Windy Ck	300-8554	82 M/16	11.4276.57448	2	3	91.10.07		40.0	11.0	40	120		10	50	40		20	5	0	50
Wood R	300-8367	83 D/1	11.4195.57878	1	1	91.10.09	CC,DV,KO,MW	450.0	63.0	30	250	1	15	42	43		50	5	0	10
Wood R	300-8367	83 D/8	11.4274.57995	3	6	91.10.11	MW	500.0	40.0	100	200	1	5	80	15		2	2	0	5
Wood R Alnus Ck	300-8367	83 C/15	11.4399.58026	5	4	91.10.11	EB	12.0	10.0	100	150	1	20	40	40		30	2	50	60
Wood R Fortress	300-8367	83 C/15	11.4398.58023	5	5	91.10.11	EB	20.0	8.0	80	250	1	20	20	60		10	4	50	20
Yellow Jacket Ck	300-8329	83 D/11	11.3615.58410	1	1	91.10.15	DV,MW	18.0	8.5	80		4				100 Rapids	0	2	0	30
Yellow Jacket Ck	300-8329	83 D/15	11.3675.58465	2	2	91.10.18	DV	9.0	9.0	100		2		90	10		0	7	80	20

APPENDIX 1: Habitat point samples

Stream Name	Cover by type (%): Deep Pool	L.O.D.	Boulder	Instream Vegetation	Canopy	Cutbank	Turbidity	Canopy Closure (%)	Bed Material (%): Fines	Small Grav.	Large Grav.	Small Cob.	Large Cob.	Boulder	Bedrock	D90 (cm)	Compaction	Banks: Height (m)	Usable (%)	Texture	Confinement	Valley: Channel Ratio	Stage	Flood Signs (m)	Braided	Bars (%)	Water Temp. C	Turbidity (cm)
Alder Ck		10	90						5	5	5	10	15	60		80	M	2.0	0	G	EN	N/A	H			0		100
Bachelor Ck			100						5	5	10	15	25	40		70	M	1.0	50	GL	CO	2-5	M	0.5	N	20	5.5	200
Bachelor Ck			100					0	5	5	10	15	25	40		70	M	1.0	25	GL	CO	0-2	M	1.0	N	20	7.0	200
Bachelor Ck	10	60			10	20		0	25	30	40	5				10	M	1.0	50	PG	CO	2-5	M	1.2	N	30	8.0	200
Bachelor Ck			100					0	5	5	10	15	25	40		80	M	1.5	0	GL	CO	2-5	M	1.0	N	0	8.0	150
Bachelor Ck			100					0	10	5	5	10	15	50	5	120	M	2.0	0	LR	EN	0-2	M	1.0	N	0		200
Bachelor Ck			100					0	10	5	5	10	15	50	5	90	M	2.0	0	L	EN	0-2	M	1.0	N	0	8.0	200
Bachelor Ck	30	10			40	20			25	30	40	5				10	L	0.5	100	F	UC	5-10	M	0.5	N	25	4.0	200
Beaver R				100				5											0	FGL	EN	0-2	H			0		15
Beaver R								0	5	5	5	15	20	40	10	200	M	10.0	10	L	EN	0-2	H	2.0	N	0	6.5	15
Beaver R								5	5	5	15	20	45	10			M	2.0	10	FGL	EN	0-2	H	1.0	N	0	6.5	15
Beaver R	5	5	90					0	5	5	10	15	25	40		50	M	2.0	0	L	FC	10+	M	1.0	N	10	5.0	250
Beaver R																	L	1.5	80	PG	FC	2-5	H	0.5		30		15
Beaver R		33			33	34		5									M	1.5	50	F	OC		H	0.5		0		15
Beaver R		40				60		10										1.5	50	GL	FC	2-5	H	0.5		20	8.0	15
Beaver R		25	25			50		10	10	5	5	20	20	40		30	M	1.5	50	PG	FC	2-5	H	0.5		20	8.0	15
Beaver R		33			33	34		5										2.0	75	PG	OC	5-10	H	0.5		20	8.0	15
Blackman Ck			100					0	5	5	10	15	25	40		70	M	2.0	100	BC	EN	0-2	M		N	0	2.0	50
Blackman Ck		40			30	30		0	30	30	15	10	5	10		25	M	1.0	20	PGC	C	0-2	M		N	20	2.0	35
Blackman Ck								0	5	5	5	15	20	50		50	M	0.5	0	BF	CO	0-2	M		N	0	2.0	35
Bulldog Ck			100					30	5	5	5	10	15	40	20	50	M	1.0	100	R	EN	0-2	M	1.0	N	0		100
Bulldog Ck			100					0	10	10	10	10	10	30	20		M	4.0	10		FC	2-5	M	0.3	N		1.0	Clear
Bush R			50				50	0	10	5	20	20	30	10	5	26	M	1.0	50	GR	CO	2-5	M	0.5	N	20	6.0	30
Bush R			50				50	0	10			5	10	75		50	M	1.5	0	GL	CO	2-5	M	1.0	N	0	7.0	20
Bush R			100					0	10	5	10	10	20	30	15	20	L	2.0	0	LR	EN	N/A	M	3.0	N	10		15
Bush R		10	10				80	0	10	5	10	20	45	10		26	M	0.7	70	PG	FC	2-5	M	0.7	Y	30	6.0	15
Bush R		10	20				70	0	10	5	10	20	45	10		26	M	0.7	100	PG	OC	2-5	M	0.6	Y	20	6.0	15
Bush R			10				90	0	15	10	30	25	15	5		15	L	0.7	0	PG	FC	0-2	M	1.0	Y			30
Bush R		10	40				50	50	10	10	20	10	40	10		26	M	1.0	80	PG	OC	2-5	M	0.5	Y	30	4.0	15
Bush R							100		20	10	30	25	15			20	M	0.7	100	PG	OC	2-5	M	1.3	Y	50		40
Bush R Rice Bk			50				50	0	5	5	10	20	25	35		40	M	1.5	80	G	N/A	N/A	M	0.5	N	10	6.5	10
Bush R Rice Trib		10	60				30	10	5	5	5	10	20	45	10	150	M	1.5	25	LR	CO	0-2	M	1.0	N	10	5.0	50
Bush R Trib 2			100					10	10	5	5	10	20	50		40	M	1.0	50	GL	CO	0-2	M	1.0	N	0		15
Bush R Trib Upper			100					0	5	5	5	10	30	40	5		M	1.0	20	G	CO	0-2	M	0.5	N	10	4.0	40
Chatter Ck			100					0	5	5	10	10	20	40	10	200	M	2.0	0	LR	EN	N/A	M	0.8	N	20	5.0	150
Chatter Ck			100					0	5	5	10	20	30	30		60	M	1.5	50	GL	OC	0-2	M	0.5	N	20		200
Chatter Ck																							M				4.0	
Chatter Ck		30	40			30		0	5	10	30	30	20	5		26	L	1.0	100	FGL	FC	2-5	M	0.5	N	30	4.0	CLEAR
Cummins R			50				50	0	5		5	10	20	60		200	M	4.0	0	LR	EN	0-2	M	1.0	N	10		30
Cummins R			50				50	0	5	5	10	15	20	45		100	M	1.5	0	L	CO	0-2	M	1.2	N	10	5.5	30
Cummins R	20	20			30	30		0	30	20	45	5				5	M	1.5	50	F	FC	2-5	M	1.0	N	5	5.0	30
Cupola Ck		10	90						10	10	10	15	15	40		80	M	1.0	100	GL	UC	N/A	H	0.5		30	7.5	50
Dave Henry Ck			95	5				5	20	10	10	15	15	30		100	M	4.0	10	G	CO	0-2	M	1.5	N		7.0	
Dave Henry Ck			80		10	10		10	5	10	10	20	25	30		80	M	1.0	20	L	FC	0-2	M	0.8	N		6.0	100
Dave Henry Ck			90		10			2		10	15	20	20	35		80	L	0.5	20	L	FC	10+	M	0.5	N		5.0	100
Dave Henry Ck	50		50					20	5	5	15	15	20	30	10	100	L				EN	0-2	M					
Dawson Ck		10	80			10		0	5	5	10	15	35	30		40	M	1.0	30	BCF	FC	0-2	M	1.0	N	10	7.0	CLEAR
Encampment Ck		10	90					5	5	5	10	15	20	45		100	M	1.5	0	GL	CO	0-2	M	0.8	N	10	7.0	0
Encampment Ck	50	20	30					10	5	5	10	15	20	35	10	70	M	2.0	0	LR	EN	0-2	M	0.9	N	0	7.0	0
Encampment Ck		10	80			10		0	5	5	10	15	25	40		70	M	1.5	0	BC	CO	0-2	M	0.7	N	10	6.0	CLEAR
Foster Ck		10	80			10		0	15	5	10	15	25	30		40	M	1.0	30	BCF	FC	0-2	M	0.7	N	10	6.0	10
Grouse Ck			70	30				0	5	5	10	20	20	40		100	M	2.0	20	BCF	EN	0-2	M	1.0	N		3.0	100
Harvey Ck		10	90					10	5	5	10	20	25	35		80	M	2.0	0	L	CO	0-2	M	0.7	N	0	7.0	150
Harvey Ck		20	80					5	5	5	10	20	25	35		80	M	1.0	50	L	CO	0-2	M	0.7	N	10	7.0	150
Harvey Ck	10	20			30	40		0	15	10	75					6	L	1.0	100	F	UC	10+	M	0.8	N	50	7.0	150
Horse Ck			100					0	5		10	20	25	40		100	L	0.5	50	L	FC	N/A	M	0.5	N		8.0	CLEAR
Horse Ck		30			30	40		0	15	5	30	40	5	5		15	L	0.7	20	F	OC	2-5	M	0.4	N	15	2.0	Clear
Howard Ck		10	90					5		10	15	15	30	30		30	M	0.5	50	BC	OC	10+	M		Y		0.0	1
Howard Ck		10	90					0	5	5	5	20	25	40		70	M	1.0	30	BC	CO	0-2	M	0.8	N	5	0.0	1
Hugh Allen Ck			100					0	10	5	10	10	15	50		50	M	1.5	20	BC	CO	0-2	M	1.0	N	10	1.5	100
Hugh Allen Ck	20	40				40		0	10	10	10	10	30	30		13	M	1.0	100	F	OC	2-5	M	0.5	N	20	1.0	100

APPENDIX 1: Habitat point samples

Stream Name	Cover by type (%) Deep Pool	L.O.D.	Boulder	Instream Vegetation	Canopy	Cutbank	Turbidity	Canopy Closure (%)	Bed Material (%) Fines	Small Grav.	Large Grav.	Small Cob.	Large Cob.	Boulder	Bedrock	D90 (cm)	Compaction	Banks Height (m)	Unstable (%)	Texture	Confinement	Valley: Channel Ratio	Stage	Flood Sigm (m)	Braided	Bars (%)	Water Temp. C	Turbidity (cm)
Hugh Allen Ck	20	20	20		10	30		5	10	10	30	30	10	10		20	M	1.0	50	F	OC	2-5	M	0.4	N	20	0.5	CLEAR
Hugh Allen Ck			100					5	5	5	10	10	20	50		100	M	0.5	0	B	OC	2-5	M	0.4	N	0	0.5	CLEAR
Icefall Brook								0	20	5	25	30	20			15	M	0.5	100	G	OC	2-5	M	0.5	Y		9.0	30
Icefall Brook			100					0	10	5	5	20	30	30		100	M	2.0	100	G	CO	0-2	M	0.5	N	0	9.0	300
Icefall Brook								0	20	10	40	30				10	L	0.5	100	PG	PC	0-2	M	0.5	Y	20	9.0	30
Kinbasket R								0	10			5	5	80		200	M	105.0	30	L	EN	0-2	H		N	0	6.5	20
Kinbasket R			100					0	5	5	10	10	20	40	10	150	M	2.0	0	GL	EN	0-2	M	1.0	N	0	4.0	150
Kinbasket R	10	10	70			10		0	10	10	15	20	20	25		70	M	1.0	30	GL	CO	0-2	M	0.7	N	20	4.0	150
Kinbasket R	20	60				20		0	20	15	30	25	10			15	L	1.0	100	PG	CO	0-2	L	1.0	Y	80	4.0	150
Molson Ck			100					5	5	5	10	10	10	50	10	150	M	2.0	0	LR	EN	0-2	M	1.0	N	0	7.0	0
Molson Ck		20			20	60		0	5	10	50	25	10			10	M	0.7	50	F	OC	2-5	M	0.5	N	50	6.0	CLEAR
Packsaddle Ck		25	50			25		10	10	10	15	25	30	10		25	M	0.5	50	L	CO	N/A	M	0.5	N	10	6.0	CLEAR
Packsaddle Ck																												
Packsaddle Ck																												
Prattle Ck	20		60				20	5	10			10	20	50	10	80	M	0.0	0	LR	EN	0-2	M	0.8	N	0	7.0	20
Prattle Ck			100					0	5	20	15	15	20	25		70	L	1.3	100	G	PC	2-5	M	1.5	N	50	4.0	100
Prattle Ck			100					0	5	5	20	20	30	20		100	L	1.5	0	GL	EN	0-2	M	1.0	N	20		100
Prattle Ck			100					0	10	10	20	20	30	10		20	L	1.0	100	G	CO	0-2	M	1.0	Y	70		100
Prattle Ck Trib.		10	80		10			0	5	10	20	20	25	20		40	L	1.0	100	PG	CO	0-2	M	1.0	N	70	4.0	100
Ptarmigan Ck			100					0	5	5	10	10	15	55		90	M	2.0	50	B	CO	0-2	M	2.0	N	20	3.0	25
Ptarmigan Ck		20	30		30	20		0	10	5	10	20	25	30		50	M	1.0	50	FBC	CO	0-2	M	0.5	N	5	1.5	40
Ptarmigan Ck		30			30	40		5	50	25	25					5	L	0.5	20	F	UC	10+	M	0.5	N	15	1.5	Clear
Ptarmigan Ck Trb			100					0	5	5	10	10	15	55		90	M	1.5	75	B	CO		M	0.5	N	5	3.0	25
Succour Ck		50	10		30	10		100	10	10	20	30	20	10		26	M	1.0	0	F	OC	10+	H	0.3	N	0	14.0	0
Succour Ck		50	10		30	10		100	10	10	20	30	20	10		26	M	1.0	0	PG	CO	10+	H	0.0	N	0	14.5	0
Succour Ck		10		70		20		0	100							1	L	0.3	0	F	OC	10+	H	0.0	N	0	13.0	LOW
Succour Ck		50		10	30	10		10	20	40	40					3	L	0.5	0	PG	PC	10+	H	0.0	N	0		0
Succour Ck		20		70		10		100								1	L	3.0	0	F	CO	10+	H	0.0	N	0		0
Succour Ck		40		20	40			10	40	40	20					4	M	3.0	0	F	CO	10+	H	0.0	N	0		0
Sullivan R							100	0	15	5	15	20	35	10		20	M	1.0	90	PG	OC	2-5	M	1.0	Y	100		10
Sullivan R		33			33	34		100	20	10	30	20	20			20	H	0.5	0	F	N/A	N/A	M	0.5	N	0	6.0	50
Sullivan R		20	80					0	15	5	15	20	35	10		20	M	1.0	90	PG	OC	2-5	M	1.0	Y	50	6.0	10
Sullivan R		100							15	5	15	20	35	10		20	M	1.0	90	PG	OC	2-5	M	1.0	Y	100	8.0	10
Sullivan R			100					0	15	5	5	20	30	20	5	200	L	105.0	25	PG	EN	0-2	H	1.0	N	25	6.0	5
Sullivan R									20		5	5	10	55	5	200	L	2.0	0	LR	EN	0-2	H	1.0	N	10	6.0	5
Sullivan R			100					0	15	5	10	20	40	10		25	M	1.5	50	G	CO	0-2	M	1.0	N	20	4.0	10
Sullivan R		10	80		10			20	5	5	10	10	40	30		100	M	1.5	50	PG	N/A	N/A	M	0.6	N	15	6.0	50
Sullivan R			100					0	5	5	5	5	30	50		100	M	2.0	0	L	OC	2-5	M	1.0	N	5	4.0	10
Sullivan R			100					0	10		10	25	25	30		40	M	105.0	100	GL	PC	2-5	M	1.3	N	50	4.5	10
Sullivan R			100						15		20	25	30	10		25	M	0.7	50	PG	CO	0-2	H	0.5	N	0	6.0	10
Sullivan R			100					0	15		5	10	45	25		25	M	0.5	5	PG	PC	0-2	H	0.6	N	20	6.0	10
Sullivan R		10	50			40		0	30	10	25	15	10	10		25	L	0.5	100	PG	PC	0-2	H	0.5	Y	60	6.0	5
Sullivan R								20					0	50	50			40.0	0	R	EN	0-2	M		N	0		20
Summit Ck	10	10		40		40		30	5	35	60					5	L	0.5	0	F	UC	N/A	H	0.0	N	0	12.0	LOW
Valenciennes R			50				50		5	5	5	20	40	20	5	50	M	2.5	0	GL	CO	0-2	M	0.7	N	10	6.0	35
Valenciennes R			100					0	5	5	10	10	20	40	10	200	M	2.0	0	LR	EN	0-2	M	2.0	N	0		30
Valenciennes R			50				50	0	5	5	5	20	40	20	5	50	M	2.0	50	GL	EN	0-2	M	0.8	N	5	7.0	10
Valenciennes R		20					80	0	20	5	25	30	20			15	M	0.5	100	G	OC	2-5	M	0.5	Y	200	7.0	15
Valenciennes R		10					90	0	10	25	40	20	5			10	L	0.5	100	G	OC	0-2	M	0.5	Y	200	7.0	10
Windfall Ck			90	10				5		5	5	10	30	50		100	M	2.0	20	BC	EN	0-2	M	0.5	N		2.5	100
Windfall Ck		10		70	20			0	5		10	30	45	10		26	M	1.5	50	F	PC	2-5	M	0.5	N	20	0.0	CLEAR
Windy Ck								10	10			5	10	75		200	M	2.0	0	GL	CO	0-2	H	1.5	N	0	4.0	20
Windy Ck		20	60		10	10		5	10	2	5	10	30	43		50	M	2.0	50	G	CO	0-2	H		Y	30		30
Windy Ck			40				60	0	10	2	5	10	30	43		50	M	2.0	50	G	CO	0-2	M	1.0	N	50		40
Windy Ck		10	0		10	80		0	15	5	15	35	30			20	M	0.7	10	PG	PC	2-5	M	0.5	N	50	6.0	40
Wood R	50	30					20	0	20	10	30	35	5			12	L	1.0	60	PG	CO	0-2	L	1.0	Y	85	6.0	100
Wood R	50	50						0	15	5	30	40	10			150	M	0.7	100	G	CO	0-2	M	0.8	Y	80	5.0	25
Wood R Alaus Ck	10	20		10	60			0	30	40	30					5	M	0.5	50	F	OC	10+	M	0.5	N	20		25
Wood R Fortress	10	20		10	60			0	15	30	50	5				5	M	0.5	50	F	OC	10+	M	0.5	N	10	7.5	200
Yellow Jacket Ck			100					0	5	5	10	10	15	55		100	M	1.5	100	BC	N/A	N/A	M	1.4	N	20	8.0	CLEAR
Yellow Jacket Ck		20	60			20		0	5	5	10	15	25	40		40	M	0.8	20	BCF	OC	2-5	M	0.5	N	15	1.5	Clear

