Reconnaissance (1:20,000) Fish and Fish Habitat Inventory of Tributaries to the Skeena and Lakelse Rivers

Watershed Codes:
400-152200, 400-154700, 400-159700,
400-160900, 420-322000

Prepared for

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February 1999

PROJECT SUMMARY SHEET

PROJECT REFERENCE INFORMATION

FRBC Multi-Year Agreement #:	SBM98311
MELP Project #:	unknown
FRBC Activity #:	6009
FDIS Project #:	06 LSKE – 000000221-1999
MELP Region:	Skeena Region (06)
FW Management Unit:	06-11, 06-15
DFO Subdistrict:	Prince Rupert (6)
Forest Region:	Prince Rupert
Forest District:	Kalum
Forest Licensee:	Skeena Cellulose Inc.
First Nations Claim Area:	Tsimsian

WATERSHED INFORMATION

Watershed Group	Lower Skeena River (LSKE)
Watershed Name	Dasque Creek
Watershed Code	400-152200
UTM at Mouth	9.6027168.504930
Watershed Area	86.6 km^2
Stream Order	4
NTS Maps (1:250,000)	103I
NTS Maps (1:50,000)	103I/07
TRIM Maps	103I.025, 103I.026, 103I.035, 103I.036
BEC Zone	$CWHws^1$, $CWHws^2$, MHb

Watershed Group	Lower Skeena River (LSKE)
Watershed Name	*alias Middle Creek*
Watershed Code	400-154700
UTM at Mouth	9.6027689.506273
Watershed Area	73.7 km^2
Stream Order	5
NTS Maps (1:250,000)	103I
NTS Maps (1:50,000)	103I/07
TRIM Maps	103I.026, 103I.036, 103I.046
BEC Zone	$CWHws^1$, $CWHws^2$, MHb, AT

Watershed Group	Lower Skeena River (LSKE)
Watershed Name	Whitebottom Creek
Watershed Code	400-159700
UTM at Mouth	9.6028626.508961
Watershed Area	17.8 km^2
Stream Order	4
NTS Maps (1:250,000)	103I
NTS Maps (1:50,000)	103I/07
TRIM Maps	103I.036, 103I.046
BEC Zone	$CWHws^1$, $CWHws^2$, MHb

Watershed Group	Lower Skeena River (LSKE)
Watershed Name	Unnamed Creek
Watershed Code	400-160900
UTM at Mouth	9.6029281.509495
Watershed Area	22.4 km^2
Stream Order	4
NTS Maps (1:250,000)	103I
NTS Maps (1:50,000)	103I/07
TRIM Maps	103I.036, 103I.037, 103I.046
BEC Zone	$CWHws^1$, $CWHws^2$, MHb

Watershed Group	Lower Skeena River (LSKE)
Watershed Name	White Creek
Watershed Code	420-332600
UTM at Mouth	9.6030822.519463
Watershed Area	35.4 km^2
Stream Order	4
NTS Maps (1:250,000)	103I
NTS Maps (1:50,000)	103I/07
TRIM Maps	103I.037, 103I.047
BEC Zone	$CWHws^1$, $CWHws^2$, MHb, AT

SAMPLING DESIGN

Watershed Codes	400-155200, 400-154300, 400-159700, 400-160900, 420-332600
Total of All Stream Lengths	578 km
Total # of Reaches	725
Random Sampling Sites	30
Discretionary Sample Sites	15
Total Sample Sites	45
Field Sampling Dates	Sept. 5-6, 1998, Sept. 24-25, 1998
Fish Species in Watershed	RB/ST, PK, CH, CO, CM, CT, DV, BT, CAL, RSC, TSB

CONTRACTOR INFORMATION

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DISCLAIMER

This product has been accepted as being in accordance with the approved standards within the limits of the Ministry quality assurance procedures. Users are cautioned that interpreted information on this product developed for the purposes of the Forest Practices Code Act and Regulations, for example stream classifications, is subject to review by a statutory decision maker for the purposes of determining whether or not to approve an operational plan.

Maps were drafted and edited by Applied Ecosystem Management Ltd. (Whitehorse, YK and Terrace, B.C.). Stream classifications indicated on the maps were not reviewed by SKR Consultants Ltd.. In cases of discrepancies between the maps and information presented in this report, the report should supercede the maps.

ACKNOWLEDGMENTS

Funding for this project was provided by Forest Renewal B.C., and administered by Skeena Cellulose Ltd., Terrace, B.C.. The contract was monitored jointly by Kim Haworth (Skeena Cellulose Ltd.) and Brad Pollard (Acer Resource Consulting Ltd.). Skeena Cellulose Ltd. provided maps and air photos. Doug Steventon (MoF, Prince Rupert Region) kindly provided references for tailed frogs. Editorial comments on drafts of this report were provided by Ron Saimoto (SKR Consultants Ltd.), Todd Zimmerling (Applied Ecosystem Management Ltd.), Stacey Brown and Brad Pollard (QA/QC Monitors), and Paul Giroux (B.C. Environment).

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1.0

1.0 INTRODUCTION

Selected tributaries to the lower Skeena River, and White Creek (a tributary to the Lakelse River, Skeena drainage) were surveyed in September 1998 to determine the habitat characteristics and the diversity, population characteristics, and distribution of fish in the study area. SKR Consultants Ltd., in association with Applied Ecosystem Management Ltd., was retained by Skeena Cellulose Inc. (Terrace, B.C.) to conduct these surveys. The project was funded by Forest Renewal B.C. (FRBC). This report summarizes the results of the reconnaissance level stream inventory project that was conducted in the tributaries to the lower Skeena River and White Creek (Lakelse watershed, Skeena drainage).

1.1 OBJECTIVES

The main objectives of the watershed reconnaissance level stream inventory project in the tributaries to the Skeena River and in White Creek (Lakelse watershed, Skeena drainage) were:

- to review and summarize historical fisheries information for the study area,
- to undertake a reconnaissance level stream inventory to describe fish distribution and diversity,
- to document barriers to fish passage,
- to document fish habitat characteristics,
- to identify further sampling requirements, and
- to classify reaches sampled according to the B.C. Forest Practices Code Fish – Stream Identification guidebook.

1.2 HISTORICAL INFORMATION

Fisheries information for the lower Skeena and Lakelse rivers is relatively extensive (FISS). However, little information has been documented for the streams within the study area (FISS). Coincidental fisheries observations and sampling has been conducted at the mouths of some of these systems, but the extent of upstream fish distribution has not been determined. Coho (*Oncorhynchus kisutch*), chinook (*O. tsawytscha*), pink (*O. gorbusha*), chum (*O. keta*), steelhead and rainbow trout (*O. mykiss*), cutthroat trout (*O. clarki*), and Dolly Varden (*Salvelinus malma*) have been reported spawning and rearing within this area of the Skeena watershed (FISS).

2.0 STUDY AREA

White Creek (a tributary to the Lakelse River) and six tributaries to the Skeena River (four watershed coded systems, and two systems that are not coded in the watershed code dictionary) were sampled during the 1:20,000 fish and fish habitat inventory project. All of these streams drain the area south of the Skeena River between the Gitnadoix watershed and the Lakelse River mainstem.

2.1 LOCATION

White Creek and the tributaries to the Skeena River are located in the Skeena Region (B.C. Ministry of Environment, Lands and Parks), and in the Kalum Forest District, Prince Rupert Forest Region. The area is characterized by moderate to steep gradient terrain, with low gradients in the Skeena River valley. White Creek is a glacial stream, which drains a moderate sized basin to the west of the Lakelse River into the river downstream of Lakelse Lake. The Skeena River tributaries surveyed drain a portion of the southern side of the Skeena River watershed between the Gitnadoix River and Lakelse River.