APPENDIX 2: Habitat summary by reach

Stream Name	Stream Code	NTS Map No.	Reach No.	Site No.s	Sample date	Fish Present	Mean Chan. Width (m)	Mean Wet Width (m)	Mean Max. Riffle Depth (cm)	Mean Max. Pool (cm)	Gradient %	Habitat type: Pool %	Riffle %	Run %	Other %	Side Channel (%)	Debris Area (%)	Stable Debris (%)	Total Cover (%)
Bachelor Ck	300-8722-342	82 N/12	1	2,3,4,5,6,7	91.09.10		22.0	15.0	100	200	2	2	3	12	83 Rapids	2	2	0	20
Bachelor Ck	300-8722-342	82 N/12	2	1	91.09.10		24.0	15.0	50	200	1	50	25	25		10	10	90	20
Beaver R	300-8857	82 N/11	1	1	91.08.29	(DV,EB,KO,MW,RB)	34.0	34.0		77	0	100				0	3		10
Beaver R	300-8857	82 N/11	2	2	91.08.29		33.0	28.0	180		2		80	20		0	0	0	
Beaver R	300-8857	82 N/11	3	3,4	91.08.29		45.8	37.0	85	250	1	5	45	50		5	1	0	30
Beaver R	300-8857	82 N/6	4	5,6,7,8,11	91.08.29	CC,MW,DV	48.0	36.6			1		25	75		10			4
Blackman Ck	300-8343-010	83 D/7	1	2	91.10.17	DV	13.0	9.5	60		2				100 Rapids	0	0		30
Blackman Ck	300-8343-010	83 D/10	2	1	91.10.17	DV	10.5	8.0	40		2		25	25	50 Rapids	0	3	50	40
Bulldog Ck	300-8331	83 D/10	1	1	91.10.16		6.0	5.0	100		4				100 Rapids	0	2	0	0
Bulldog Ck	300-8331	83 D/10	2																
Bulldog Ck	300-8331	83 D/10	3	2	91.10.18		11.0	8.2	100		1			100		0			20
Bush R	300-8700	82 N/14	1.00	1,9	91.09.07		155.0	85.0	160		0		35	65		35	3	0	10
Bush R	300-8700	82 N/14	2	8	91.09.08	DV,KO,MW	37.0	28.5	200		0		50	50		0	1	0	12
Bush R	300-8700	82 N/14	3	7	91.09.08		15.0	15.0	300		3				100 Rapids	0	0		5
Bush R	300-8700		4																
Bush R	300-8700	82 N/14	5	3,4,5	91.09.07	MW	65.0	35.0	110		1		55	45		30	5	0	10
Bush R	300-8700		6	2			27.5	21.3	125		2		80	20		30	2	0	3
Chatter Ck	300-8692	82 N/14	1	1,2,3	91.09.09	DV,CRH,KO,MW	18.0	15.0	80	150	3	10			90 Rapids	4	0	0	25
Chatter Ck	300-8692	82 N/13	2	4	91.10.07	DV	21.0	9.0	30	70	1	15	55	30		5	3	30	30
Chatter Ck	300-8692	82 N/13	3																
Cummins R	300-8447	83 D/1	1	1,2	91.10.10	KO	19.0	13.5	100		4				100 Rapids	0	2	0	40
Cummins R	300-8447	83 D/11	2	3	91.10.11	DV,MW	20.0	11.0	100	250	1	20	10	70		0	5	50	20
Dave Henry Ck	300-8328	83 D/11	1	1	91.10.14	CC,MW	12.9	7.4	50		3		10	90		0	1	50	30
Dave Henry Ck	300-8328	83 D/11	Canyon		91.10.15		7.0	7.0	40	200	15	40	20		40 Cascades	0	3		30
Dave Henry Ck	300-8328	83 D/14	2	2,3	91.10.14	DV	15.0	9.8	40	40	3		75	25		0	5	0	45
Dawson Ck	300-8333	83D/8	1	1	91.10.11	DV	20.0	16.0	50		3		90	10		0	3	0	40
Encampment Ck	300-8284	83 D/2	1	1,2		DV	12.0	8.3	85	200	6	10	25	10	55 Rapids/Cascades	0	6	0	30
Foster Ck	300-8293	83 D/7	1	1	91.10.11	MW	25.0	21.0	100		2		100			0	3	0	40
Grouse Ck	300-8302	83 D/7	1	1	91.10.19	DV	7.0	4.4	20		7				100 Rapids	0	10	0	50
Harvey Ck	300-8356	83 D/1	1	1,2	91.09.11	DV,KO,RB	13.3	11.8	80		4				100 Rapids	0	8	0	15
Harvey Ck	300-8356	83 D/8	2	3	91.10.11		10.0	5.0	40	200	1	40	20	40		0	5	100	40
Horse Ck	300-8330	83 D/11	1	1	91.10.15	DV,RB	12.0	6.0	70	90	4	10		90		0	2	0	30
Horse Ck	300-8330	83 D/10	2	2	91.10.18		4.3	4.3	20	80	1	20	50	30		0	4	100	20
Howard Ck	300-8298	83 D/7	1	1,2	91.10.17	DV	13.5	8.0	65		3		50		50 Rapids	0	8	50	35
Hugh Allen Ck	300-8343	83 D/7	1	3	91.10.17	DV	20.0	15.0	100		2				100 Rapids	0	2	20	30
Hugh Allen Ck	300-8343	83 D/7	2	2	91.10.17	MW	34.0	20.0	50	200	1	40	10	50		0	5	60	40
Hugh Allen Ck	300-8343		3																
Hugh Allen Ck	300-8343	83 D/8	4	1a,1b	91.10.17		10.0	7.0	40	200	4	10	10	30	50 Rapids	0	2	65	30

APPENDIX 2: Habitat summary by reach

Stream Name	Stream Code	NTS Map No.	Reach No.	Site No.s	Sample date	Fish Present	Mean Chan. Width (m)	Mean Wet Width (m)	Mean Max. Riffle Depth (cm)	Mean Max. Pool (cm)	Gradient %	Habitat type: Pool %	Habitat type: Riffle %	Habitat type: Run %	Habitat type: Other %	Side Channel (%)	Debris Area (%)	Stable Debris (%)	Total Cover (%)
Kinbasket R	300-8535	82N/13	1	1	91.09.02		20.9	20.0			3				100 Rapids	0	0		0
Kinbasket R	300-8535	82 N/13	2	3	91.10.11		34.0	25.0	100	150	2	10		45	45 Rapids	5	2	0	30
Kinbasket R	300-8535	82 N/13	3	2	91.10.11		200.0	32.5	40	150	1	5	50	45		100	4	0	20
Molson Ck	300-8359	83 D/1	1	1	91.09.11		14.0	8.0	100		8				100 Rapids	0	10	0	20
Molson Ck	300-8359	83 D/1	2	2	91.10.11	DV	11.0	6.5	30	100	1	20	30	50		0	3	50	20
Packsaddle Ck	300-8326	83 D14	1	1	91.10.14	DV,NSC,RB	22.0	9.5	30	70	2	10	70	20		0	2	50	20
Packsaddle Ck	300-8326	83 D14	2																
Prattle Ck	300-8693	82 N/14	1	1	91.09.09	CRH,DV,MW	20.0	15.0	80	250	1	30	70			0	5	0	20
Prattle Ck	300-8693	82 N/14	2	2,3,4,5	91.10.07		26.0	8.6	60	60	1		90	10		8	3	0	18
Ptarmigan Ck	300-8333	83 D/10	1	1,2	91.10.16	DV	29.0	14.0	100		3				100 Rapids	0	4	0	20
Ptarmigan Ck	300-8333	83 D/10	2	3	91.10.16	DV	14.0	13.0	70		3				100 Rapids	0	5	50	40
Ptarmigan Ck	300-8333	83 D/10	3	4	91.10.18		8.0	4.8	180	40	1	40	30	30		0	5	100	25
Succour Ck	300-8714	82 N/12	1	8	91.09.01	CRH,LSU,MW,RB	5.5	5.5			2	10	90			0	20	100	50
Succour Ck	300-8714	82 N/11	2	7	91.09.01	EB,LSU,RB	5.0	5.0			2	10	70	20		0	20	100	50
Succour Ck	300-8714	82 N/11	3	2,4,5,6	91.08.31	LSU,RB	14.0	14.0			0	5		20	75 Marsh/Glide	0	25	100	55
Sullivan R	300-8566		1																
Sullivan R	300-8566	82 N/13	2	1,12,13,14	91.10.07	KO,DV,MW	233.0	42.0	60	80	1		40	60		45	4	0	20
Sullivan R	300-8566	82 N/13	3	7,8,9,10,11	91.09.04	DV,MW	40.0	25.0			3	10	10	15	65 Rapids	1	1	0	10
Sullivan R	300-8566	83 C/4	4	3,4,5,6	91.09.04	DV,MW	47.0	33.0			2		85		15 Rapids	5	1	0	13
Sullivan R	300-8566	83 C/4	5	2	91.09.04		6.0	6.0				50			50 Rapids	0	0		0
Valenciennes R	300-8700-021	82 N/14	1	8	91.09.07		28.0	26.0			1		20	80		0	0		15
Valenciennes R	300-8700-021	82 N/14	2	1,7			23.0	23.0			2				100 Rapids	0	0		6
Valenciennes R	300-8700-021	82 N/14	3	5,6	91.09.06		165.0	82.0			2		60	40		250	5	0	6
Icefall Brook	300-8700-021-492	82 N/14	1	4	91.09.06		30.0	14.0			1		60	40		30	1	0	0
Icefall Brook	300-8700-021-492	82 N/14	2	3	91.09.06		19.0	16.0			2		30	50	20 Rapids	0	3	0	5
Icefall Brook	300-8700-021-492	82 N/14	3	2	91.09.06		194.0	67.5			1		30	70		100	1	0	0
Windfall Ck	300-8301	83 D/7	1	2	91.10.19	DV	10.0	7.0	40		4				100 Rapids	0	5	0	40
Windfall Ck	300-8301	83 D/7	2	1	91.10.17		11.0	8.0	30		1		100			0	0		15
Windfall Ck	300-8301	83 D/7	3																
Windfall Ck	300-8301	83 D/7	4																
Windy Ck	300-8554	82 M/16	1	1,2	91.09.03	(MW)	55.0	20.0	60		3		25	10	65 Rapids	7	3	0	20
Windy Ck	300-8554	82 M/16	2	3	91.10.07		40.0	11.0	40	120		10	50	40		20	5	0	50
Windy Ck	300-8554		3																
Wood R	300-8367	83 D/1	1	1	91.10.09	CC,DV,KO,MW	450.0	63.0	30	250	1	15	42	43		50	5	0	10
Wood R	300-8367		2																
Wood R	300-8367	83 D/8	3	6	91.10.11	MW	500.0	40.0	100	200	1	5	80	15		2	2	0	5
Wood R	300-8367		4																
Wood R	300-8367	83 C/15	5	4,5	91.10.11	EB	16.0	9.0	90	200	1	20	30	50		20	3	50	40
Yellow Jacket Ck	300-8329	83 D/11	1	1	91.10.15	DV,MW	18.0	8.5	80		4				100 Rapids	0	2	0	30
Yellow Jacket Ck	300-8329	83 D/15	2	2	91.10.18	DV	9.0	9.0	100		2		90	10		0	7	80	20

APPENDIX 2: Habitat summary by reach

Stream Name	Cover composition (%): Deep Pool	L.O.D.	Boulder	Instream Vegetation	Canopy	Cutbank	Turbidity	Crown Closure	Bed Material: Fines	Substrate composition (%): Small Gravels	Large Gravels	Small Cobble	Large Cobble	Boulder	Bedrock	D90 (cm)	Compaction	Banks: Height (m)	Unstable (%)	Texture	Confinement	Valley: Channel Ratio	Stage	Flood Signs (m)	Braided	Bars (%)	Water Temp. C	Turbidity (cm)
Bachelor Ck	2	10	83		2	3		0	10	10	15	10	18	35	2	70	M	1.5	20	GL	CO	0-5	M	1.0		10	7.5	190
Bachelor Ck	30	10			40	20			25	30	40	5				10	L	0.5	100	F	UC	5-10	M	0.5	N	25	4.0	200
Beaver R				100				5											0	FGL	EN	0-2	H			0		15
Beaver R								0	5	5	5	15	20	40	10	200	M	10.0	10	L	EN	0-2	H	2.0	N	0	6.5	15
Beaver R	5	5	90					3	5	5	13	18	35	25		50	M	2.0	5	FGL	EN	0-2	H	1.0	N	5	5.7	100
Beaver R		30	10		15	45		8	10	10	5	5	20	20	30	30	M	1.5	55	FG	FC	2-5	H	1.0		20	8.0	15
Blackman Ck			100					0	5	5	10	15	25	40		70	M	2.0	100	BC	EN	0-2	M		N	0	2.0	50
Blackman Ck		40			30	30		0	20	20	10	10	10	30		40	M	0.7	10	FGCB	CO	0-2	M		N	10	2.0	35
Bulldog Ck			100					30	5	5	5	10	15	40	20	50	M	1.0	100	R	EN	0-2	M	1.0	N	0		100
Bulldog Ck																												
Bulldog Ck			100					0	10	10	10	10	10	30	20		M	4.0	10		FC	2-5	M	0.3	N		1.0	Clear
Bush R			25				75	0	15	8	25	22	22	5	3	23	M	0.9	75	FGR	OC/CO	2-5	M	0.9	Y	35	6.0	35
Bush R			50				50	0	10			5	10	75		50	M	1.5	0	GL	CO	2-5	M	1.0	N	0	7.0	20
Bush R			100					0	10	5	10	10	20	30	15	20	L	2.0	0	LR	EN	N/A	M	3.0	N	10		15
Bush R																												
Bush R		5	15				80	0	10	5	15	25	35	10		22	M	0.7	60	FG	OC	0-5	M	0.8	Y	15	6.0	20
Bush R		10	40				50	50	8	10	20	10	40	10		26	M	1.0	80	FG	OC	2-5	M	1.0	Y	30	4.0	15
Chatter Ck			100					0	5	5	10	15	25	35	5	130	M	1.8	25	GLR	CO	0-2	M	0.7	N	20	4.5	175
Chatter Ck		30	40			30		0	5	10	30	30	20	5		26	L	1.0	100	FGL	FC	2-5	M	0.5	N	30	4.0	CLEAR
Chatter Ck																												
Cummins R			50				50	0	5	3	8	13	20	53		150	M	1.5	0	LR	CO	0-2	M	1.0	N	10	5.5	30
Cummins R	20	20			30	30		0	30	20	45	5				5	M	1.5	50	F	FC	2-5	M	1.0	N	5	5.0	30
Dave Henry Ck			95	5				5	20	10	10	15	15	30		100	M	4.0	10	G	CO	0-2	M	1.5	N		7.0	
Dave Henry Ck	50		50					20	5	5	15	15	20	30	10	100	L				EN	0-2	M					
Dave Henry Ck			85		10	5		6	3	10	13	20	23	33		80	M	0.7	20	L	FC	0-2/10+	M	1.0	N		5.5	100
Dawson Ck		10	80			10		0	5	5	10	15	35	30		40	M	1.0	30	BCF	FC	0-2	M	1.0	N	10	7.0	CLEAR
Encampment Ck	15	15	65			5		5	5	5	10	15	20	40	5	80	M	1.5	0	GLR	CO	0-2	M	1.0	N	7	6.7	Clear
Foster Ck		10	80			10		0	15	5	10	15	25	30		40	M	1.0	30	BCF	FC	0-2	M	0.7	N	10	6.0	10
Grouse Ck			70	30				0	5	5	10	20	20	40		100	M	2.0	20	BCF	EN	0-2	M	1.0	N		3.0	100
Harvey Ck		15	85					8	5	5	10	20	25	35		80	M	1.5	25	L	CO	0-2	M	1.0	N	5	7.0	150
Harvey Ck	10	20			30	40		0	15	10	75					6	L	1.0	100	F	UC	10+	M	0.8	N	50	7.0	150
Horse Ck			100					0	5		10	20	25	40		100	L	0.5	50	L	FC	N/A	M	0.5	N		8.0	CLEAR
Horse Ck		30			30	40		0	15	5	30	40	5	5		15	L	0.7	20	F	OC	2-5	M	0.4	N	15	2.0	Clear
Howard Ck		10	90					3	3	8	10	18	28	35		50	M	0.7	40	BC	OC		M	0.8	Y/N	5	0.0	100
Hugh Allen Ck			100					0	10	5	10	10	15	50		50	M	1.5	20	BC	CO	0-2	M	1.0	N	10	1.5	100
Hugh Allen Ck	20	40				40		0	10	10	10	10	30	30		13	M	1.0	100	F	OC	2-5	M	0.5	N	20	1.0	100
Hugh Allen Ck																												
Hugh Allen Ck	10	10	60		5	15		3	8	8	20	20	15	30		60	M	0.7	25	FB	OC	2-5	M	0.0	N	10	0.5	CLEAR