The area drained by streams examined lies within the Kitimat Ranges Ecosection, Coastal Gap Ecoregion (Coastal Mountains Ecoprovince, Humid Maritime Highlands Ecodivision, Humid Temperate Ecodomoain). The two smaller tributaries to the Skeena River (Unnamed Creeks (ILP 77 and ILP 13), as well as the lower reaches of the larger systems (Dasque, White, Middle, Whitebottom and White Creeks) surveyed are within the Wet Submaritime Variant of the Coastal Western Hemlock Biogeoclimatic Zone (CWHws[1]). Mid reaches of the larger systems are found within the Montane Variant of the Coastal Western Hemlock Biogeoclimatic Zone (CWHws[2]), and upper reaches of these systems extend into the Submaritime Forested and Parkland Mountain Hemlock Biogeoclimatic Zone (MHb). The undifferentiated Alpine Tundra Biolgeoclimatic zone accounts for a minor portion of the drainage area, at the very headwaters of Middle and White Creeks (MoF 1998).

2.2 ACCESS

The study area can be accessed by vehicle, helicopter or boat. Lower reaches of streams can be accessed via boat from the Skeena River. To access the area by vehicle, proceed on Queensway Avenue in Terrace for approximately 4 km. At 4 km, turn west onto the Old Remo Road, then turn southwest onto the Whitebottom Logging Road (at 9 km) and continue on this logging road for about 1.5 km to the Lakelse River Bridge. The White Creek road is located approximately 0.5 km south of the Lakelse Bridge on the Whitebottom Logging Road. However, like most spur roads in the area, this road was deactivated at the time of sampling. The Whitebottom Logging Road continues for an additional 3 km past the Lakelse Bridge. Access to upper reaches in the study area is by helicopter only.

colour copy of overview map will be inserted. This map was not available at the time of draft report production.

Figure 1. Overview map of the study area within the Skeena and Lakelse watersheds, British Columbia.

3.0 RESOURCE USE

The study area consists primarily of public land, which is utilized by several different resource sectors.

1. First Nations issues and interests in the study area:
   - The Tsimsian Nation land claim area includes all drainages surveyed during this 1:20,000 fish and fish habitat inventory project. The status of their claim is currently at stage 4 of the Treaty Negotiation Process (B.C. Treaty Commission 1998).
2. Development and land use: forestry, mining, recreation:
   - The study area falls into tree farm licence TFL#1 (Skeena Cellulose Inc.), and harvest in the area has been proposed to the year 2003 (Skeena Cellulose Inc. five year development plan).
   - No mineral tenures are located in the area (Ministry of Employment and Investment 1998).
   - The guide outfitter territory in the study area is 610G001, and the trapline territories are 610T001, 610T004 and 615T001 (B.C. Environment 1998a).
   - No B.C. Forest Service Recreation (BCFSR) sites or trail exist in the study area. The nearest B.C.F.S.R. site is located near the confluence of the Lakelse and Skeena rivers.
3. Other developments, concerns or points of interest:
   - No higher level plans are in place for the study area. However, the Kalum Forest District in the process of developing an LRMP and delineating Landscape Areas that would include the drainages in the study area (Paris pers. comm.).
   - No water licences have been recorded for the study area (B.C. Environment 1998b).
4. Existing water quality data:
   - No water quality data is reported in the EMS database for the study area, and no EMS sites have been established for the area (B.C. Environment 1998c).
5. Previous presence of fish in systems of interest:
   - Fish presence previously documented in the study area is summarized in Table 1.

Table 1. A summary of fish previously documented present in selected inlet streams to the Skeena River and the Lakelse River.

Species	Scientific Name	Reference
chum	*Oncorhynchus keta*	FISS
coho	*Oncorhynchus kisutch*	FISS
chinook	*Oncorhynchus tsawytscha*	FISS
pink	*Oncorhynchus gorbusha*	FISS
steelhead	*Oncorhynchus mykiss*	FISS
rainbow trout	*Oncorhynchus mykiss*	FISS
Dolly Varden	*Salvelinus malma*	FISS
cutthroat	*Oncorhynchus clarki*	FISS

4.0 METHODS

4.1 SAMPLE SITE SELECTION

Sample sites were selected randomly through the Fish Data Information System (FDIS) by conducting reach break analysis for the entire watershed. All streams on 1:20,000 TRIM map scale were identified numerically by assigning an Interim Location Point (ILP) or watershed code, following 1:20,000 fish and fish habitat inventory standards (RIC 1998). Streams were divided into reaches based on map and air photo interpretation. Basin types were assigned to each reach, and all reach information was entered in the FDIS database, following Resource Inventory Committee standards (RIC 1998). FDIS selected random sites, which were mapped on 1:20,000 and 1:50,000 map scale. Some sites were deleted or moved based on previous fish sampling in the watershed and site accessibility. Random and biased sampling sites were mapped on 1:50,000 scale, along with existing fisheries information for presentation to the contract monitor and the ministry representative. The sampling plan was summarized in a project plan (SKR 1998a) for ministry and contract monitor approval.

4.2 STREAM ASSESSMENT

All stream assessment was conducted on September 5-6, 1998 and September 24-25, 1998. Stream sites were accessed by four wheel drive vehicle and helicopter. Stream sections of interest were assessed to determine fish presence and habitat values. Fish Data Information System (FDIS) site cards and fish collection cards were completed at sample sites, following Resource Inventory Committee Standards (RIC 1998), and data were entered into the FDIS database. A list of sampling equipment used during this 1:20,000 reconnaissance level fish and fish habitat inventory project is presented in Table 2.

Table 2. List of sampling equipment used during the 1:20,000 reconnaissance fish and fish habitat inventory project, September 1998.

Parameter	Sampling Intensity	Method
date and time	each site	wrist watch
weather conditions	each reach	visual
air temperature	each reach	alcohol thermometer
water temperature	each site	alcohol thermometer
pH	each site	LaMotte pH meter, Oaktron pHTestr2
conductivity	each site	Hanna HI 9033, Oaktron TDSTestr 3
water clarity	each site	visual
fish presence	as required to determine fish presence	Smith Root Model 15C and Smith Root Model 12B backpack electroshocker, minnow traps
photography	each site	Canon Sureshot A1, Minolta Weathermatic Dual 35
GPS	where available	Garmen GPS 45
gradient	each site	Abney Level or Suunto clinometer

All fish that were captured were identified to species, except in the instances where the number of fish and their size precluded definitive identification to species in the field. Bull trout and Dolly Varden char were distinguished between based on the linear discriminant function (equation 1) developed by Haas and McPhail (1991).

Equation 1. $LDF = 0.63 \times BR + 0.18 \times AFR + 37.31 \times (UJL/SL) - 21.8$

where: LDF = linear discriminant function (>0 are bull trout, <0 are Dolly Varden)
BR = total branchiostegal ray number
AFR = total anal fin ray number
UJL = total upper jaw length
SL = standard length

Fork lengths were recorded for all salmonids captured, as well as for most non-salmonids. Voucher specimens were retained for a sub-sample of fish captured (Appendix 2). Voucher specimens were preserved in 10% formalin for a minimum of 14 days after which they were rinsed in water and transferred to 50% isopropyl alcohol. DNA samples were also collected for a sub-sample of bull trout, Dolly Varden and cutthroat trout (Appendix 2). DNA samples usually consisted of a tissue plug preserved in 90% ethanol.

4.3 MAPPING

Digital mapping was conducted by Nadelle Flynn, Applied Ecosystem Management Ltd. (Whitehorse, YK). MapInfo Professional version 4.5 was used to digitize points and complete preliminary layouts. Mapping was completed by running an Arc/Info user interface (FDISMap version 2.0 developed by Wynrib 1998), which partially automates the mapping process. FDISMap version 2.0 was used to produce maps by extracting data from the FDIS database provided by SKR Consultants Ltd.. In addition, historic information such as fish presence, distribution and spawning limits, and known obstructions were captured digitally in a separate point file from the FDIS information for inclusion on interpretive maps. Overview, project, and interpretive maps were produced following RIC standards (RIC 1998b).

5.0 RESULTS AND DISCUSSION

5.1 LOGISTICS

Overall, water temperatures and water clarity were conducive to fish sampling by electroshocking. However, conductivities encountered in the majority of reaches were low, ranging between 10 and 110 μS/cm for reaches sampled. It was noted that electrofishing in waters with very low conductivities had less effect on fish, which reduced sampling efficiency.

Access to some sections of the drainage was difficult. For example, no suitable helicopter landing sites could be located in reach 6 of Unnamed Creek (400-160900), and the sample site was shifted downstream to the nearest accessible site.