APPENDIX 2: Habitat summary by reach

Stream Name	Cover composition (%) Deep Pool	L.O.D.	Boulder	Instream Vegetation	Canopy	Cutbank	Turbidity	Crown Closure	Bed Material Fines	Substrate composition (%) Small Gravels	Large Gravels	Small Cobble	Large Cobble	Boulder	Bedrock	D90 (cm)	Compaction	Banks Height (m)	Unstable (%)	Texture	Confine-ment	Valley: Channel Ratio	Stage	Flood Signs (m)	Braided	Bars (%)	Water Temp. C	Turbid-ity (cm)
Kinbasket R								0	10			5	5	80		200	M	105.0	30	L	EN	0-2	H		N	0	6.5	20
Kinbasket R	10	10	70			10		0	10	10	15	20	20	25		70	M	1.0	30	GL	CO	0-2	M	0.7	N	20	4.0	150
Kinbasket R	20	60				20		0	20	15	30	25	10			15	L	1.0	100	FG	CO	0-2	L	1.0	Y	80	4.0	150
Molson Ck			100					5	5	5	10	10	10	50	10	150	M	2.0	0	LR	EN	0-2	M	1.0	N	0	7.0	0
Molson Ck		20			20	60		0	5	10	50	25	10			10	M	0.7	50	F	OC	2-5	M	0.5	N	50	6.0	CLEAR
Packsaddle Ck		25	50			25		10	10	10	15	25	30	10		25	M	0.5	50	L	CO	N/A	M	0.5	N	10	6.0	CLEAR
Packsaddle Ck																												
Prattle Ck	20		60				20	5	10			10	20	50	10	80	M	0.0	0	LR	EN	0-2	M	0.8	N	0	7.0	20
Prattle Ck		3	95		3			0	5	10	20	20	25	20		60	L	1.2	75	G	CO	0-2	M	1.1	N	50	4.0	100
Ptarmigan Ck			100					0	5	5	10	10	15	55		90	M	2.0	50	B	CO	0-2	M	2.0	N	20	3.0	25
Ptarmigan Ck		20	30		30	20		0	10	5	10	20	25	30		50	M	1.0	50	FBC	CO	0-2	M	0.5	N	5	1.5	40
Ptarmigan Ck		30			30	40		5	50	25	25					5	L	0.5	20	F	UC	10+	M	0.5	N	15	1.5	Clear
Succour Ck		50	10		30	10		100	10	10	20	30	20	10		26	M	1.0	0	F	OC	10+	H	0.3	N	0	14.0	0
Succour Ck		50	10		30	10		100	10	10	20	30	20	10		26	M	1.0	0	FG	CO	10+	H	0.0	N	0	14.5	0
Succour Ck		30		45	20	10		30	55	25	20					2	M	1.7	0	F	CO	10+	H	0.0	N	0	13.0	
Sullivan R																												
Sullivan R		40	25				35	0	15	5	15	20	35	10		20	M	1.0	90	FG	OC	2-5	M	1.0	Y	80	7.0	10
Sullivan R		5	90		5			5	10	5	5	10	30	35	5	125	M	2.0	25	FGL	EN	0-2	H	1.0	N	15	5.2	16
Sullivan R		5	85			10		0	15	5	15	20	25	20		29	L	0.6	65	FG	FC	0-2	M	0.7	N	30	5.6	8
Sullivan R								20					0	50	50			40.0	0	R	EN	0-2	M		N	0		20
Valenciennes R			50				50		5	5	5	20	40	20	5	50	M	2.5	0	GL	CO	0-2	M	0.7	N	10	6.0	35
Valenciennes R			75				25	0	5	5	10	15	30	30	5	125	M	2.0	25	GLR	CO	0-2	M	1.4	N	2	7.0	20
Valenciennes R		15					85	0	15	15	30	25	15			12	M	0.5	100	G	OC	0-5	M	0.5	Y	200	7.0	12
Icefall Brook								0	20	5	25	30	20			15	M	0.5	100	G	OC	2-5	M	0.5	Y		9.0	30
Icefall Brook			100					0	10	5	5	20	30	30		100	M	2.0	100	G	CO	0-2	M	0.5	N	0	9.0	300
Icefall Brook								0	20	10	40	30				10	L	0.5	100	FG	FC	0-2	M	0.5	Y	20	9.0	30
Windfall Ck			90	10				5		5	5	10	30	50		100	M	2.0	20	BC	EN	0-2	M	0.5	N		2.5	100
Windfall Ck		10		70	20			0	5		10	30	45	10		26	M	1.5	50	F	FC	2-5	M	0.5	N	20	0.0	CLEAR
Windfall Ck																												
Windfall Ck																												
Windy Ck		10	50		5	5	30	5	10		5	10	25	50		100	M	2.0	35	FGL	CO	0-2	M	0.8	N	30	4.0	25
Windy Ck		10	0		10	80		0	15	5	15	35	30			20	M	0.7	10	FG	FC	2-5	M	0.5	N	50	6.0	40
Windy Ck																												
Wood R	50	30					20	0	20	10	30	35	5			12	L	1.0	60	FG	CO	0-2	L	1.0	Y	85	6.0	100
Wood R																												
Wood R	50	50						0	15	5	30	40	10			150	M	0.7	100	G	CO	0-2	M	0.8	Y	80	5.0	25
Wood R																												
Wood R	10	20		10	60			0	25	35	40					5	M	0.5	50	F	OC	10+	M	1.0	N	15	7.5	110
Yellow Jacket Ck			100					0	5	5	10	10	15	55		100	M	1.5	100	BC	N/A	N/A	M	1.4	N	20	8.0	CLEAR
Yellow Jacket Ck		20	60			20		0	5	5	10	15	25	40		40	M	0.8	20	BCF	OC	2-5	M	0.5	N	15	1.5	Clear

APPENDIX 3: Fish catch summary

System	Stop net	Pass #	Site #	Set #	Date	Method	Length (m)	Width (m)	Area (m2)	Time (sec)	Kokanee	Dolly Varden	Mountain Whitefish	Rainbow Trout	Cottids	LSU	LNC	Brook Trout	CRH	NSC	CBA	Total catch
BACHELOR	-	-	1	1	Sept 10	Float			1350													0
BACHELOR	YES	-	2	1	Sept 10	ES			48													0
BACHELOR	YES	-	3	1	Sept 10	ES			120													0
BLACKMAN	YES	-	1	1	Oct 17	ES			60			1										1
BLACKMAN	NO	-	1	2	Oct 17	ES			50	200												0
BLACKMAN	-	-	1	3	Oct 17	BS			36			3										3
BLACKMAN	-	-	1	4	Oct 17	BS			36			1										1
BLACKMAN	-	-	1	5	Oct 17	BS			42			1										1
BLACKMAN	YES	-	2	1	Oct 17	ES			36	120												0
BLACKMAN	NO	-	2	2	Oct 17	ES			100			3										3
BULLDOG	YES	-	1	1	Oct 18	ES			96													0
BULLDOG	NO	-	1	2	Oct 18	ES			400	204												0
BEAVER	-	-	5	1	Aug 29	BS	10.0	4.0	40													0
BEAVER	-	-	5	2	Aug 29	BS	10.0	4.0	40			1										1
BEAVER	-	-	5	3	Aug 29	BS	10.0	4.0	40				4									4
BEAVER	-	-	5	4	Aug 29	BS	10.0	4.0	40				1									1
BEAVER	-	-	5	5	Aug 29	BS	10.0	4.0	40													0
BEAVER	-	-	5	6	Aug 29	BS	6.0	4.0	24						2							2
BEAVER	-	-	7	1	Aug 30	BS	8.0	4.0	32						1							1
BEAVER	-	-	7	2	Aug 30	BS	8.0	4.0	32				4									4
BEAVER	-	-	7	3	Aug 30	BS	12.0	4.0	48			1										1
BEAVER	-	-	7	4	Aug 30	BS	10.0	4.0	40				1		1							2
BEAVER	-	-	7	5	Aug 30	BS	5.0	5.0	25													0
BEAVER	-	-	8	1	Aug 30	BS	10.0	4.0	40													0
BEAVER	-	-	8	2	Aug 30	BS	10.0	4.0	40			1	1									2
BEAVER	-	-	8	3	Aug 30	BS	10.0	4.0	40													0
BEAVER	-	-	9	1	Aug 30	BS	10.0	5.0	50				2									2
BEAVER	-	-	9	2	Aug 30	BS	8.0	4.0	32				2									2
BEAVER	-	-	10	1	Aug 30	BS	9.0	4.0	36				1									1
BUSH	-	-	2	1	Sept 7	BS			6													0
BUSH	-	-	2	2	Sept 7	BS			18													0
BUSH	-	-	3	1	Sept 7	BS			28													0
BUSH	-	-	3	2	Sept 7	BS			30													0
BUSH	-	-	3	3	Sept 7	BS			45													0
BUSH	-	-	3	4	Sept 7	BS			28													0
BUSH	-	-	3	5	Sept 7	BS			70				2									2
BUSH	-	-	3	6	Sept 8	BS			120													0
BUSH	-	-	4	1	Sept 8	BS			100													0
BUSH	-	-	4	2	Sept 8	BS			150				1									1
BUSH	-	-	4	3	Sept 8	BS			150				3									3
BUSH	-	-	4	4	Sept 8	BS			64				1									1
BUSH	-	-	4	5	Sept 8	BS			180													0
BUSH	-	-	4	6	Sept 8	BS			40													0
BUSH	-	-	5	1	Sept 8	BS			45				3									3
BUSH	-	-	5	2	Sept 8	BS			100				23									23

APPENDIX 3: Fish catch summary

System	Stop net	Pass #	Site #	Set #	Date	Method	Length (m)	Width (m)	Area (m2)	Time (sec)	Kokanee	Dolly Varden	Mountain Whitefish	Rainbow Trout	Cottids	LSU	LNC	Brook Trout	CRH	NSC	CBA	Total catch
BUSH	-	-	5	3	Sept 8	BS			90				3									3
BUSH	-	-	5	4	Sept 8	BS			80				1									1
BUSH	-	-	5	5	Sept 8	BS			40				9									9
BUSH	-	-	8	1	Sept 8	BS			35													0
BUSH	-	-	8	2	Sept 8	BS			21													0
BUSH	-	-	8	3	Sept 8	BS			80													0
BUSH	-	-	8	4	Sept 8	BS			56			1	7									8
BUSH	-	-	8	5	Sept 8	BS			60													0
BUSH	-	-	8	6	Sept 8	BS			70				3									3
BUSH	-	-	9	1	Sept 8	BS			25													0
BUSH	-	-	9	2	Sept 8	BS			64													0
BUSH	-	-	9	3	Sept 8	BS			45				5						1			6
BUSH	-	-	9	4	Sept 8	BS			60													0
BUSH	-	-	9	5	Sept 8	BS			100													0
BUSH	-	-	9	6	Sept 8	BS			100													0
BUSH	-	-	9	7	Sept 8	BS			100				1									1
BUSH	-	-	9	8	Sept 8	BS			115				1									1
BUSH	-	-	9	9	Sept 8	BS			100				7									7
BUSH	-	-	10	1	Oct 7	BS					25											25
CHATTER	NO	-	1	1	Sept 9	ES			600	1788		1	8						4			13
CHATTER	NO	-	3	1	Oct 7	ES			100		15		1									16
CHATTER	YES	-	4	1	Oct 7	ES			135			1										1
CHATTER	YES	-	4	2	Oct 7	ES			180			2										2
CUMMINS	-	-	1	1	Oct 10	BS					20											20
CUMMINS	YES	-	2	1	Oct 11	ES			96	77												0
CUMMINS	NO	-	2	2	Oct 11	ES				178												0
CUMMINS	-	-	3	1	Oct 11	BS			96			1	8									9
CUMMINS	-	-	3	2	Oct 11	BS			50				1									1
CUMMINS	-	-	3	3	Oct 11	BS			32				13									13
CUMMINS	-	-	3	4	Oct 11	BS			48				5									5
CUMMINS	-	-	3	5	Oct 11	BS			32				3									3
CUMMINS	-	-	3	6	Oct 11	BS			25				1									1
CUMMINS	-	-	3	7	Oct 11	BS			25				16									16
DAVE HENRY	YES	PASS 1	1	1	Oct 14	ES			68	164			2								6	8
DAVE HENRY	YES	PASS 2	1	2	Oct 14	ES			68	164											4	4
DAVE HENRY	NO		1	3	Oct 14	ES	75.0	7.5	563	353											2	2
DAVE HENRY	NO		2	1	Oct 14	ES	50.0	12.0	600	380		5										5
DAVE HENRY	YES		3	1	Oct 15	ES	7.0	15.0	105	350		1										1
DAVE HENRY	NO		3	2	Oct 15	ES	75.0	7.2	540	478		6										6
DAWSON	YES		1	1	Oct 11	ES			48			5										5
ENCAMPMENT	NO		1	1	Sept 11	ES			60	497		4										4
ENCAMPMENT	YES		2	1	Oct 11	ES			90			3										3
FOSTER	YES		1	1	Oct 11	ES			60				3									3
FOSTER	-		1	2	Oct 11	BS			40				2									2
FOSTER	NO		1	3	Oct 11	ES				480			5									5

APPENDIX 3: Fish catch summary

System	Stop net	Pass #	Site #	Set #	Date	Method	Length (m)	Width (m)	Area (m2)	Time (sec)	Kokanee	Dolly Varden	Mountain Whitefish	Rainbow Trout	Cottids	LSU	LNC	Brook Trout	CRH	NSC	CBA	Total catch
GROUSE	NO		1	1	Oct 19	ES	4.0	50.0	200	568		4										4
GROUSE	YES		1	2	Oct 19	ES	4.0	12.0	48	170												0
HARVEY	NO		1	1	Sept 11	ES			75			5										5
HARVEY	YES		1	2	Sept 11	ES			60			3										3
HARVEY	NO		3	1	Oct 11	ES				574												0
HARVEY	YES		1	1	Oct 11	ES			60		16			1								17
HORSE	YES	PASS 1	1	1	Oct 15	ES	13.0	6.5	85	200		1		3								4
HORSE	YES	PASS 2	1	2	Oct 15	ES	13.0	6.5	85	200		2										2
HORSE	NO	-	1	3	Oct 15	ES	50.0	6.2	310	296		3		4								7
HORSE	YES	-	2	1	Oct 18	ES	4.0	17.0	68	110												0
HORSE	NO	-	2	2	Oct 18	ES	40.0	4.0	160	152												0
HOWARD	YES	-	1	1	Oct 17	ES			240	180												0
HOWARD	NO	-	1	2	Oct 17	ES			75	120												0
HOWARD	YES	-	2	1	Oct 17	ES			24	100		1										1
HOWARD	NO	-	2	2	Oct 17	ES			30	341		3										3
H. ALLEN	NO	-	1	1	Oct 17	ES			50													0
H. ALLEN	-	-	2	2	Oct 17	BS			50			1	1									2
H. ALLEN	-	-	2	3	Oct 17	BS			60			1	5									6
H. ALLEN	-	-	2	4	Oct 17	BS			60				79									79
H. ALLEN	-	-	2	5	Oct 17	BS			75													0
H. ALLEN	-	-	2	6	Oct 17	BS			32													0
H. ALLEN	-	-	2	7	Oct 17	BS			40				80									80
H. ALLEN	-	-	2	8	Oct 17	BS			60													0
H. ALLEN	YES	PASS 1	3	1	Oct 17	ES			84	170		2										2
H. ALLEN	YES	PASS 2	3	2	Oct 17	ES			84	170												0
H. ALLEN	NO	-	3	3	Oct 17	ES			150	560		5										5
ICEBROOK	-	-	2	1	Sept 6	BS			10													0
ICEBROOK	-	-	2	2	Sept 6	BS			10													0
ICEBROOK	-	-	2	3	Sept 6	BS			30													0
ICEBROOK	-	-	2	4	Sept 6	BS			60													0
ICEBROOK	-	-	3	1	Sept 6	BS			20													0
ICEBROOK	-	-	4	1	Sept 6	BS			36													0
KINBASKET	-	-	1	1	Oct 11	BS					20											20
KINBASKET	NO	-	2	1	Oct 11	ES			100	600												0
KINBASKET	-	-	2	2	Oct 11	BS			60													0
KINBASKET	-	-	2	3	Oct 11	BS			48													0
KINBASKET	YES	-	3	1	Oct 11	ES			84													0
KINBASKET	NO	-	3	2	Oct 11	ES				480												0
MOLSEN	NO	-	1	1	Sept 11	ES			30	127												0
MOLSEN	YES	PASS 1	2	1	Oct 11	ES			95			3										3
MOLSEN	YES	PASS 2	2	2	Oct 11	ES			95													0
MOLSEN	NO	-	2	2	Oct 11	ES			100	502		5										5
PACKSADDLE	YES	-	1	1	Oct 14	ES			180	270										1		1
PACKSADDLE	YES	PASS 1	2	1	Oct 14	ES			81	195		1									11	12
PACKSADDLE	YES	PASS 2	2	2	Oct 14	ES			81	211				1							4	5

APPENDIX 3: Fish catch summary

System	Stop net	Pass #	Site #	Set #	Date	Method	Length (m)	Width (m)	Area (m2)	Time (sec)	Kokanee	Dolly Varden	Mountain Whitefish	Rainbow Trout	Cottids	LSU	LNC	Brook Trout	CRH	NSC	CBA	Total catch
PACKSADDLE	NO	-	3	1	Oct 14	ES			420	440		2		8							3	13
PRATTLE	YES	-	1	1	Sept 9	ES			96			2	2						18			22
PRATTLE	YES	-	2	1	Oct 7	ES			140													0
PRATTLE	YES	-	2	2	Oct 7	ES			140													0
PTARMIGAN	NO	-	1	1	Oct 16	ES			100	660		3										3
PTARMIGAN	YES	PASS 1	2	1	Oct 16	ES			28	160		2										2
PTARMIGAN	YES	PASS 2	2	2	Oct 16	ES			28	160												0
PTARMIGAN	NO	-	2	3	Oct 16	ES			300	550		4										4
PTARMIGAN	YES	-	3	1	Oct 18	ES			50	130												0
PTARMIGAN	NO	-	3	2	Oct 18	ES			200	170												0
COMFORT L.	NO	-	1	1	Aug 31	ES				244												0
SUCCOUR	NO	-	2	1	Aug 31	ES				360						2						2
SUCCOUR	YES	PASS 1	3	1	Aug 31	ES	15.8	25.0	395					9								9
SUCCOUR	YES	PASS 2	3	2	Aug 31	ES	15.8	25.0	395													0
SUCCOUR	YES	PASS 1	4	1	Aug 31	ES	7.3	3.8	28					6		1						7
SUCCOUR	YES	PASS 2	4	2	Aug 31	ES	7.3	3.8	28					3								3
SUCCOUR	NO	-	6	1	Sept 1	ES				1047				4			4					8
SUCCOUR	YES	PASS 1	7	1	Sept 1	ES	20.2	5.0	101					25			1	1				27
SUCCOUR	YES	PASS 2	7	2	Sept 1	ES	20.2	5.0	101					5								5
SUCCOUR	YES	PASS 1	8	1	Sept 1	ES	17.3	5.5	95				1	9		2			5			17
SUCCOUR	YES	PASS 2	8	2	Sept 1	ES	17.3	5.5	95					5					1			6
SUCCOUR	-	-	8	3	Oct 6	BS					50											50
SULLIVAN	-	-	BAY	1	Sept 3	ANG					2											2
SULLIVAN	-	-	1	1	Sept 3	BS			140			1							1			2
SULLIVAN	-	-	1	2	Sept 3	BS			175			1	23									24
SULLIVAN	-	-	1	3	Sept 3	BS			120			1										1
SULLIVAN	-	-	3	1	Sept 4	BS			12													0
SULLIVAN	-	-	3	2	Sept 4	BS			12													0
SULLIVAN	-	-	3	3	Sept 4	BS			12													0
SULLIVAN	-	-	4	1	Sept 4	BS	8.0	3.0	24			1										1
SULLIVAN	-	-	5	1	Sept 4	BS	6.0	6.0	36													0
SULLIVAN	-	-	5	2	Sept 4	BS			36													0
SULLIVAN	-	-	5	3	Sept 4	BS	25.0	6.0	150													0
SULLIVAN	-	-	5	4	Sept 4	BS	8.0	2.5	20				1									1
SULLIVAN	-	-	6	1	Sept 4	BS			21													0
SULLIVAN	-	-	6	2	Sept 4	BS			105			9	1									10
SULLIVAN	-	-	6	3	Sept 4	BS			112			1	3									4
SULLIVAN	-	-	6	4	Sept 4	BS			60													0
SULLIVAN	-	-	6	5	Sept 4	BS			12													0
SULLIVAN	-	-	9	1	Sept 5	BS			32													0
SULLIVAN	-	-	9	2	Sept 5	BS			32			1	2									3
SULLIVAN	-	-	9	3	Sept 5	BS			32			1										1
SULLIVAN	YES	-	TRIB.3	1	Sept 5	ES			120													0
SULLIVAN	-	-	13	1	Sept 5	BS			56			1	1									2
SULLIVAN	-	-	13	2	Sept 5	BS			120													0

APPENDIX 3: Fish catch summary

System	Stop net	Pass #	Site #	Set #	Date	Method	Length (m)	Width (m)	Area (m2)	Time (sec)	Kokanee	Dolly Varden	Mountain Whitefish	Rainbow Trout	Cottids	LSU	LNC	Brook Trout	CRH	NSC	CBA	Total catch
SULLIVAN	-	-	13	3	Sept 5	BS			60													0
SULLIVAN	-	-	13	4	Sept 5	BS			120													0
SULLIVAN	-	-	13	5	Sept 5	BS			180			1										1
SULLIVAN	-	-	13	6	Sept 5	BS			240			1										1
SULLIVAN	-	-	13	7	Sept 5	BS			90													0
SULLIVAN	-	-	13	7	Sept 5	BS			90				2									2
SULLIVAN	-	-	14	1	Sept 5	BS			42				2									2
SULLIVAN	-	-	14	2	Sept 5	BS			18													0
SULLIVAN	-	-	14	3	Sept 5	BS			24			1										1
SULLIVAN	-	-	14	4	Sept 5	BS			60				4									4
SULLIVAN	-	-	15	1	Sept 5	BS			90				3									3
SULLIVAN	-	-	16	1	Oct 7	BS					23											23
VALENCIENNES	-	-	5	1	Sept 6	BS			16													0
VALENCIENNES	-	-	6	1	Sept 6	BS			32													0
VALENCIENNES	-	-	6	2	Sept 6	BS			40													0
VALENCIENNES	-	-	8	1	Sept 7	BS			175													0
VALENCIENNES	-	-	8	2	Sept 7	BS			175													0
VALENCIENNES	-	-	8	3	Sept 7	BS			40				8									8
VALENCIENNES	-	-	8	4	Sept 7	BS			10													0
VALENCIENNES	-	-	8	5	Sept 7	BS			100													0
WINDFALL	YES	-	1	1	Oct 17	ES			144	200												0
WINDFALL	NO	-	1	2	Oct 17	ES			100	707												0
WINDFALL	NO	-	2	1	Oct 19	ES			300	554		5										5
WINDFALL	YES	-	2	2	Oct 19	ES			90	240		1										1
WINDY	-	-	1	1	Sept 3	BS			10													0
WINDY	-	-	1	2	Sept 3	BS			10													0
WINDY	-	-	1	3	Sept 3	BS			10													0
WINDY	-	-	1	4	Sept 3	BS			10													0
WINDY	YES	-	3	1	Oct 7	ES			72													0
WINDY	-	-	3	2	Oct 7	BS			64													0
WINDY	-	-	3	3	Oct 7	BS			48													0
WINDY	-	-	3	4	Oct 7	BS			40													0
WINDY	-	-	2	1	Oct 7	ES			72													0
WINDY	NO	-	2	2	Oct 7	ES	40.0	2.5	100													0
WOOD	-	-	1	1	Oct 9	BS			56													0
WOOD	-	-	1	2	Oct 9	BS			70													0
WOOD	-	-	1	3	Oct 9	BS			105		1											1
WOOD	-	-	2	1	Oct 9	BS			126		15		1									16
WOOD	-	-	2	2	Oct 9	BS			140		1											1
WOOD	-	-	2	3	Oct 9	BS			105						1							1
WOOD	-	-	3	1	Oct 9	BS			140													0
WOOD	-	-	3	2	Oct 9	BS			105		1	1										2
WOOD	-	-	3	3	Oct 9	BS			126		18		3									21
WOOD	-	-	3a	1	Oct 9	BS			70		28											28
WOOD	-	-	3a	2	Oct 9	BS			120				4									4

APPENDIX 3: Fish catch summary

System	Stop net	Pass #	Site #	Set #	Date	Method	Length (m)	Width (m)	Area (m2)	Time (sec)	Kokanee	Dolly Varden	Mountain Whitefish	Rainbow Trout	Cottids	LSU	LNC	Brook Trout	CRH	NSC	CBA	Total catch
WOOD	-	-	3a	3	Oct 9	BS			72		6											6
WOOD	-	-	3a	4	Oct 9	BS			150		7											7
WOOD (ALNUS)	NO	-	4	1	Oct 11	ES				300								2				2
WOOD (ALNUS)	-	-	4	2	Oct 11	BS			20													0
WOOD (ALNUS)	-	-	4	3	Oct 11	BS			20													0
WOOD (ALNUS)	-	-	4	4	Oct 11	BS			42													0
WOOD (ALNUS)	-	-	4	5	Oct 11	BS			16													0
WOOD (FORTRESS)	NO		5	1	Oct 11	ES			250	780								23				23
WOOD	-	-	6	2	Oct 11	BS			40													0
WOOD	-	-	6	3	Oct 11	BS			60				5									5
WOOD	-	-	6	4	Oct 11	BS			96													0
WOOD	-	-	6	5	Oct 11	BS			96				1									1
WOOD	-	-	6	6	Oct 11	BS			32													0
Y. JACKET	YES	-	1	2	Oct 15	ES	11.0	2.5	28				1									1
Y. JACKET	NO	-	1	2	Oct 15	ES	300.0	2.5	750	1836		4	2									6
Y. JACKET	YES	-	2	1	Oct 18	ES	6.0	12.0	72	200												0
Y. JACKET	NO	-	2	2	Oct 18	ES	4.0	50.0	200	243		4										4
																						0
					Totals						248	130	389	83	5	5	5	26	30	1	30	952

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
1	DV	Beaver R	5	4	Aug 29	BS	201		100.80			1							
2	MW	Beaver R	5	4	Aug 29	BS	188		62.40			2	3						
3	MW	Beaver R	5	4	Aug 29	BS	132		21.50			3	2						
4	MW	Beaver R	5	4	Aug 29	BS	65		2.35			4	0						
5	MW	Beaver R	5	4	Aug 29	BS	65		2.60			5	0						
6	MW	Beaver R	5	4	Aug 29	BS	53		1.20			6	0						
7	CC	Beaver R	5	4	Aug 29	BS	35												
8	CC	Beaver R	5	4	Aug 29	BS	33												
1	DV	Beaver R	7-8	4	Aug 30	BS	302		309.50			7		1					
2	MW	Beaver R	7-8	4	Aug 30	BS	150		32.60			9	2						
3	CC	Beaver R	7-8	4	Aug 30	BS	60												
4	CC	Beaver R	7-8	4	Aug 30	BS	34												
5	MW	Beaver R	7-8	4	Aug 30	BS	84		4.80			10	1						
6	MW	Beaver R	7-8	4	Aug 30	BS	229		136.10			11	4						
7	DV	Beaver R	7-8	4	Aug 30	BS	214		100.50			8		2					
8	MW	Beaver R	7-8	4	Aug 30	BS	143		29.60			12	2						
9	MW	Beaver R	7-8	4	Aug 30	BS	121		16.90			13	2						
10	MW	Beaver R	7-8	4	Aug 30	BS	98		8.80			14	1						
11	MW	Beaver R	7-8	4	Aug 30	BS	50		1.30			15	0						
12	MW	Beaver R	7-8	4	Aug 30	BS	98		9.40			16	1						
13	MW	Beaver R	7-8	4	Aug 30	BS													
14	MW	Beaver R	7-8	4	Aug 30	BS													
15	MW	Beaver R	7-8	4	Aug 30	BS													
1	DV	Blackman	1	2	Oct 17	ES	261		165.00	F									
2	DV	Blackman	1	2	Oct 17	ES	183		69.50	M									
3	DV	Blackman	1	2	Oct 17	ES	237		127.10										
4	DV	Blackman	1	2	Oct 17	ES	250		150.00	F									
5	DV	Blackman	1	2	Oct 17	ES	182		64.70	M									
6	DV	Blackman	1	2	Oct 17	ES	102		12.60										
1	DV	Blackman	2	1	Oct 17	ES	207		92.60	M									
2	DV	Blackman	2	1	Oct 17	ES	192		67.90										
3	DV	Blackman	2	1	Oct 17	ES	105		12.70										
1	MW	Bush R	3	4	Sept 7	BS	272		260.00		A	1	5						
2	MW	Bush R	3	4	Sept 7	BS	182		68.30		J	2	3						
1	MW	Bush R	4	4	Sept 8	BS	112		14.10		J	1	1						
2	MW	Bush R	4	4	Sept 8	BS	138		26.20		J	2	2						
3	MW	Bush R	4	4	Sept 8	BS	186		64.25		A	3	3						
4	MW	Bush R	4	4	Sept 8	BS	185		65.70		A	4	3						
5	MW	Bush R	4	4	Sept 8	BS	153		38.15		J	5	2						
1	MW	Bush R	5	4	Sept 8	BS	254		200.00		A	1	4						
2	MW	Bush R	5	4	Sept 8	BS	227		134.10		A	2	4						

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
3	MW	Bush R	5	4	Sept 8	BS	253		220.00		A	3							
4	MW	Bush R	5	4	Sept 8	BS	212		98.10		A	4	4						
5	MW	Bush R	5	4	Sept 8	BS	214		96.10		A	5	4						
6	MW	Bush R	5	4	Sept 8	BS	111		12.05		J	6	1						
7	MW	Bush R	5	4	Sept 8	BS	142		26.60		J	7	2						
8	MW	Bush R	5	4	Sept 8	BS	109		12.65		J	8	1						
9	MW	Bush R	5	4	Sept 8	BS	55		1.40		F	9	0						
10	MW	Bush R	5	4	Sept 8	BS	92		7.00		J	10	1						
12	MW	Bush R	5	4	Sept 8	BS	105		10.60		J	11	1						
13	MW	Bush R	5	4	Sept 8	BS	100		8.30		J	12	1						
14	MW	Bush R	5	4	Sept 8	BS	54		1.30		F	13	0						
15	MW	Bush R	5	4	Sept 8	BS	100		9.40		J	14	1						
16	MW	Bush R	5	4	Sept 8	BS	100		8.65		J	15	1						
17	MW	Bush R	5	4	Sept 8	BS	91		6.50		J	16	1						
18	MW	Bush R	5	4	Sept 8	BS	105		9.95		J	17	1						
19	MW	Bush R	5	4	Sept 8	BS	98		8.20		J	18	1						
20	MW	Bush R	5	4	Sept 8	BS	95		7.10		J	19	1						
21	MW	Bush R	5	4	Sept 8	BS	98		8.40		J	20	1						
22	MW	Bush R	5	4	Sept 8	BS	100		8.30		J	21	1						
23	MW	Bush R	5	4	Sept 8	BS	88		6.00		J	22	1						
24	MW	Bush R	5	4	Sept 8	BS	107		11.15		J								
25	MW	Bush R	5	4	Sept 8	BS	143		29.40		A	23	2						
26	MW	Bush R	5	4	Sept 8	BS	173		58.70		A	24	3						
27	MW	Bush R	5	4	Sept 8	BS	145		32.40		A	25	2						
28	MW	Bush R	5	4	Sept 8	BS	54		1.35		F	26	0						
29	MW	Bush R	5	4	Sept 8	BS	99		8.50		J								
30	MW	Bush R	5	4	Sept 8	BS	115		13.95		J								
31	MW	Bush R	5	4	Sept 8	BS	99		8.90		J								
32	MW	Bush R	5	4	Sept 8	BS	102		9.25		J								
33	MW	Bush R	5	4	Sept 8	BS	107		11.15		J								
34	MW	Bush R	5	4	Sept 8	BS	106		10.80		J								
35	MW	Bush R	5	4	Sept 8	BS	105		11.60		J								
36	MW	Bush R	5	4	Sept 8	BS	98		8.15		J								
37	MW	Bush R	5	4	Sept 8	BS	88		6.00		J								
38	MW	Bush R	5	4	Sept 8	BS	95		7.70		J								
39	MW	Bush R	5	4	Sept 8	BS	145		30.00		J	27	2						
40	MW	Bush R	5	4	Sept 8	BS	96		7.95		J								
1	DV	Bush R	8	2	Sept 8	BS	547		1500.00	F	T								
2	MW	Bush R	8	2	Sept 8	BS	244		142.00		A	28	4						
3	MW	Bush R	8	2	Sept 8	BS	256		192.00		A	29	4						
4	MW	Bush R	8	2	Sept 8	BS	260		175.00		A	30	4						

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
5	MW	Bush R	8	2	Sept 8	BS	184		65.85		J	31	3						
6	MW	Bush R	8	2	Sept 8	BS	198		78.80		J	32	3						
7	MW	Bush R	8	2	Sept 8	BS	197		71.95		J	33	3						
8	MW	Bush R	8	2	Sept 8	BS	148		37.35		J	34	2						
9	MW	Bush R	8	2	Sept 8	BS	98		9.95		J	35	1						
10	MW	Bush R	8	2	Sept 8	BS	104		10.70		J	36	1						
11	MW	Bush R	8	2	Sept 8	BS	92		7.85		J	37	1						
1	MW	Bush R	9	1	Sept 8	BS	148		30.25		J	38	2						
2	MW	Bush R	9	1	Sept 8	BS	134		23.45		J	39	2						
3	MW	Bush R	9	1	Sept 8	BS	146		27.80		J	40	2						
4	MW	Bush R	9	1	Sept 8	BS	115		15.05		J	41	1						
5	MW	Bush R	9	1	Sept 8	BS	100		9.20		J	42	1						
6	CRH	Bush R	9	1	Sept 8	BS	70		3.25										
7	MW	Bush R	9	1	Sept 8	BS	160				J								
8	MW	Bush R	9	1	Sept 8	BS	153				J								
9	MW	Bush R	9	1	Sept 8	BS	111				J								
10	MW	Bush R	9	1	Sept 8	BS	155				J								
11	MW	Bush R	9	1	Sept 8	BS	148				J								
12	MW	Bush R	9	1	Sept 8	BS	114				J								
13	MW	Bush R	9	1	Sept 8	BS	145				J								
14	MW	Bush R	9	1	Sept 8	BS	118				J								
15	MW	Bush R	9	1	Sept 8	BS	112				J								
1	KO	Bush R	10	1	Oct 7	BS	278	220	276.00	M	M			16	4.50	6.10			
2	KO	Bush R	10	1	Oct 7	BS	268	213	234.00	M	M			17	4.00	9.90			
3	KO	Bush R	10	1	Oct 7	BS	273	220	298.00	M	PS			18	4.50	7.00			
4	KO	Bush R	10	1	Oct 7	BS	272	218	254.00	M	M			19	4.00	12.00			
5	KO	Bush R	10	1	Oct 7	BS	287	231	278.00	M	PS			20	4.00	3.80			
6	KO	Bush R	10	1	Oct 7	BS	272	220	190.00	F	S			21	3.40				ER 0
7	KO	Bush R	10	1	Oct 7	BS	272	218	240.00	M	PS			22	3.40	2.50			
8	KO	Bush R	10	1	Oct 7	BS	285	228	280.00	M	PS			23	4.00	2.50			
9	KO	Bush R	10	1	Oct 7	BS	303	251	275.00	F	PS			24	4.50		4.9		
10	KO	Bush R	10	1	Oct 7	BS	287	230	308.00	M	PS			25	4.50	7.30			
11	KO	Bush R	10	1	Oct 7	BS	290	236	301.00	M	PS			26	4.00	4.40			
12	KO	Bush R	10	1	Oct 7	BS	289	234	289.00	F	T			27	4.50		4.8		
13	KO	Bush R	10	1	Oct 7	BS	285	229	299.00	M	PS			28	4.50	4.80			
14	KO	Bush R	10	1	Oct 7	BS	271	220	203.00	F	PS			29	4.50		4.8		
15	KO	Bush R	10	1	Oct 7	BS	280	223	285.00	M	T	1		30	4.00	2.80			
16	KO	Bush R	10	1	Oct 7	BS	276	223	306.00	M	M			31		12.00			
17	KO	Bush R	10	1	Oct 7	BS	280	225	223.00	F	PS	2		32	3.00		4.5		
18	KO	Bush R	10	1	Oct 7	BS		210	213.00	M	T			33	4.00	1.50			
19	KO	Bush R	10	1	Oct 7	BS	292	236	294.00	M	PS			34	4.00	5.80			