5.2 SUMMARY OF SUB-BASIN BIOPHYSICAL INFORMATION

The study area was divided into four sub-basins based on topography, and the location of major systems inventoried (Table 3). Three of these sub-basins drain directly into the Skeena River, and one (White Creek sub-basin) drains into the Lakelse River. The significant proportion of the drainage examined is located in the Skeena and Lakelse river valley flats, and is characterized by low to moderate gradients. Streams rise relatively steeply out of the valley flats, and mid to upper reaches of systems are characterized by moderate to high gradients. The headwaters of several systems, including White, Dasque, and Middle creeks. Water quality appeared to be impacted somewhat by the glacial origin of White and Dasque creeks. A significant proportion of the streams within the study area appear to be accessible to fish, and the lower reaches of these systems, within the Lakelse and Skeena river valley flats, offer suitable spawning and rearing habitat for resident and anadromous salmonids.

Table 3. Summary of watershed information for the sub-drainages distinguished between in the study area.

Gazetted Name and Watershed Code	including	Stream Order	NTS map	BEC zone	Lake Names	Number of Sample Sites	previous fisheries information
Dasque Creek (400-152200)	Dasque Creek and ILP 81	4	103I/06 & 103I/07	CWHws[1], CWHws[2], MHb	none	10	yes[4]
Middle Creek (400-154700)		5	103I/07	CWHws[1], CWHws[2], MHb, AT	none	14	yes[4]
Whitebottom Creek (400-159700)	Whitebottom, and Unnamed Creeks 400-160900 and ILP 13	4	103I/07	CWHws[1], CWHws[2], MHb	none	11	yes[4]
White Creek (420-332600)		4	103I/07	CWHws[1], CWHws[2],	none	10	yes[4]

				MHb, AT			

4 = FISS

5.3 HABITAT AND FISH DISTRIBUTION

The study area is characterized by a predominance of steep lands. Some of the lower reaches of the main tributaries (Dasque, Middle, Whitebottom, and White creeks) are located on the Skeena River and Lakelse River valley flats and are thus accessible to fish. A significant proportion of these watersheds are in the steeper terrain which limits the quantity and diversity of fish habitat. Lakes and ice cover a small proportion of the study area, but White Creek appears to be notably influenced by glacial run off. A total of 45 sites were sampled in selected tributaries to the Skeena and Lakelse rivers (Table 3). Based on the results and observations conducted in this study, all of the sub-basins except Dasque Creek appear to offer valuable fish habitat in their lower reaches.

Water chemistry was relatively consistent between tributaries to the Skeena and Lakelse rivers sampled, and was generally conducive to sampling (Table 4). Water temperatures encountered during sampling ranged between 4.5 and 11^{o}C. Conductivities were low in most reaches, and ranged between 10 – 110 μS/cm. The pH readings recorded for the study area were slightly acidic to slightly basic, ranging between 6.3 and 8.5. The water was clear, except in one tributary to Dasque Creek and a tributary to White Creek.

Overall, fish distribution in the study area appeared to be limited by a combination of gradient barriers (including falls and cascades) dewatered channels and underground flow (Tables 4 and 5). The following sections provide further detail on information that was attained for the Dasque Creek, Middle Creek, Whitebottom Creek and White Creek sub-basins.

Table 4. Summary of water quality characteristics encountered in each of the sub-drainages in the study area (*for details see* Appendix 1).