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
20	KO	Bush R	10	1	Oct 7	BS	277	222	235.00	F	M	3		35	5.00		4.3		
21	KO	Bush R	10	1	Oct 7	BS	282	234	260.00	F	T	4		36	4.00		4.50	511.00	
22	KO	Bush R	10	1	Oct 7	BS	287	237	257.00	F	M			37	4.50		4.5		
23	KO	Bush R	10	1	Oct 7	BS	284	227	260.00	F	M			38	4.00		4.7		
24	KO	Bush R	10	1	Oct 7	BS	276	225	273.00	M	M			39		12.50			
25	KO	Bush R	10	1	Oct 7	BS	282	230	299.00	M	PS			40	4.00	4.90			
1	MW	Chatter Ck	1	1	Sept 9	ES	161		38.00		J	1	2						
2	MW	Chatter Ck	1	1	Sept 9	ES	153		38.80		J	2	2						
3	MW	Chatter Ck	1	1	Sept 9	ES	230		135.55		A	3	4						
4	MW	Chatter Ck	1	1	Sept 9	ES	157		42.45		J	4	2						
5	CRH	Chatter Ck	1	1	Sept 9	ES	79		5.25										
6	CRH	Chatter Ck	1	1	Sept 9	ES	76		4.50										
7	DV	Chatter Ck	1	1	Sept 9	ES	72		3.40										
8	CRH	Chatter Ck	1	1	Sept 9	ES	72		4.40										
9	MW	Chatter Ck	1	1	Sept 9	ES													
10	MW	Chatter Ck	1	1	Sept 9	ES													
11	MW	Chatter Ck	1	1	Sept 9	ES													
12	MW	Chatter Ck	1	1	Sept 9	ES													
13	MW	Chatter Ck	1	1	Sept 9	ES													
1	KO	Chatter Ck	2	1	Oct 7	ES	279	227	210.00	F	S	1		1	4.00				
2	KO	Chatter Ck	2	1	Oct 7	ES	275	247	233.00	M	PS			2	4.00	4.30			
3	KO	Chatter Ck	2	1	Oct 7	ES	278	231	198.00	F	PS	2		3	4.00		4.4		
4	KO	Chatter Ck	2	1	Oct 7	ES	264	238	228.00	M	M	3		4	3.40	5.00			
5	KO	Chatter Ck	2	1	Oct 7	ES	275	224	301.00	M	M	4		5	3.40	4.40			
6	KO	Chatter Ck	2	1	Oct 7	ES	274	224	244.00	M	M	5		6	3.40	3.70			
7	KO	Chatter Ck	2	1	Oct 7	ES	274	223	210.00	F	S	6		7	4.00				
8	KO	Chatter Ck	2	1	Oct 7	ES	280	224	308.00	M	M			8	4.00	4.50			
9	KO	Chatter Ck	2	1	Oct 7	ES	280	228	240.00	M	PS	7		9	4.00	2.50			
10	KO	Chatter Ck	2	1	Oct 7	ES	283	237	239.00	F	M			10	4.00		4.4		
11	KO	Chatter Ck	2	1	Oct 7	ES	275	221	196.00	F	S			11	4.00				
12	KO	Chatter Ck	2	1	Oct 7	ES	275	226	211.00	F	PS			12	4.50		4.8		
13	KO	Chatter Ck	2	1	Oct 7	ES	282	227	271.00	M	PS			13	3.40	2.70			
14	KO	Chatter Ck	2	1	Oct 7	ES	269	222	190.00	F	PS			14	4.00		4.7		
15	KO	Chatter Ck	2	1	Oct 7	ES	267	208	248.00	M	M			15	3.40	5.00			
16	MW	Chatter Ck	2	1	Oct 7	ES	165		44.00		J	8							
1	DV	Chatter Ck	4	2	Oct 7	ES	121		17.00		J								
2	DV	Chatter Ck	4	2	Oct 7	ES	61		1.90		J								
3	DV	Chatter Ck	4	2	Oct 7	ES	50		1.10		J								
1	KO	Cummins R	1	1	Oct 10	BS	270	220	223.00	M	M			29	4.50	3.90			
2	KO	Cummins R	1	1	Oct 10	BS	283	228	244.00	M	M			30	4.00	6.30			
3	KO	Cummins R	1	1	Oct 10	BS	276	223	207.00	F	M			31	4.00		4.8		

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
4	KO	Cummins R	1	1	Oct 10	BS	282	232	272.00	F	M			32	4.00		5.0		
5	KO	Cummins R	1	1	Oct 10	BS	282	230	245.00	F	M			33			4.6		
6	KO	Cummins R	1	1	Oct 10	BS	305	247	337.00	M	M			34	3.40	6.90			
7	KO	Cummins R	1	1	Oct 10	BS	279	223	258.00	M	M			35	3.00	7.70			
8	KO	Cummins R	1	1	Oct 10	BS	295	240	284.00	M	M			36	4.00	5.30			
9	KO	Cummins R	1	1	Oct 10	BS	282	226	247.00	M	M			37	3.40	3.80			
10	KO	Cummins R	1	1	Oct 10	BS	275	231	236.00	F	T			38	4.00		4.90	445.00	
11	KO	Cummins R	1	1	Oct 10	BS	274	231	235.00	M	M					4.60			
12	KO	Cummins R	1	1	Oct 10	BS	282	231	247.00	M	M					4.80			
13	KO	Cummins R	1	1	Oct 10	BS	292	244	284.00	M	M					3.10			
14	KO	Cummins R	1	1	Oct 10	BS	287	235	257.00	F	M						4.3		
15	KO	Cummins R	1	1	Oct 10	BS	285	235	241.00	F	M						4.8		
16	KO	Cummins R	1	1	Oct 10	BS	270	222	191.00	F	M								
17	KO	Cummins R	1	1	Oct 10	BS	284	230	222.00	F	M						4.7		
18	KO	Cummins R	1	1	Oct 10	BS	289	238	214.00	F	M						5.0		
19	KO	Cummins R	1	1	Oct 10	BS	276	225	244.00	F	M						5.0		
20	KO	Cummins R	1	1	Oct 10	BS	263	219	204.00	M	M					4.15			
1	MW	Cummins R	3	2	Oct 11	BS	189		64.30			1	3						
2	MW	Cummins R	3	2	Oct 11	BS	201		73.20			2	3						
3	MW	Cummins R	3	2	Oct 11	BS	128		18.10			3	2						
4	MW	Cummins R	3	2	Oct 11	BS	106		9.70			4	1						
5	MW	Cummins R	3	2	Oct 11	BS	113		13.90			5	1						
6	MW	Cummins R	3	2	Oct 11	BS	87		5.90			6	1						
7	MW	Cummins R	3	2	Oct 11	BS	95		7.10			7	1						
8	MW	Cummins R	3	2	Oct 11	BS	44		0.50				0						
9	MW	Cummins R	3	2	Oct 11	BS	45		0.70				0						
10	MW	Cummins R	3	2	Oct 11	BS	41		0.40				0						
11	MW	Cummins R	3	2	Oct 11	BS	37		0.40				0						
12	MW	Cummins R	3	2	Oct 11	BS	37		0.35				0						
13	MW	Cummins R	3	2	Oct 11	BS	43		0.50				0						
14	MW	Cummins R	3	2	Oct 11	BS	45		0.75				0						
15	MW	Cummins R	3	2	Oct 11	BS	38		0.35				0						
16	MW	Cummins R	3	2	Oct 11	BS	48		1.00				0						
17	MW	Cummins R	3	2	Oct 11	BS	216		101.20			8	4						
18	MW	Cummins R	3	2	Oct 11	BS	142		27.60			9	2						
19	MW	Cummins R	3	2	Oct 11	BS	128		19.60			10	2						
20	MW	Cummins R	3	2	Oct 11	BS	114		12.40			11	2						
21	MW	Cummins R	3	2	Oct 11	BS	124		16.00			12	2						
22	MW	Cummins R	3	2	Oct 11	BS	85		4.90			13	1						
23	MW	Cummins R	3	2	Oct 11	BS	84		4.60			14	1						
24	MW	Cummins R	3	2	Oct 11	BS	104		9.50			15	1						

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
25	MW	Cummins R	3	2	Oct 11	BS	143		25.60			16	2						
26	MW	Cummins R	3	2	Oct 11	BS	103		84.50			17	1						
27	MW	Cummins R	3	2	Oct 11	BS	102		9.40			18	1						
28	MW	Cummins R	3	2	Oct 11	BS	92		5.70			19	1						
29	MW	Cummins R	3	2	Oct 11	BS	81		4.50			20	1						
30	MW	Cummins R	3	2	Oct 11	BS	103		9.70			21	1						
31	MW	Cummins R	3	2	Oct 11	BS	87		5.50			22	1						
32	MW	Cummins R	3	2	Oct 11	BS	90		5.80			23	1						
33	MW	Cummins R	3	2	Oct 11	BS	87		5.35			24	1						
34	MW	Cummins R	3	2	Oct 11	BS	85		4.75			25	1						
35	MW	Cummins R	3	2	Oct 11	BS	42		0.55										
36	MW	Cummins R	3	2	Oct 11	BS	39		0.45										
37	MW	Cummins R	3	2	Oct 11	BS	41		0.55										
38	MW	Cummins R	3	2	Oct 11	BS	45		0.80										
39	MW	Cummins R	3	2	Oct 11	BS	44		0.60										
40	MW	Cummins R	3	2	Oct 11	BS	48		1.00										
41	MW	Cummins R	3	2	Oct 11	BS	38		0.50										
42	MW	Cummins R	3	2	Oct 11	BS	49		0.80										
43	MW	Cummins R	3	2	Oct 11	BS	43		0.55										
44	MW	Cummins R	3	2	Oct 11	BS	42		0.55										
45	MW	Cummins R	3	2	Oct 11	BS	48		0.80										
46	MW	Cummins R	3	2	Oct 11	BS	42		0.60										
47	MW	Cummins R	3	2	Oct 11	BS													
48	MW	Cummins R	3	2	Oct 11	BS	93		7.30										
1	MW	Dave Henry	1	1	Oct 14	ES	102		10.15			1	2						
2	MW	Dave Henry	1	1	Oct 14	ES	109		12.60			2	2						
3	CBA	Dave Henry	1	1	Oct 14	ES	85		5.60										
4	CBA	Dave Henry	1	1	Oct 14	ES	87		7.50										
5	CBA	Dave Henry	1	1	Oct 14	ES	79		5.00										
6	CBA	Dave Henry	1	1	Oct 14	ES	77		4.60										
7	CBA	Dave Henry	1	1	Oct 14	ES	79		5.40										
8	CBA	Dave Henry	1	1	Oct 14	ES	63		2.40										
9	CBA	Dave Henry	1	1	Oct 14	ES	64		2.80										
10	CBA	Dave Henry	1	1	Oct 14	ES	84		6.20										
11	CBA	Dave Henry	1	1	Oct 14	ES	77		4.40										
12	CBA	Dave Henry	1	1	Oct 14	ES	71		3.40										
13	CBA	Dave Henry	1	1	Oct 14	ES	82		5.50										
14	CBA	Dave Henry	1	1	Oct 14	ES	77		4.80										
1	DV	Dave Henry	2	2	Oct 14	ES	182		69.00										
2	DV	Dave Henry	2	2	Oct 14	ES	185		67.90										
3	DV	Dave Henry	2	2	Oct 14	ES	172		45.80										

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
4	DV	Dave Henry	2	2	Oct 14	ES	112		11.50										
5	DV	Dave Henry	2	2	Oct 14	ES	73		3.90										
1	DV	Dave Henry	3	2	Oct 15	ES	196		50.40										
2	DV	Dave Henry	3	2	Oct 15	ES	177		52.40										
3	DV	Dave Henry	3	2	Oct 15	ES	192		65.00										
4	DV	Dave Henry	3	2	Oct 15	ES	60		1.80										
5	DV	Dave Henry	3	2	Oct 15	ES	79		4.50										
6	DV	Dave Henry	3	2	Oct 15	ES	73		2.50										
7	DV	Dave Henry	3	2	Oct 15	ES	43		0.80										
1	DV	Dawson Ck	1	1	Oct 11	ES	128		21.00										
2	DV	Dawson Ck	1	1	Oct 11	ES	53		1.40										
3	DV	Dawson Ck	1	1	Oct 11	ES	98		9.60										
4	DV	Dawson Ck	1	1	Oct 11	ES	148		33.20										
5	DV	Dawson Ck	1	1	Oct 11	ES	134		27.20										
1	DV	Encampment	2	1	Oct 11	ES	213		91.50										
2	DV	Encampment	2	1	Oct 11	ES	127		19.80										
3	DV	Encampment	2	1	Oct 11	ES	112		12.40										
1	DV	Encamp. Ck	1	1	Sept 11	ES	93		9.15		J								
2	DV	Encamp. Ck	1	1	Sept 11	ES	82		5.15		J								
3	DV	Encamp. Ck	1	1	Sept 11	ES	36		0.45		J								
4	DV	Encamp. Ck	1	1	Sept 11	ES	41		0.75		J								
1	MW	Foster Ck	1	1	Oct 11	ES/BS	228		136.00	F		1	4						
2	MW	Foster Ck	1	1	Oct 11	ES/BS	124		17.00	M		2	1						
3	MW	Foster Ck	1	1	Oct 11	ES/BS	191		88.00			3	3						
4	MW	Foster Ck	1	1	Oct 11	ES/BS	248		172.00	M		4	4						
5	MW	Foster Ck	1	1	Oct 11	ES/BS	161		43.00	F		5	2						
6	MW	Foster Ck	1	1	Oct 11	ES/BS	120		14.00	M		6	1						
7	MW	Foster Ck	1	1	Oct 11	ES/BS	138		24.00	M		7	1						
8	MW	Foster Ck	1	1	Oct 11	ES/BS	123		14.80	M		8	1						
9	MW	Foster Ck	1	1	Oct 11	ES/BS	101		9.60	M		9	1						
10	MW	Foster Ck	1	1	Oct 11	ES/BS	117		14.30	M		10	1						
1	DV	Grouse Ck	1	1	Oct 19	ES	43		0.75										
2	DV	Grouse Ck	1	1	Oct 19	ES	46		0.85										
3	DV	Grouse Ck	1	1	Oct 19	ES	58		1.60										
4	DV	Grouse Ck	1	1	Oct 19	ES	577		1800.00										
1	DV	Harvey Ck	1	1	Sept 11	ES	116		15.95		J								
2	DV	Harvey Ck	1	1	Sept 11	ES	105		12.80		J								
3	DV	Harvey Ck	1	1	Sept 11	ES	115		13.75		J								
4	DV	Harvey Ck	1	1	Sept 11	ES	102		10.85		J								
5	DV	Harvey Ck	1	1	Sept 11	ES	65		3.00		J								
6	DV	Harvey Ck	1	1	Sept 11	ES	47		1.20		J								

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
7	DV	Harvey Ck	1	1	Sept 11	ES	48		1.00		J								
8	DV	Harvey Ck	1	1	Sept 11	ES	36		0.45		J								
1	KO	Harvey Ck	2	1	Oct 11	BS	275	225	230.00	F	M			39	4.00		4.9		
2	KO	Harvey Ck	2	1	Oct 11	BS	269	219	199.00	F	PS			40	4.00		4.8		
3	KO	Harvey Ck	2	1	Oct 11	BS	263	215	288.00	M	M			41	4.00	16.10			
4	KO	Harvey Ck	2	1	Oct 11	BS	277	224	296.00	M	M			42	3.40	12.10			
5	KO	Harvey Ck	2	1	Oct 11	BS	273	223	231.00	F	M			43	3.40		5.1		
6	KO	Harvey Ck	2	1	Oct 11	BS	279	223	266.00	M	M			44	3.40	4.30			
7	KO	Harvey Ck	2	1	Oct 11	BS	266	215	262.00	M	M			45	4.50	7.50			
8	KO	Harvey Ck	2	1	Oct 11	BS	263	213	262.00	M	M			46	4.00	7.50			
9	KO	Harvey Ck	2	1	Oct 11	BS	281	233	282.00	F	M			47	4.00		5.1		
10	KO	Harvey Ck	2	1	Oct 11	BS	282	225	240.00	M	M			48	3.40	3.60			
11	KO	Harvey Ck	2	1	Oct 11	BS	286	231	340.00	M	M					7.30			
12	KO	Harvey Ck	2	1	Oct 11	BS	284	235	257.00	F	M						4.6		
13	KO	Harvey Ck	2	1	Oct 11	BS	277	224	310.00	M	M					11.60			
14	KO	Harvey Ck	2	1	Oct 11	BS	290	230	284.00	M	M					6.10			
15	KO	Harvey Ck	2	1	Oct 11	BS	277	228	283.00	F	M						4.8		
16	KO	Harvey Ck	2	1	Oct 11	BS	286	232	306.00	M	M					13.00			
17	RB	Harvey Ck	2	1	Oct 11	BS	117		18.30			1							
1	RB	Horse Ck	1	1	Oct 15	ES	143		42.00			1	2						
2	DV	Horse Ck	1	1	Oct 15	ES	118		15.80										
3	RB	Horse Ck	1	1	Oct 15	ES	123		25.20			2	1						
4	DV	Horse Ck	1	1	Oct 15	ES	112		13.60										
5	DV	Horse Ck	1	1	Oct 15	ES	87		6.70										
6	RB	Horse Ck	1	1	Oct 15	ES	88		7.60			3	0						
7	RB	Horse Ck	1	1	Oct 15	ES	186		103.20			4	3						
8	RB	Horse Ck	1	1	Oct 15	ES	157		53.10			5	2						
9	DV	Horse Ck	1	1	Oct 15	ES	141		25.70										
10	DV	Horse Ck	1	1	Oct 15	ES	144		26.40										
11	RB	Horse Ck	1	1	Oct 15	ES	98		11.20			6	1						
12	RB	Horse Ck	1	1	Oct 15	ES	103		16.40			7	1						
13	DV	Horse Ck	1	1	Oct 15	ES	45		0.80										
1	DV	Howard Ck	2	1	Oct 17	ES	191		69.20										
2	DV	Howard Ck	2	1	Oct 17	ES	99		10.50										
3	DV	Howard Ck	2	1	Oct 17	ES	77		4.90										
1	DV	Howard Ck	2	1	Oct 17	ES													
1	DV	Hugh Allen	3	1	Oct 17	BS	50		1.00										
2	DV	Hugh Allen	3	1	Oct 17	BS	84		7.20										
3	DV	Hugh Allen	3	1	Oct 17	BS	103		13.00										
4	DV	Hugh Allen	3	1	Oct 17	BS	135		28.50										
5	DV	Hugh Allen	3	1	Oct 17	BS	50		1.00										

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
6	DV	Hugh Allen	3	1	Oct 17	BS	53		1.30										
7	DV	Hugh Allen	3	1	Oct 17	BS	45		0.90										
1	MW	Hugh Allen	2	1	Oct 17	BS	161		39.30			1	2						
2	MW	Hugh Allen	2	1	Oct 17	BS	175		51.20			2	3						
3	MW	Hugh Allen	2	1	Oct 17	BS	182		59.20			3	3						
4	MW	Hugh Allen	2	1	Oct 17	BS	157		38.50			4	3						
5	MW	Hugh Allen	2	1	Oct 17	BS	141		24.80			5	2						
6	MW	Hugh Allen	2	1	Oct 17	BS	161		39.60			6	3						
7	MW	Hugh Allen	2	1	Oct 17	BS	133		22.60			7	3						
8	MW	Hugh Allen	2	1	Oct 17	BS	172		51.40			8	3						
9	MW	Hugh Allen	2	1	Oct 17	BS	167		45.20			9	3						
10	MW	Hugh Allen	2	1	Oct 17	BS	155		38.40			10	3						
11	MW	Hugh Allen	2	1	Oct 17	BS	135		23.10			11	2						
12	MW	Hugh Allen	2	1	Oct 17	BS	139		24.20			12	2						
13	MW	Hugh Allen	2	1	Oct 17	BS	197		75.20			13	4						
14	MW	Hugh Allen	2	1	Oct 17	BS	163		43.40			14	3						
15	MW	Hugh Allen	2	1	Oct 17	BS	128		20.70			15	2						
16	MW	Hugh Allen	2	1	Oct 17	BS	48		1.00										
17	MW	Hugh Allen	2	1	Oct 17	BS	132		20.50			17	2						
18	MW	Hugh Allen	2	1	Oct 17	BS	92		6.55			18	1						
19	MW	Hugh Allen	2	1	Oct 17	BS	90		6.45			19	1						
20	MW	Hugh Allen	2	1	Oct 17	BS	98		8.00			20	1						
21	MW	Hugh Allen	2	1	Oct 17	BS	95		8.00			21	1						
22	MW	Hugh Allen	2	1	Oct 17	BS	90		7.00			22	1						
23	MW	Hugh Allen	2	1	Oct 17	BS	92		6.90			23	1						
24	MW	Hugh Allen	2	1	Oct 17	BS	88		6.10			24	1						
25	MW	Hugh Allen	2	1	Oct 17	BS	68					25	0						
26	MW	Hugh Allen	2	1	Oct 17	BS	92		7.20			26	1						
27	MW	Hugh Allen	2	1	Oct 17	BS	95		9.20			27	1						
28	MW	Hugh Allen	2	1	Oct 17	BS	95		7.70			28	1						
29	MW	Hugh Allen	2	1	Oct 17	BS	86		6.30			29	1						
30	MW	Hugh Allen	2	1	Oct 17	BS	51		1.00			30	0						
31	MW	Hugh Allen	2	1	Oct 17	BS	48		0.90			31	0						
32	MW	Hugh Allen	2	1	Oct 17	BS	52		1.20										
33	MW	Hugh Allen	2	1	Oct 17	BS	47		0.70										
34	MW	Hugh Allen	2	1	Oct 17	BS	52		0.95										
35	MW	Hugh Allen	2	1	Oct 17	BS	51		1.20										
36	MW	Hugh Allen	2	1	Oct 17	BS	48		1.05										
37	MW	Hugh Allen	2	1	Oct 17	BS	47		0.85										
38	MW	Hugh Allen	2	1	Oct 17	BS	45												
39	MW	Hugh Allen	2	1	Oct 17	BS	48		0.85										

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
40	MW	Hugh Allen	2	1	Oct 17	BS	50		0.90										
41	MW	Hugh Allen	2	1	Oct 17	BS	47		0.60										
42	MW	Hugh Allen	2	1	Oct 17	BS	52		0.80										
43	DV	Hugh Allen	2	1	Oct 17	BS	115		14.60										
44	MW	Hugh Allen	2	1	Oct 17	BS													Released
45	MW	Hugh Allen	2	1	Oct 17	BS													Released
46	MW	Hugh Allen	2	1	Oct 17	BS													Released
47	MW	Hugh Allen	2	1	Oct 17	BS													Released
48	MW	Hugh Allen	2	1	Oct 17	BS													Released
49	MW	Hugh Allen	2	1	Oct 17	BS													Released
50	MW	Hugh Allen	2	1	Oct 17	BS													Released
51	MW	Hugh Allen	2	1	Oct 17	BS													Released
52	MW	Hugh Allen	2	1	Oct 17	BS													Released
53	MW	Hugh Allen	2	1	Oct 17	BS													Released
54	MW	Hugh Allen	2	1	Oct 17	BS													Released
55	MW	Hugh Allen	2	1	Oct 17	BS													Released
56	MW	Hugh Allen	2	1	Oct 17	BS													Released
57	MW	Hugh Allen	2	1	Oct 17	BS													Released
58	MW	Hugh Allen	2	1	Oct 17	BS													Released
59	MW	Hugh Allen	2	1	Oct 17	BS													Released
60	MW	Hugh Allen	2	1	Oct 17	BS													Released
61	MW	Hugh Allen	2	1	Oct 17	BS													Released
62	MW	Hugh Allen	2	1	Oct 17	BS													Released
63	MW	Hugh Allen	2	1	Oct 17	BS													Released
64	MW	Hugh Allen	2	1	Oct 17	BS													Released
65	MW	Hugh Allen	2	1	Oct 17	BS													Released
66	MW	Hugh Allen	2	1	Oct 17	BS													Released
67	MW	Hugh Allen	2	1	Oct 17	BS													Released
68	MW	Hugh Allen	2	1	Oct 17	BS													Released
69	MW	Hugh Allen	2	1	Oct 17	BS													Released
70	MW	Hugh Allen	2	1	Oct 17	BS													Released
71	MW	Hugh Allen	2	1	Oct 17	BS													Released
72	MW	Hugh Allen	2	1	Oct 17	BS													Released
73	MW	Hugh Allen	2	1	Oct 17	BS													Released
74	MW	Hugh Allen	2	1	Oct 17	BS													Released
75	MW	Hugh Allen	2	1	Oct 17	BS													Released
76	MW	Hugh Allen	2	1	Oct 17	BS													Released
77	MW	Hugh Allen	2	1	Oct 17	BS													Released
78	MW	Hugh Allen	2	1	Oct 17	BS													Released
79	MW	Hugh Allen	2	1	Oct 17	BS													Released
80	MW	Hugh Allen	2	1	Oct 17	BS													Released

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
81	MW	Hugh Allen	2	1	Oct 17	BS													Released
82	MW	Hugh Allen	2	1	Oct 17	BS													Released
83	MW	Hugh Allen	2	1	Oct 17	BS													Released
84	MW	Hugh Allen	2	1	Oct 17	BS													Released
85	MW	Hugh Allen	2	1	Oct 17	BS													Released
86	MW	Hugh Allen	2	1	Oct 17	BS													Released
87	MW	Hugh Allen	2	1	Oct 17	BS													Released
88	MW	Hugh Allen	2	1	Oct 17	BS													Released
89	MW	Hugh Allen	2	1	Oct 17	BS													Released
90	MW	Hugh Allen	2	1	Oct 17	BS													Released
91	MW	Hugh Allen	2	1	Oct 17	BS													Released
92	MW	Hugh Allen	2	1	Oct 17	BS													Released
93	MW	Hugh Allen	2	1	Oct 17	BS													Released
94	MW	Hugh Allen	2	1	Oct 17	BS													Released
95	MW	Hugh Allen	2	1	Oct 17	BS													Released
96	MW	Hugh Allen	2	1	Oct 17	BS													Released
97	MW	Hugh Allen	2	1	Oct 17	BS													Released
98	MW	Hugh Allen	2	1	Oct 17	BS													Released
99	MW	Hugh Allen	2	1	Oct 17	BS													Released
100	MW	Hugh Allen	2	1	Oct 17	BS													Released
101	MW	Hugh Allen	2	1	Oct 17	BS													Released
102	MW	Hugh Allen	2	1	Oct 17	BS													Released
103	MW	Hugh Allen	2	1	Oct 17	BS													Released
104	MW	Hugh Allen	2	1	Oct 17	BS													Released
105	MW	Hugh Allen	2	1	Oct 17	BS													Released
106	MW	Hugh Allen	2	1	Oct 17	BS													Released
107	MW	Hugh Allen	2	1	Oct 17	BS													Released
108	MW	Hugh Allen	2	1	Oct 17	BS													Released
109	MW	Hugh Allen	2	1	Oct 17	BS													Released
110	MW	Hugh Allen	2	1	Oct 17	BS													Released
111	MW	Hugh Allen	2	1	Oct 17	BS													Released
112	MW	Hugh Allen	2	1	Oct 17	BS													Released
113	MW	Hugh Allen	2	1	Oct 17	BS													Released
114	MW	Hugh Allen	2	1	Oct 17	BS													Released
115	MW	Hugh Allen	2	1	Oct 17	BS													Released
116	MW	Hugh Allen	2	1	Oct 17	BS													Released
117	MW	Hugh Allen	2	1	Oct 17	BS													Released
118	MW	Hugh Allen	2	1	Oct 17	BS													Released
119	MW	Hugh Allen	2	1	Oct 17	BS													Released
120	MW	Hugh Allen	2	1	Oct 17	BS													Released
121	MW	Hugh Allen	2	1	Oct 17	BS													Released

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
122	MW	Hugh Allen	2	1	Oct 17	BS													Released
123	MW	Hugh Allen	2	1	Oct 17	BS													Released
124	MW	Hugh Allen	2	1	Oct 17	BS													Released
125	MW	Hugh Allen	2	1	Oct 17	BS													Released
126	MW	Hugh Allen	2	1	Oct 17	BS													Released
127	MW	Hugh Allen	2	1	Oct 17	BS													Released
128	MW	Hugh Allen	2	1	Oct 17	BS													Released
129	MW	Hugh Allen	2	1	Oct 17	BS													Released
130	MW	Hugh Allen	2	1	Oct 17	BS													Released
131	MW	Hugh Allen	2	1	Oct 17	BS													Released
132	MW	Hugh Allen	2	1	Oct 17	BS													Released
133	MW	Hugh Allen	2	1	Oct 17	BS													Released
134	MW	Hugh Allen	2	1	Oct 17	BS													Released
135	MW	Hugh Allen	2	1	Oct 17	BS													Released
136	MW	Hugh Allen	2	1	Oct 17	BS													Released
137	MW	Hugh Allen	2	1	Oct 17	BS													Released
138	MW	Hugh Allen	2	1	Oct 17	BS													Released
139	MW	Hugh Allen	2	1	Oct 17	BS													Released
140	MW	Hugh Allen	2	1	Oct 17	BS													Released
141	MW	Hugh Allen	2	1	Oct 17	BS													Released
142	MW	Hugh Allen	2	1	Oct 17	BS													Released
143	MW	Hugh Allen	2	1	Oct 17	BS													Released
144	MW	Hugh Allen	2	1	Oct 17	BS													Released
145	MW	Hugh Allen	2	1	Oct 17	BS													Released
146	MW	Hugh Allen	2	1	Oct 17	BS													Released
147	MW	Hugh Allen	2	1	Oct 17	BS													Released
148	MW	Hugh Allen	2	1	Oct 17	BS													Released
149	MW	Hugh Allen	2	1	Oct 17	BS													Released
150	MW	Hugh Allen	2	1	Oct 17	BS													Released
151	MW	Hugh Allen	2	1	Oct 17	BS													Released
152	MW	Hugh Allen	2	1	Oct 17	BS													Released
153	MW	Hugh Allen	2	1	Oct 17	BS													Released
154	MW	Hugh Allen	2	1	Oct 17	BS													Released
155	MW	Hugh Allen	2	1	Oct 17	BS													Released
156	MW	Hugh Allen	2	1	Oct 17	BS													Released
157	MW	Hugh Allen	2	1	Oct 17	BS													Released
158	MW	Hugh Allen	2	1	Oct 17	BS													Released
159	MW	Hugh Allen	2	1	Oct 17	BS													Released
160	MW	Hugh Allen	2	1	Oct 17	BS													Released
161	MW	Hugh Allen	2	1	Oct 17	BS													Released
162	MW	Hugh Allen	2	1	Oct 17	BS													Released

APPENDIX 4: Fish sample summary

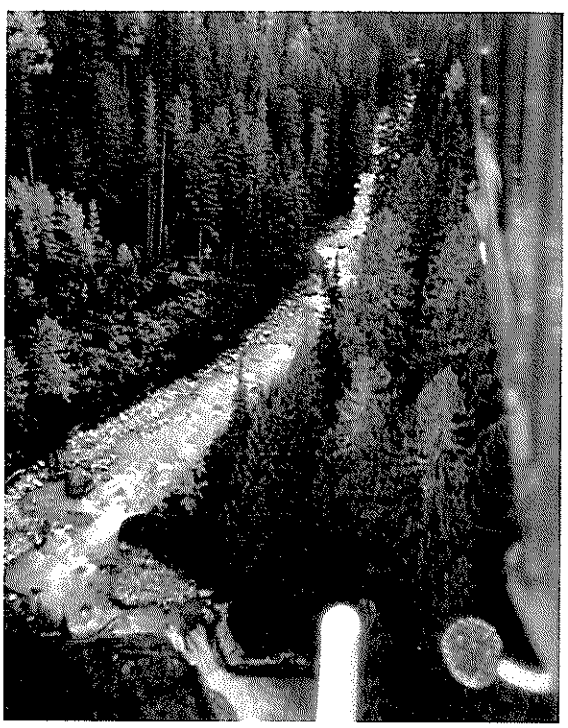
Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
163	MW	Hugh Allen	2	1	Oct 17	BS													Released
164	MW	Hugh Allen	2	1	Oct 17	BS													Released
165	MW	Hugh Allen	2	1	Oct 17	BS													Released
166	MW	Hugh Allen	2	1	Oct 17	BS													Released
167	DV	Hugh Allen	2	1	Oct 17	BS													Released
1	KO	Kinbasket R	1	1	Oct 11	BS	272	224	277.00	M	M			49	4.00	5.70			
2	KO	Kinbasket R	1	1	Oct 11	BS	290	244	297.00	F	T			50	3.40		5.50	757.00	
3	KO	Kinbasket R	1	1	Oct 11	BS	290	238	281.00	F	T						5.00	555.00	
4	KO	Kinbasket R	1	1	Oct 11	BS	285	237	267.00	F	M						4.9		
5	KO	Kinbasket R	1	1	Oct 11	BS	278	227	200.00	F	M						4.4		
6	KO	Kinbasket R	1	1	Oct 11	BS	275	225	232.00	M	M					3.40			
7	KO	Kinbasket R	1	1	Oct 11	BS	290	240	266.00	F	M						4.8		
8	KO	Kinbasket R	1	1	Oct 11	BS	280	230	238.00	M	M					5.40			
9	KO	Kinbasket R	1	1	Oct 11	BS	274	227	243.00	M	M					1.70			
10	KO	Kinbasket R	1	1	Oct 11	BS	272	218	268.00	M	M					5.30			
11	KO	Kinbasket R	1	1	Oct 11	BS	295	244	278.00	F	M						4.4		
12	KO	Kinbasket R	1	1	Oct 11	BS	279	226	319.00	M	M					7.40			
13	KO	Kinbasket R	1	1	Oct 11	BS	271	219	244.00	M	M					3.20			
14	KO	Kinbasket R	1	1	Oct 11	BS	286	234	222.00	F	M						4.5		
15	KO	Kinbasket R	1	1	Oct 11	BS	285	233	301.00	M	M					10.60			
16	KO	Kinbasket R	1	1	Oct 11	BS	289	234	296.00	M	M					6.90			
17	KO	Kinbasket R	1	1	Oct 11	BS	280	231	257.00	F	M						4.7		
18	KO	Kinbasket R	1	1	Oct 11	BS	280	229	280.00	M	M					5.60			
19	KO	Kinbasket R	1	1	Oct 11	BS	285	240	229.00	F	M						4.7		
20	KO	Kinbasket R	1	1	Oct 11	BS	298	242	288.00	M	M					4.30			
1	DV	Molson Ck	2	2	Oct 11	ES	203		100.90										
2	DV	Molson Ck	2	2	Oct 11	ES	184		62.80										
3	DV	Molson Ck	2	2	Oct 11	ES	98		11.10										
4	DV	Molson Ck	2	2	Oct 11	ES	99		11.60										
5	DV	Molson Ck	2	2	Oct 11	ES	160		45.30										
6	DV	Molson Ck	2	2	Oct 11	ES	125		22.50										
7	DV	Molson Ck	2	2	Oct 11	ES	153		38.00										
8	DV	Molson Ck	2	2	Oct 11	ES	125		23.00										
1	RB	Packsaddle	2-3	1	Oct 14	ES	114		19.70			1	1						
2	CBA	Packsaddle	2-3	1	Oct 14	ES	80		4.85										
3	CBA	Packsaddle	2-3	1	Oct 14	ES	72		3.45										
4	CBA	Packsaddle	2-3	1	Oct 14	ES	73												
5	CBA	Packsaddle	2-3	1	Oct 14	ES	76		4.50										
6	CBA	Packsaddle	2-3	1	Oct 14	ES	78		4.95										
7	CBA	Packsaddle	2-3	1	Oct 14	ES	95		9.15										
8	CBA	Packsaddle	2-3	1	Oct 14	ES	79		5.35										

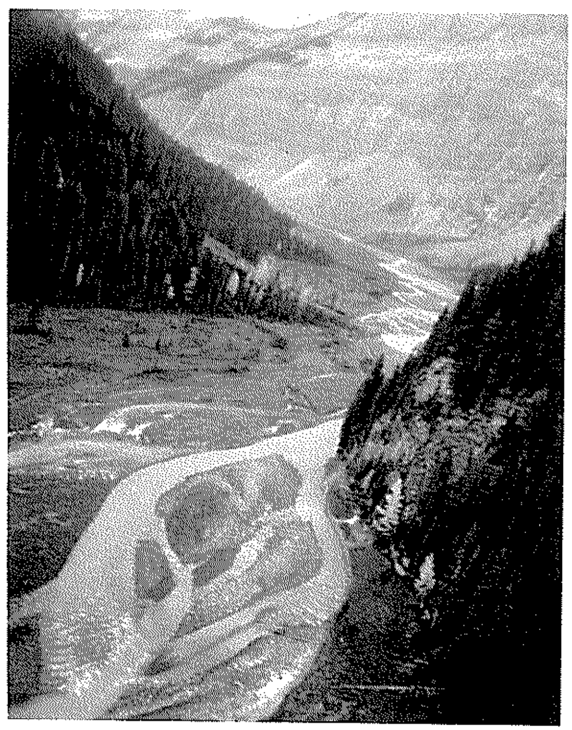
APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
9	CBA	Packsaddle	2-3	1	Oct 14	ES	91		7.50										
10	CBA	Packsaddle	2-3	1	Oct 14	ES	82		4.60										
11	CBA	Packsaddle	2-3	1	Oct 14	ES	86		6.00										
12	CBA	Packsaddle	2-3	1	Oct 14	ES	88		7.00										
13	CBA	Packsaddle	2-3	1	Oct 14	ES	81		5.60										
14	CBA	Packsaddle	2-3	1	Oct 14	ES	65		2.50										
15	CBA	Packsaddle	2-3	1	Oct 14	ES	94		8.30										
16	CBA	Packsaddle	2-3	1	Oct 14	ES	69		2.90										
17	DV	Packsaddle	2-3	1	Oct 14	ES	53		1.30										
18	RB	Packsaddle	2-3	1	Oct 14	ES	146		41.55			2	2						
19	RB	Packsaddle	2-3	1	Oct 14	ES	126		26.15			3	1						
20	RB	Packsaddle	2-3	1	Oct 14	ES	119		20.65			4	1						
21	RB	Packsaddle	2-3	1	Oct 14	ES	91		10.30			5	1						
22	RB	Packsaddle	2-3	1	Oct 14	ES	120		17.75			6	1						
23	RB	Packsaddle	2-3	1	Oct 14	ES	96		11.20			7	1						
24	RB	Packsaddle	2-3	1	Oct 14	ES	107		14.80			8	1						
25	RB	Packsaddle	2-3	1	Oct 14	ES	113		16.60			9	1						
26	DV	Packsaddle	2-3	1	Oct 14	ES	36		0.40										
27	DV	Packsaddle	2-3	1	Oct 14	ES	102		10.60										
28	DV	Packsaddle	2-3	1	Oct 14	ES	43		0.65										
1	CBA	Packsaddle	2-3	1	Oct 14	ES													
2	CBA	Packsaddle	2-3	1	Oct 14	ES													
3	CBA	Packsaddle	2-3	1	Oct 14	ES													
1	CRH	Prattle Ck	1	1	Sept 9	ES	60		1.80		F	1	0						
2	CRH	Prattle Ck	1	1	Sept 9	ES	90		7.25										
3	CRH	Prattle Ck	1	1	Sept 9	ES	66		2.80										
4	CRH	Prattle Ck	1	1	Sept 9	ES	85		9.05										
5	DV	Prattle Ck	1	1	Sept 9	ES	114		13.40		J								
6	MW	Prattle Ck	1	1	Sept 9	ES	86		6.30		J	2	1						
7	DV	Prattle Ck	1	1	Sept 9	ES	100		9.00		J								
8	CRH	Prattle Ck	1	1	Sept 9	ES	64												
9	CRH	Prattle Ck	1	1	Sept 9	ES	65												
10	CRH	Prattle Ck	1	1	Sept 9	ES	68												
11	CRH	Prattle Ck	1	1	Sept 9	ES	55												
12	CRH	Prattle Ck	1	1	Sept 9	ES	65												
13	CRH	Prattle Ck	1	1	Sept 9	ES	74												
14	CRH	Prattle Ck	1	1	Sept 9	ES	63												
15	CRH	Prattle Ck	1	1	Sept 9	ES	67												
16	CRH	Prattle Ck	1	1	Sept 9	ES	69												
17	CRH	Prattle Ck	1	1	Sept 9	ES	72												
18	CRH	Prattle Ck	1	1	Sept 9	ES	54												

Plate 11.