Sub-basin	Watershed Code/ILP	Reach	Date	Agency	Water Temp.	pH	conductivity (µS/cm)	Turbidity[1]	Cover Total[2]
Das	ILP 81	1	1998/09/24	AEM	dry at time of survey				A
	400-152200	1	1998/09/05	SKR	9	7.7	20	C	A
	400-152200	3	1998/09/24	AEM	8	6.9	20	C	T
	400-152200	5	1998/09/24	AEM	8	8.5	10	L	T
	400-152200	6	1998/09/24	AEM	6	7.5	20	C	T
	ILP 218	1	1998/09/24	AEM	9	6.5	20	C	A
	ILP 284	1	1998/09/24	AEM	6.5	7.4	10	C	A
	ILP 375	1	1998/09/24	AEM	7	7	20	C	T
	400-152200-50500	1	1998/09/24	AEM	7	7.4	10	M	A
	400-152200-87900	1	1998/09/24	AEM	8	8.3	10	L	T
Mid	400-154700	2	1998/09/05	SKR	10	6.9	15	C	M
	400-154700	3	1998/09/05	SKR	8	6.8	14	C	A
	400-154700	4	1998/09/24	AEM	7	7.4	10	L	A
	ILP 185	1	1998/09/05	SKR	no defined channel				
	400-154700-14600	2	1998/09/05	SKR	9	7.8	14	C	A
	400-154700-14600-45700	1	1998/09/25	SKR	5	8	12	C	A
	ILP 477	1	1998/09/25	SKR	dry at time of survey				
	ILP 481	1	1998/09/25	SKR	no well defined channel, dry at time of survey				
	ILP 485	1	1998/09/25	SKR	dry at time of survey				
	400-154700-14600-59700	1	1998/09/25	SKR	7	7.1	12	C	A
	ILP 379	1	1998/09/05	SKR	10	7	32	C	A
	ILP 459	1	1998/09/24	AEM	no visible channel				
	ILP 476	1	1998/09/24	AEM	dry at time of survey				T
	ILP 583	1	1998/09/24	AEM	7	6.7	20	C	T
Whi	400-159700	7	1998/09/05	SKR	10	7.7	32	C	A
	400-159700	8	1998/09/25	SKR	4.5	7.4	31	C	M
	400-159700-14300	1	1998/09/06	SKR	11	7.8	54	C	A
	400-160900	4	1998/09/06	SKR	10	7.5	30	C	M
	400-160900 (site 17)	5	1998/09/06	SKR	10	7.7	27	L	A
	400-160900 (site 18)	5	1998/09/25	AEM	7	7.6	20	C	A
	ILP 35	1	1998/09/06	SKR	9	7.1	36	C	M
	ILP 28	4	1998/09/06	SKR	dry at time of survey				
	ILP 46	2	1998/09/06	SKR	dry at time of survey				
	ILP 36	1	1998/09/06	SKR	9	6.3	62	C	A
	ILP 13	1	1998/09/06	SKR	9	6.9	48	C	A
Whi	420-332600	1	1998/09/25	AEM	11	7.1	30	C	A
	420-332600	4	1998/09/25	AEM	9	7.6	20	L	A
	420-332600	5	1998/09/25	AEM	6	7.4	20	L	M
	420-332600	7	1998/09/25	AEM	5	7.7	20	C	M
	ILP 30	1	1998/09/25	AEM	10	7.6	20	C	M
	420-332600-08300	1	1998/09/25	AEM	dry at time of survey				T
	ILP 27	1	1998/09/25	AEM	dry at time of survey				M
	420-332600-47000	1	1998/09/25	AEM	dry at time of survey				A
	420-332600-57700	1	1998/09/25	AEM	8	8.1	110	L	T
	420-332600-73000	1	1998/09/25	AEM	4.5	7.8	10	T	A

[1] C = clear, L = low, M = moderate, T = turbid
[2] A= abundant, M = moderate, L = low, T = trace, N = none

Table 5. Summary of historic and new barriers to fish migration found in White Creek (tributary to Lakelse River) and selected tributaries to the lower Skeena River.

Sub-basin	Stream	TRIM map #	Reach	Barrier			
				Type	Height (m)	Verified in field	Description
+	Unnamed Creek (400-152200-50500)	103I.035	2	F	30	Y	at lower end of reach 2, no sampling upstream of falls
Middle Creek Sub-Basin	Unnamed Creek (ILP 185)	103I.036	1	NDC		Y	no defined channel, no fish habitat
	Unnamed Creek (400-154700-14600)	103I.036	2	C	6	Y	likely a barrier to fish migration, no fish captured upstream
	Unnamed Creek (ILP 481)	103I.036	1	NDC		Y	no well defined channel, no fish habitat
	Unnamed Creek (400-154700-14600-59700)	103I.036	1	F	1	Y	located 5 meters upstream of confluence. Falls is a barrier to fish migration; no fish captured upstream of falls.
	Unnamed Creek (ILP 459)	103I.036	1	NDC		Y	no defined channel, no fish habitat
*	Whitebottom Creek (400-159700)	103I.036	8	C		Y	cascades appear to be barriers; no fish captured upstream.