No fish were found in Reach 4 of Hugh Allen Creek which is mainly glide and pool habitat (above). Cascades near the bottom of Kinbasket River Reach 1 prevent fish from migrating upstream (lower left). Reach 3 is braided and unstable (lower right).





APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
19	CRH	Prattle Ck	1	1	Sept 9	ES	57												
20	CRH	Prattle Ck	1	1	Sept 9	ES	57												
21	CRH	Prattle Ck	1	1	Sept 9	ES	60												
22	CRH	Prattle Ck	1	1	Sept 9	ES	56												
1	DV	Ptarmigan	1	1	Oct 16	ES	167		43.25										
2	DV	Ptarmigan	1	1	Oct 16	ES	117		17.65										
3	DV	Ptarmigan	1	1	Oct 16	ES	119		15.60										
1	DV	Ptarmigan	2	2	Oct 16	ES	167		49.55										
2	DV	Ptarmigan	2	2	Oct 16	ES	129		20.40										
1	DV	Ptarmigan	2	2	Oct 16	ES	138		24.10										
2	DV	Ptarmigan	2	2	Oct 16	ES	106		14.40										
3	DV	Ptarmigan	2	2	Oct 16	ES	127		19.45										
4	DV	Ptarmigan	2	2	Oct 16	ES	121		20.10										
1	KO	Succour Ck	8	1	Oct 6	BS	281	229	283.00	M	PS			1	4.00	4.00			
2	KO	Succour Ck	8	1	Oct 6	BS	292	241	248.00	F	PS			2	4.00		5.2		
3	KO	Succour Ck	8	1	Oct 6	BS	270	224	223.00	F	PS			3	4.00		5.1		
4	KO	Succour Ck	8	1	Oct 6	BS	296	237	309.00	M	PS			4	4.00	2.40			
5	KO	Succour Ck	8	1	Oct 6	BS	278	222	273.00	M	PS			5	3.40	4.50			
6	KO	Succour Ck	8	1	Oct 6	BS		223	183.00	F	SPENT			6	4.00				Eggs R:2
7	KO	Succour Ck	8	1	Oct 6	BS		223	271.00	M	SPENT			7	4.00	1.60			
8	KO	Succour Ck	8	1	Oct 6	BS		225	255.00	M	PS			8	4.00	5.00			
9	KO	Succour Ck	8	1	Oct 6	BS		227	256.00	M	PS			9	4.00	7.50			
10	KO	Succour Ck	8	1	Oct 6	BS	278	227	281.00	M	SPENT			10		1.60			
11	KO	Succour Ck	8	1	Oct 6	BS		226	173.00	F	SPENT			11	4.00		5.3		Eggs R:24
12	KO	Succour Ck	8	1	Oct 6	BS		235	212.00	F	SPENT			12	3.40		4.9		Eggs R:24
13	KO	Succour Ck	8	1	Oct 6	BS		224	188.00	F	PS			13	4.00		5.1		
14	KO	Succour Ck	8	1	Oct 6	BS	280	229	286.00	M	PS			14	4.00	3.20			
15	KO	Succour Ck	8	1	Oct 6	BS		219	224.00	M	SPENT			15	3.40	1.30			
16	KO	Succour Ck	8	1	Oct 6	BS	294	237	355.00	M	PS			16	3.40	5.60			
17	KO	Succour Ck	8	1	Oct 6	BS		219	254.00	M	PS			17	4.00	3.20			
18	KO	Succour Ck	8	1	Oct 6	BS	291	240	230.00	F	PS			18	5.00		5.2		
19	KO	Succour Ck	8	1	Oct 6	BS	264	213	215.00	M	SPENT			19	4.00	1.70			
20	KO	Succour Ck	8	1	Oct 6	BS		234	320.00	M	SPENT			20	3.40	2.40			
21	KO	Succour Ck	8	1	Oct 6	BS		234	205.00	F	SPENT			21	4.00		5.0		Eggs R:14
22	KO	Succour Ck	8	1	Oct 6	BS		231	190.00	F	SPENT			22	3.40				Eggs R:2
23	KO	Succour Ck	8	1	Oct 6	BS		221	253.00	M	SPENT			23	4.00	2.40			
24	KO	Succour Ck	8	1	Oct 6	BS		214	163.00	F	SPENT			24	4.00				Eggs R:5
25	KO	Succour Ck	8	1	Oct 6	BS		226	193.00	F	SPENT			25	3.40				Eggs R:0
26	KO	Succour Ck	8	1	Oct 6	BS		217	242.00	M	SPENT			26	4.50	1.20			
27	KO	Succour Ck	8	1	Oct 6	BS		231	201.00	F	PS			27	3.40		5.0		
28	KO	Succour Ck	8	1	Oct 6	BS		229	266.00	M	SPENT			28	3.00	1.00			

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
29	KO	Succour Ck	8	1	Oct 6	BS		223	198.00	F	SPENT			29	4.00		5.4		Eggs R:14
30	KO	Succour Ck	8	1	Oct 6	BS		230	185.00	F	PS			30	4.00		5.2		
31	KO	Succour Ck	8	1	Oct 6	BS		215	199.00	F	SPENT			31	3.00		4.9		ER 40
32	KO	Succour Ck	8	1	Oct 6	BS		220	194.00	F	SPENT			32	4.00				ER 5
33	KO	Succour Ck	8	1	Oct 6	BS		231	161.00	F	SPENT			33	4.00		5.3		ER 26
34	KO	Succour Ck	8	1	Oct 6	BS		247	258.00	F	SPENT			34	5.00		4.8		ER 11
35	KO	Succour Ck	8	1	Oct 6	BS		241	247.00	F	SPENT			35	4.00		5.2		ER 10
36	KO	Succour Ck	8	1	Oct 6	BS		224	264.00	M	SPENT			36		1.20			
37	KO	Succour Ck	8	1	Oct 6	BS		230	198.00	F	SPENT			37	4.00				ER 6
38	KO	Succour Ck	8	1	Oct 6	BS		198	157.00	M	SPENT			38	4.00	0.70			
39	KO	Succour Ck	8	1	Oct 6	BS		219	205.00	F	SPENT			39	4.50		4.9		ER 30
40	KO	Succour Ck	8	1	Oct 6	BS		214	238.00	M	SPENT			40	4.50	1.50			
41	KO	Succour Ck	8	1	Oct 6	BS		235	216.00	F	SPENT			41	3.40		5.0		
42	KO	Succour Ck	8	1	Oct 6	BS		210	245.00	M	SPENT			42	4.00	2.00			
43	KO	Succour Ck	8	1	Oct 6	BS		216	223.00	M	SPENT			43	4.00	1.10			
44	KO	Succour Ck	8	1	Oct 6	BS		224	281.00	M	SPENT			44	4.50	1.20			
45	KO	Succour Ck	8	1	Oct 6	BS		235	318.00	M	SPENT			45	4.00	1.60			
46	KO	Succour Ck	8	1	Oct 6	BS		209	177.00	M	SPENT			46	4.50	1.00			
47	KO	Succour Ck	8	1	Oct 6	BS		219	233.00	M	SPENT			47	4.00	1.20			
48	KO	Succour Ck	8	1	Oct 6	BS		222	171.00	F	SPENT			48	4.50				
49	KO	Succour Ck	8	1	Oct 6	BS		229	270.00	M	SPENT			49	4.00	3.00			
50	KO	Succour Ck	8	1	Oct 6	BS		225	188.00	F	SPENT			50	4.00				
1	LSU	Succour C	2	3	Aug 31	ES	78				J								
2	LSU	Succour C	2	3	Aug 31	ES	68				J								
1	RB	Succour C	3	3	Aug 31	ES	117		17.80		J	1	1						
2	RB	Succour C	3	3	Aug 31	ES	86		6.05		J	2	1						
3	RB	Succour C	3	3	Aug 31	ES	109		14.05			3	1						
4	RB	Succour C	3	3	Aug 31	ES	122		19.55			4	1						
5	RB	Succour C	3	3	Aug 31	ES	102		11.40			5	1						
6	RB	Succour C	3	3	Aug 31	ES	126		24.00			6	1						
7	RB	Succour C	3	3	Aug 31	ES	107		13.60			7	1						
8	RB	Succour C	3	3	Aug 31	ES	74		3.85			8	0						
9	RB	Succour C	3	3	Aug 31	ES	88		9.10			9	1						
1	RB	Succour C	4	3	Aug 31	ES	64		2.60		J	10	0						
2	RB	Succour C	4	3	Aug 31	ES	54		1.40		J	11	0						
3	RB	Succour C	4	3	Aug 31	ES	75		4.10		J	12	1						
4	LSU	Succour C	4	3	Aug 31	ES	69				J								
5	RB	Succour C	4	3	Aug 31	ES	105		11.20		J	13	1						
6	RB	Succour C	4	3	Aug 31	ES	49		1.10		J	14	0						
7	RB	Succour C	4	3	Aug 31	ES	96		8.65		J	15	1						
8	RB	Succour C	4	3	Aug 31	ES	139		30.00		J	16	1						

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
9	RB	Succour C	4	3	Aug 31	ES	60		2.30		J	17	0						
10	RB	Succour C	4	3	Aug 31	ES	73		3.80		J	18	0						
1	RB	Succour C	5	3	Sept 1	ES	81		6.65		J	19	1						
2	RB	Succour C	5	3	Sept 1	ES	50		1.25		J	20	0						
3	LNC	Succour C	5	3	Sept 1	ES	79		6.10										
4	RB	Succour C	5	3	Sept 1	ES	57		1.90		J	21	0						
5	RB	Succour C	5	3	Sept 1	ES	59		2.15		J	22	0						
6	LNC	Succour C	5	3	Sept 1	ES	72		3.95										
7	LNC	Succour C	5	3	Sept 1	ES	55		1.80										
8	LNC	Succour C	5	3	Sept 1	ES	79		5.50										
1	RB	Succour C	7	2	Sept 1	ES	53		1.55		J	23	0						
2	RB	Succour C	7	2	Sept 1	ES	42		0.75		J	24	0						
3	RB	Succour C	7	2	Sept 1	ES	48		1.10		J	25	0						
4	RB	Succour C	7	2	Sept 1	ES	89		8.70		J	26	1						
5	RB	Succour C	7	2	Sept 1	ES	57		2.05		J	27	0						
6	RB	Succour C	7	2	Sept 1	ES	72		5.20		J	28	1						
7	RB	Succour C	7	2	Sept 1	ES	94		10.55		J	29	1						
8	EB	Succour C	7	2	Sept 1	ES	112		14.25		J	1	1						
9	RB	Succour C	7	2	Sept 1	ES	58		2.10		J	30	0						
10	RB	Succour C	7	2	Sept 1	ES	110		15.85		J	31	1						
11	RB	Succour C	7	2	Sept 1	ES	106		13.40		J	32	1						
12	RB	Succour C	7	2	Sept 1	ES	133		32.80		J	33	1						
13	RB	Succour C	7	2	Sept 1	ES	105		15.15		J	34	1						
14	RB	Succour C	7	2	Sept 1	ES	80		7.30		J	35	1						
15	RB	Succour C	7	2	Sept 1	ES	56		2.10		J	36	0						
16	RB	Succour C	7	2	Sept 1	ES	43		0.90		J	37	0						
17	RB	Succour C	7	2	Sept 1	ES	93		9.10		J								
18	RB	Succour C	7	2	Sept 1	ES	83		6.90		J	38	1						
19	RB	Succour C	7	2	Sept 1	ES	49		1.35		J	39	0						
20	RB	Succour C	7	2	Sept 1	ES	48		1.10		J	40	0						
21	RB	Succour C	7	2	Sept 1	ES	56		1.65		J	41	0						
22	RB	Succour C	7	2	Sept 1	ES	68		3.70		J								
23	RB	Succour C	7	2	Sept 1	ES	82		6.95		J								
24	RB	Succour C	7	2	Sept 1	ES	49		1.55		J	42	0						
25	LNC	Succour C	7	2	Sept 1	ES	110		17.00		J								
26	RB	Succour C	7	2	Sept 1	ES	64		3.30		J								
27	RB	Succour C	7	2	Sept 1	ES	59		2.60		J								
28	RB	Succour C	7	2	Sept 1	ES	51		1.45		J								
29	RB	Succour C	7	2	Sept 1	ES	47		1.30		J	43	0						
30	RB	Succour C	7	2	Sept 1	ES	140		34.40		J	44	2						
31	RB	Succour C	7	2	Sept 1	ES	59		2.40		J								

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
32	RB	Succour C	7	2	Sept 1	ES	53		1.60		J								
1	RB	Succour C	8	1	Sept 1	ES	107		13.50		J								
2	RB	Succour C	8	1	Sept 1	ES	57		2.30		J								
3	RB	Succour C	8	1	Sept 1	ES	65		2.90		J								
4	RB	Succour C	8	1	Sept 1	ES	63		3.20		J								
5	RB	Succour C	8	1	Sept 1	ES	40		0.65		J								
6	RB	Succour C	8	1	Sept 1	ES	155		51.25		J	45	2						
7	RB	Succour C	8	1	Sept 1	ES	96		9.70		J								
8	RB	Succour C	8	1	Sept 1	ES	128		23.00		J	46	1						
9	RB	Succour C	8	1	Sept 1	ES	55		2.15		J								
10	CRH	Succour C	8	1	Sept 1	ES	88		8.85		A								
11	CRH	Succour C	8	1	Sept 1	ES	89		8.45		A								
12	CRH	Succour C	8	1	Sept 1	ES	87		7.75		A								
13	CRH	Succour C	8	1	Sept 1	ES	96		10.05		A								
14	CRH	Succour C	8	1	Sept 1	ES	85		6.70		A								
15	LNC	Succour C	8	1	Sept 1	ES	74		4.75										
16	MW	Succour C	8	1	Sept 1	ES	75		3.30										
17	LNC	Succour C	8	1	Sept 1	ES	87		9.15										
18	CRH	Succour C	8	1	Sept 1	ES	102		16.80		A								
19	RB	Succour C	8	1	Sept 1	ES	100		11.40		J								
20	RB	Succour C	8	1	Sept 1	ES	105		14.70		J								
21	RB	Succour C	8	1	Sept 1	ES	96		9.65		J								
22	RB	Succour C	8	1	Sept 1	ES	90		7.40		J								
23	RB	Succour C	8	1	Sept 1	ES	59		2.75		J								
1	KO	Sullivan R	Bay		Sept 2	Angling	282		239.10		A	1	3				4.10	674.00	
2	KO	Sullivan R	Bay		Sept 2	Angling	288		286.60		A	2	3						
1	DV	Sullivan R	1	2	Sept 3	BS	146		27.60		J	2							
2	CRH	Sullivan R	1	2	Sept 3	BS	75		4.50										
1	MW	Sullivan R	1	2	Sept 3	BS	322		375.00		A	1	5						
2	MW	Sullivan R	1	2	Sept 3	BS	470		425.00		A	2	8						
3	MW	Sullivan R	1	2	Sept 3	BS	301		300.00		A	3	5						
4	MW	Sullivan R	1	2	Sept 3	BS	307		360.00		A	4	5						
5	MW	Sullivan R	1	2	Sept 3	BS	196		73.35		A	5	3						
6	MW	Sullivan R	1	2	Sept 3	BS	166		44.15		A	6	2						
7	MW	Sullivan R	1	2	Sept 3	BS	201		84.80		A	7	3						
8	MW	Sullivan R	1	2	Sept 3	BS	195		71.00		A	8	3						
9	MW	Sullivan R	1	2	Sept 3	BS	108		11.50		J	9	1						
10	MW	Sullivan R	1	2	Sept 3	BS	114		14.25		J								
11	MW	Sullivan R	1	2	Sept 3	BS	101		8.80		J								
12	MW	Sullivan R	1	2	Sept 3	BS	97		8.00		J	12	1						
13	MW	Sullivan R	1	2	Sept 3	BS	116		14.05		J	13	1						

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
14	MW	Sullivan R	1	2	Sept 3	BS	117		14.55		J	14	1						
15	MW	Sullivan R	1	2	Sept 3	BS	102		9.35		J	15	1						
16	MW	Sullivan R	1	2	Sept 3	BS	46		0.90		F								
17	MW	Sullivan R	1	2	Sept 3	BS	34		0.30		F								
18	DV	Sullivan R	1	2	Sept 3	BS	54		1.15		F	1							
19	MW	Sullivan R	1	2	Sept 3	BS					F								
1	KO	Sullivan R	10	1	Oct 7	BS	285	227	261.00	M	S			41	3.40	1.50			
2	KO	Sullivan R	10	1	Oct 7	BS	280	224	270.00	M	M			42	4.50	6.90			
3	KO	Sullivan R	10	1	Oct 7	BS	222	222	213.00	M	S			43	4.00	1.60			
4	KO	Sullivan R	10	1	Oct 7	BS	254	209	208.00	M	M			44	4.00	7.90			
5	KO	Sullivan R	10	1	Oct 7	BS	295	237	254.00	F	S			45	4.00		4.5		ER 30
6	KO	Sullivan R	10	1	Oct 7	BS	287	235	269.00	M	S			46	4.50	1.90			
7	KO	Sullivan R	10	1	Oct 7	BS	287	237	245.00	F	S			47	4.00				ER 5
8	KO	Sullivan R	10	1	Oct 7	BS	272	220	189.00	M	S			48	4.00	1.00			
9	KO	Sullivan R	10	1	Oct 7	BS	288	232	314.00	M	M			49	4.00	10.40			
10	KO	Sullivan R	10	1	Oct 7	BS	274	221	241.00	M	PS			50	4.50	2.10			
11	KO	Sullivan R	10	1	Oct 7	BS	278	224	261.00	M	PS			3	3.40	3.90			
12	KO	Sullivan R	10	1	Oct 7	BS	282	234	236.00	F	PS			4	4.00		4.6		
13	KO	Sullivan R	10	1	Oct 7	BS	285	237	253.00	F				5	4.00		4.4		
14	KO	Sullivan R	10	1	Oct 7	BS	262	213	223.00	M	PS			6	4.00	1.70			
15	KO	Sullivan R	10	1	Oct 7	BS	281	230		M	M								
16	KO	Sullivan R	10	1	Oct 7	BS	286	237		M	M								
17	KO	Sullivan R	10	1	Oct 7	BS	284	229		M	M								
18	KO	Sullivan R	10	1	Oct 7	BS	275	226	213.00	F				7	4.00		4.5		
19	KO	Sullivan R	10	1	Oct 7	BS	270	227	198.00	F				8	3.40		4.4		
20	KO	Sullivan R	10	1	Oct 7	BS	300	246		M	PS								
21	KO	Sullivan R	10	1	Oct 7	BS	291	237		M	M								
22	KO	Sullivan R	10	1	Oct 7	BS	275	225		M	M								
23	KO	Sullivan R	10	1	Oct 7	BS	278	215		M	M								
20	MW	Sullivan R	1	2	Sept 3	BS					F								
21	MW	Sullivan R	1	2	Sept 3	BS					F								
22	MW	Sullivan R	1	2	Sept 3	BS					F								
23	MW	Sullivan R	1	2	Sept 3	BS					F								
24	MW	Sullivan R	1	2	Sept 3	BS					F								
1	DV	Sullivan R	1	2	Sept 3	BS	575		1760.00		A	3							
1	DV	Sullivan R	4	4	Sept 4	BS	130		18.30		J	1.00							
2	MW	Sullivan R	5	4	Sept 4	BS	225		130.00		A	1.00	4						
3	DV	Sullivan R	6	4	Sept 4	BS	116				J								
4	DV	Sullivan R	6	4	Sept 4	BS	145												
5	DV	Sullivan R	6	4	Sept 4	BS	169				J								
6	DV	Sullivan R	6	4	Sept 4	BS	133				J								

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
7	DV	Sullivan R	6	4	Sept 4	BS	130				J								
8	DV	Sullivan R	6	4	Sept 4	BS	170				J								
9	DV	Sullivan R	6	4	Sept 4	BS	149				J								
10	DV	Sullivan R	6	4	Sept 4	BS	112				J								
11	DV	Sullivan R	6	4	Sept 4	BS	118				J								
12	MW	Sullivan R	6	4	Sept 4	BS	238				A								
13	MW	Sullivan R	6	4	Sept 4	BS	270				A								
14	MW	Sullivan R	6	4	Sept 4	BS	228				A								
15	MW	Sullivan R	6	4	Sept 4	BS	258				A								
16	DV	Sullivan R	6	4	Sept 4	BS	144				J								
1	MW	Sullivan R	9	3	Sept 5	BS	320				A								
2	MW	Sullivan R	9	3	Sept 5	BS	191				J								
3	DV	Sullivan R	9	3	Sept 5	BS	167				J								
4	DV	Sullivan R	9	3	Sept 5	BS	166				J								
5	DV	Sullivan R	13	2	Sept 5	BS	35												
6	MW	Sullivan R	13	2	Sept 5	BS	236												
7	DV	Sullivan R	13	2	Sept 5	BS	730			M	A								
8	DV	Sullivan R	13	2	Sept 5	BS	560		1500.00	M	A								
9	MW	Sullivan R	13	2	Sept 5	BS	42		0.65		F								
10	MW	Sullivan R	13	2	Sept 5	BS	43		0.65		F								
1	MW	Sullivan R	14	2	Sept 5	BS	315		350.00		A	1	5						
2	MW	Sullivan R	14	2	Sept 5	BS	255		210.00		A	2	4						
3	MW	Sullivan R	14	2	Sept 5	BS	168		46.80		A	3	2						
4	MW	Sullivan R	14	2	Sept 5	BS	278		290.00		A	4	5						
5	MW	Sullivan R	14	2	Sept 5	BS	240		156.00		A	5	4						
6	MW	Sullivan R	14	2	Sept 5	BS	252		154.95		A	6	4						
7	MW	Sullivan R	14	2	Sept 5	BS	247		159.50		A	7	4						
8	MW	Sullivan R	14	2	Sept 5	BS	193		74.20		J	8	3						
9	MW	Sullivan R	14	2	Sept 5	BS	103		10.10		J	9	1						
10	DV	Sullivan R	14	2	Sept 5	BS	760			F	A	1							
1	MW	Valenciennes R	8	1	Sept 7	BS	47		0.90		F								
2	MW	Valenciennes R	8	1	Sept 7	BS	271		1.93		A	1.00							
3	MW	Valenciennes R	8	1	Sept 7	BS	217		94.45		A	2.00							
4	MW	Valenciennes R	8	1	Sept 7	BS	200		83.60		A	3.00							
5	MW	Valenciennes R	8	1	Sept 7	BS	153		34.90		J	4.00							
6	MW	Valenciennes R	8	1	Sept 7	BS	167		38.15		J	5.00							
7	MW	Valenciennes R	8	1	Sept 7	BS	92		7.00		J	6.00							
8	MW	Valenciennes R	8	1	Sept 7	BS	50		1.00		F								
1	DV	Windfall	2	1	Oct 19	ES	113		15.90										
2	DV	Windfall	2	1	Oct 19	ES	142		21.00										
3	DV	Windfall	2	1	Oct 19	ES	120		19.00										

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
4	DV	Windfall	2	1	Oct 19	ES	113		14.90										
5	DV	Windfall	2	1	Oct 19	ES	152		33.45										
6	DV	Windfall	2	1	Oct 19	ES	42		0.65										
1	MW	Wood R	1-3A	1	Oct 9	BS	254		155.00		A	1							
2	MW	Wood R	1-3A	1	Oct 9	BS	271		202.00		A	2							
3	MW	Wood R	1-3A	1	Oct 9	BS	231		118.00		A	3							
4	MW	Wood R	1-3A	1	Oct 9	BS	272		191.00		A	4							
5	MW	Wood R	1-3A	1	Oct 9	BS	133				J	5							
1	KO	Wood R	1-3A	1	Oct 9	BS	296	237	266.00	F	M		9	5		5.3			
2	KO	Wood R	1-3A	1	Oct 9	BS	273	221	249.00	F	T		10	4	38.9	5.0	479		
3	KO	Wood R	1-3A	1	Oct 9	BS	291	234	303.00	F	T		11	5	47.7	4.5	807		
4	KO	Wood R	1-3A	1	Oct 9	BS	288	234	261.00	F	T		12	4	39.2	4.5	643		
5	KO	Wood R	1-3A	1	Oct 9	BS	293	235	330.00	M	M		13	3	15.2				
6	KO	Wood R	1-3A	1	Oct 9	BS	276	222	267.00	M	M		14	3	12.4				
7	KO	Wood R	1-3A	1	Oct 9	BS	295	235	321.00	M	M		15	3	11.1				
8	KO	Wood R	1-3A	1	Oct 9	BS	279	230	279.00	M	M		16	4	14.3				
9	KO	Wood R	1-3A	1	Oct 9	BS	285	228	285.00	M	M		17		12.1				
10	KO	Wood R	1-3A	1	Oct 9	BS	288	240	274.00	F	M		18	4		5.0			
11	KO	Wood R	1-3A	1	Oct 9	BS	272	223	273.00	M	M		19	4	14.4				
12	KO	Wood R	1-3A	1	Oct 9	BS	271	224	253.00	F	M		20	5		4.8			
13	KO	Wood R	1-3A	1	Oct 9	BS	278	224	282.00	M	M		21	4	13.7				
14	KO	Wood R	1-3A	1	Oct 9	BS	287	230	313.00	M	M		22	4	13.2				
15	KO	Wood R	1-3A	1	Oct 9	BS	286	230	253.00	F	M		23	3		5.0			
16	KO	Wood R	1-3A	1	Oct 9	BS	276	229	254.00	F	T		24	5	36.9	4.5	528		
17	KO	Wood R	1-3A	1	Oct 9	BS	286	235	289.00	F	M		25	4		4.8	568		
18	KO	Wood R	1-3A	1	Oct 9	BS	287	238	287.00	F	T		26	4	42.0				
19	KO	Wood R	1-3A	1	Oct 9	BS	285	228	282.00	M	M		27	5	13.1				
20	KO	Wood R	1-3A	1	Oct 9	BS	276	220	284.00	M	M		28	4	17.7				
1	MW	Wood R	1-3A	1	Oct 9	BS	230	231				6							
2	MW	Wood R	1-3A	1	Oct 9	BS	77		4.20			7							
3	DV	Wood R	1-3A	1	Oct 9	BS	430		700										
1	KO	Wood R	1-3A	1	Oct 9	BS												Released	
2	KO	Wood R	1-3A	1	Oct 9	BS												Released	
3	KO	Wood R	1-3A	1	Oct 9	BS												Released	
4	KO	Wood R	1-3A	1	Oct 9	BS												Released	
5	KO	Wood R	1-3A	1	Oct 9	BS												Released	
6	KO	Wood R	1-3A	1	Oct 9	BS												Released	
7	KO	Wood R	1-3A	1	Oct 9	BS												Released	
8	KO	Wood R	1-3A	1	Oct 9	BS												Released	
9	KO	Wood R	1-3A	1	Oct 9	BS												Released	
10	KO	Wood R	1-3A	1	Oct 9	BS												Released	
11	KO	Wood R	1-3A	1	Oct 9	BS												Released	
12	KO	Wood R	1-3A	1	Oct 9	BS												Released	
13	KO	Wood R	1-3A	1	Oct 9	BS												Released	

APPENDIX 4: Fish sample summary

Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
14	KO	Wood R	1-3A	1	Oct 9	BS												Released	
15	KO	Wood R	1-3A	1	Oct 9	BS												Released	
16	KO	Wood R	1-3A	1	Oct 9	BS												Released	
17	KO	Wood R	1-3A	1	Oct 9	BS												Released	
18	KO	Wood R	1-3A	1	Oct 9	BS												Released	
19	KO	Wood R	1-3A	1	Oct 9	BS												Released	
20	KO	Wood R	1-3A	1	Oct 9	BS												Released	
21	KO	Wood R	1-3A	1	Oct 9	BS												Released	
22	KO	Wood R	1-3A	1	Oct 9	BS												Released	
23	KO	Wood R	1-3A	1	Oct 9	BS												Released	
24	KO	Wood R	1-3A	1	Oct 9	BS												Released	
25	KO	Wood R	1-3A	1	Oct 9	BS												Released	
26	KO	Wood R	1-3A	1	Oct 9	BS												Released	
27	KO	Wood R	1-3A	1	Oct 9	BS												Released	
28	KO	Wood R	1-3A	1	Oct 9	BS												Released	
29	KO	Wood R	1-3A	1	Oct 9	BS												Released	
30	KO	Wood R	1-3A	1	Oct 9	BS												Released	
31	KO	Wood R	1-3A	1	Oct 9	BS												Released	
32	KO	Wood R	1-3A	1	Oct 9	BS												Released	
33	KO	Wood R	1-3A	1	Oct 9	BS												Released	
34	KO	Wood R	1-3A	1	Oct 9	BS												Released	
35	KO	Wood R	1-3A	1	Oct 9	BS												Released	
36	KO	Wood R	1-3A	1	Oct 9	BS												Released	
37	KO	Wood R	1-3A	1	Oct 9	BS												Released	
38	KO	Wood R	1-3A	1	Oct 9	BS												Released	
39	KO	Wood R	1-3A	1	Oct 9	BS												Released	
40	KO	Wood R	1-3A	1	Oct 9	BS												Released	
41	KO	Wood R	1-3A	1	Oct 9	BS												Released	
42	KO	Wood R	1-3A	1	Oct 9	BS												Released	
43	KO	Wood R	1-3A	1	Oct 9	BS												Released	
44	KO	Wood R	1-3A	1	Oct 9	BS												Released	
45	KO	Wood R	1-3A	1	Oct 9	BS												Released	
46	KO	Wood R	1-3A	1	Oct 9	BS												Released	
47	KO	Wood R	1-3A	1	Oct 9	BS												Released	
48	KO	Wood R	1-3A	1	Oct 9	BS												Released	
49	KO	Wood R	1-3A	1	Oct 9	BS												Released	
50	KO	Wood R	1-3A	1	Oct 9	BS												Released	
51	KO	Wood R	1-3A	1	Oct 9	BS												Released	
52	KO	Wood R	1-3A	1	Oct 9	BS												Released	
53	KO	Wood R	1-3A	1	Oct 9	BS												Released	
54	KO	Wood R	1-3A	1	Oct 9	BS												Released	
55	KO	Wood R	1-3A	1	Oct 9	BS												Released	
56	KO	Wood R	1-3A	1	Oct 9	BS												Released	
57	KO	Wood R	1-3A	1	Oct 9	BS												Released	

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Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
58	MW	Wood R	1-3A	1	Oct 9	BS												Released	
59	CC	Wood R	1-3A	1	Oct 9	BS												Released	
1	EBT	Wood R	4-5	5	Oct 11	ES	106		14.50	J									
2	EBT	Wood R	4-5	5	Oct 11	ES	83		4.90	J									
3	EBT	Wood R	4-5	5	Oct 11	ES	90		9.10	J									
4	EBT	Wood R	4-5	5	Oct 11	ES	78		5.30	J									
5	EBT	Wood R	4-5	5	Oct 11	ES	71		4.80	J									
6	EBT	Wood R	4-5	5	Oct 11	ES	67		3.80	J									
7	EBT	Wood R	4-5	5	Oct 11	ES	92		9.10	J									
8	EBT	Wood R	4-5	5	Oct 11	ES	76		5.40	J									
9	EBT	Wood R	4-5	5	Oct 11	ES	73		4.90	J									
10	EBT	Wood R	4-5	5	Oct 11	ES	72		4.20	J									
11	EBT	Wood R	4-5	5	Oct 11	ES	71		4.90	J									
12	EBT	Wood R	4-5	5	Oct 11	ES	84		7.60	J									
13	EBT	Wood R	4-5	5	Oct 11	ES	142		29.30	J									
14	EBT	Wood R	4-5	5	Oct 11	ES	63		3.60	J									
15	EBT	Wood R	4-5	5	Oct 11	ES	58		2.80	J									
16	EBT	Wood R	4-5	5	Oct 11	ES	72		4.80	J									
17	EBT	Wood R	4-5	5	Oct 11	ES	56		2.10	J									
18	EBT	Wood R	4-5	5	Oct 11	ES	60		2.10	J									
19	EBT	Wood R	4-5	5	Oct 11	ES	77		5.50	J									
20	EBT	Wood R	4-5	5	Oct 11	ES	60		2.20	J									
21	EBT	Wood R	4-5	5	Oct 11	ES	64		2.60	J									
22	EBT	Wood R	4-5	5	Oct 11	ES	67		3.10	J									
23	EBT	Wood R	4-5	5	Oct 11	ES	71		4.10	J									
1	EBT	Wood R	4-5	5	Oct 11	ES	60		2.70										
2	EBT	Wood R	4-5	5	Oct 11	ES	42		0.70										
1	MW	Wood R	6	3	Oct 11	BS	275		194.00	F		1							
2	MW	Wood R	6	3	Oct 11	BS	155		34.50			2							
3	MW	Wood R	6	3	Oct 11	BS	188		68.10	F		3							
4	MW	Wood R	6	3	Oct 11	BS	154		31.00	F		4							
5	MW	Wood R	6	3	Oct 11	BS	182		55.50	M		5							
6	MW	Wood R	6	3	Oct 11	BS	152		31.50	F		6							
1	MW	Y.Jacket	1	1	Oct 15	ES	215		118.00			1	3						
2	MW	Y.Jacket	1	1	Oct 15	ES	210		130.00			2	3						
3	DV	Y.Jacket	1	1	Oct 15	ES	120		14.80										
4	DV	Y.Jacket	1	1	Oct 15	ES	111		14.30										
5	DV	Y.Jacket	1	1	Oct 15	ES	78		4.90										
6	DV	Y.Jacket	1	1	Oct 15	ES	40		1.90										
7	DV	Y.Jacket	1	1	Oct 15	ES													
1	DV	Y.Jacket	2	2	Oct 18	ES	220		108.30										
2	DV	Y.Jacket	2	2	Oct 18	ES	190		77.40										
3	DV	Y.Jacket	2	2	Oct 18	ES	92		9.00										

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Fish No.	Species	System	Site	Reach	Date/ Time	Capture Method	Length (fork mm)	Length (POH mm)	Weight (g)	Sex	Maturity	Scale No.	Scale age	Otolith No.	Otolith Age	Gonad Wt. (g)	Egg Diam (mm)	Egg Count	Other Info
4	DV	Y.Jacket	2	2	Oct 18	ES	126		21.70										