White Creek Sub-Basin	White Creek (420-332600)	103I.037	4	F	15	Y	no fish captured upstream
	White Creek (420-332600)	103I.037	7	F	10	Y	no fish captured upstream
	Unnamed Creek (420-332600-47000)	103I.037	1	GR		Y	38-42 % gradient
	Unnamed Creek (420-332600-57700)	103I.037	1	C	4	Y	36% gradient over lower 10 meters

+ Dasque sub-basin, * Whitebottom Sub-Basin, [1] UGF = underground flow, GR = gradient barrier, NDC = no defined channel

5.3.1 Dasque Sub-Basin

The Dasque sub-basin includes the mainstem Dasque Creek, its tributaries, and a small, first order tributary (ILP 81) to the Skeena River. Dasque Creek drains into the southern shore of the Skeena River approximately 10.5 km east of Lakelse River, and Unnamed Creek (ILP 81) is located approximately 3 km east of Dasque Creek. The Dasque sub-basin is characterized by gentle to moderately sloped terrain within the Skeena River valley. The entire length of Unnamed Creek (ILP 81) is located within this valley flat area. Gradient increases in the middle and upper reaches of Dasque Creek and tributaries, as the terrain becomes predominantly steep lands. Wedeene Mountain is located at the headwaters of this system. Map interpretation indicates that the best accessible habitat appears to be confined to the mainstem of Dasque Creek, particularly in reaches within the Skeena River valley flat area.

Pink salmon have been reported spawning in Dasque Creek just upstream of the Skeena River, and coho, cutthroat trout and Dolly Varden utilize the lower reach of Dasque Creek (FISS). Prior to this study, no fisheries information was available for the majority of the Dasque Creek drainage upstream of the Skeena River valley flat area.

A 30 m falls was identified on a main tributary to Dasque Creek (Unnamed Creek 400-152200-50500) (Table 5). No other barriers to fish migration were identified in the Dasque Creek drainage. Dolly Varden are present up to the alpine reaches in the mainstem of Dasque Creek. The lower reaches of most tributaries to Dasque Creek also appear to offer usable fish habitat, since they are located in the relatively wide Dasque Creek valley bottom.

A total of five sites selected randomly by the FDIS database were sampled in the Dasque sub-basin. Two additional biased sites were added to the Dasque Creek mainstem (reaches 3 and 5) and three replacement sites were chosen in tributaries where FDIS sample site selection appeared insufficient. The following sections provide further detail of the fisheries information that was attained in Unnamed Creek (ILP 81), and Dasque Creek.

Table 6. Summary of habitat characteristics in reaches sampled in the Dasque sub-basin. (*for details see* Appendix 1).

Section	Stream	TRIM map	Reach	Species [4]	channel		Substrate [1]		Morphology [2]	Habitat [3]		
					gradient (%)	width (m)	Dominant	Sub-dominant		Rearing	Spawning	Overwinter
5.3.1.1	Unnamed Creek (Trib. to Skeena River) (ILP 81)	103I.036	1	NFC	7.0-9.5	3.2	G	F	dry	D	D	D
5.3.1.2	Dasque Creek (400-152200)	103I.036	1	BT, CH, CAL	2.5-3.0	47	C	G	RP	M	M	G
5.3.1.2	Dasque Creek (400-152200)	103I.036	3	DV	2.5	50.5	C	B	CP	G	P	M
5.3.1.2	Dasque Creek (400-152200)	103I.026	5	DV	7-11.5	47.5	B	C	RP	G	M	M
5.3.1.2	Dasque Creek (400-152200)	103I.026	6	DV	4-7	34.2	B	C	CPB	G	P	P
5.3.1.2	Unnamed Creek (trib. to Dasque C.) (ILP 218)	103I.036	1	DV	12-27	1.2	F	C	LC	G	P	N
5.3.1.2	Unnamed Creek (trib. to Dasque C.) (ILP 284)	103I.036	1	DV	19-21	4.6	B	C	CPB	P	P	P
5.3.1.2	Unnamed Creek (trib. to Dasque C.) (ILP 375)	103I.036	1	DV	2	5.7	F	F	LC	G	N	M
5.3.1.2	Unnamed Creek (trib. to Dasque C.) (400-152200-50500)	103I.035	1	DV	16-18	9.2	B	C	CPB	M	P	G
5.3.1.2	Unnamed Creek (trib. to Dasque C.) (400-152200-87900)	103I.025	1	NFC	14	5.8	B	C	CPB	M	P	M

[1] R = bedrock, B = boulders, C = cobbles, G= gravels, F = fines
[2] RP = riffle pool; CP = cascade pool, CPB = cascade pool, boulder; LC = large channel
[3] G = good, M = moderate, F = fair, P = poor, N = nil, D = dry channel
[4] NFC = no fish captured, BT = bull trout, DV = Dolly Varden, CH = chinook, CAL = coastrange sculpin

5.3.1.1 Unnamed Creek (ILP 81)

Unnamed Creek (ILP 81) is a third order tributary to the Skeena River and is characterized by gentle terrain. The entire length of this stream is located in the Skeena River valley, thus the basin is characterized by a predominance of valley flats. Map interpretation indicates that available habitat in this system is accessible to fish.

No previous information was found for Unnamed Creek (ILP 81). The channel in reach 1 of ILP 81 was dry at the time of survey, and appeared to offer no suitable fish habitat (Table 6). This system has limited fisheries values, but may be utilized as refuge habitat during high flows in the Skeena River mainstem.

5.3.1.2 Dasque Creek (400-152200)

The majority of the Dasque sub-basin is drained by Dasque Creek, a fourth order tributary to the Skeena River. The Dasque Creek drainage basin is characterized by valley flats in the lower reaches, which are located in the Skeena River valley. Gradients increase as the stream rises out of the Skeena River valley, and the stream becomes more confined. The mid and upper reaches of Dasque Creek and tributaries drain an area consisting primarily of steep lands. No lakes were identified in the drainage. The majority of the mainstem appears to be accessible to fish, but gradients indicate that mid to upper reaches of most tributaries, and alpine reaches of the mainstem offer limited accessible fish habitat.

Sampling during the current study was dispersed among mainstem reaches, covering reaches 1, 3, 5 and 6 of Dasque Creek. Some sampling in tributaries was also conducted to help assess fish distribution, and the value of available habitat. Bull trout (*Salvelinus confluentus*), chinook, and coastrange sculpins (*Cottus aleuticus*) were captured in reach 1, while Dolly Varden was the only species captured upstream of reach 1. Dolly Varden were captured as far upstream as reach 6 of Dasque Creek, and this species may be present beyond the upper limit of sampling in the mainstem. Dolly Varden were also captured in steeper tributaries, including reach 1 of Unnamed Creek (ILP 284), which had a site gradient of 19-21 % (Table 6). Fish were captured in all reaches sampled in the Dasque Creek drainage except for reach 1 of Unnamed Creek (400-152200-87900). Tailed frogs (*Ascaphus truei*) and Dolly Varden were also identified in reach 1 of Unnamed Creek (ILP 218). A 30 meter waterfall on the largest tributaries to Dasque Creek (400-152200-50500) was identified just upstream of the confluence (Table5), but no fish sampling was conducted upstream of this barrier. Gradient analysis indicates that reach 8 of Dasque Creek (gradient = 44%) is the limit to fish distribution in this system. The lower reaches of Dasque Creek offered the best fish habitat in the Dasque Creek sub-basin due to evidence of some anadromous fish (i.e. chinook) using reach one.

5.3.2 Middle Creek Sub-Basin

The Middle Creek (alias) sub-basin is characterized by a predominance of steep lands and a low proportion of ice and lakes. Middle Creek forks into two sections of about equal size approximately 2.5 km upstream of the Skeena River. The mainstem Middle Creek drains the western half of the basin, while the unnamed tributary (400-154700-14600) drains the eastern half. The lower reaches of Middle Creek, downstream of the fork in the creek, are located in the

valley flats of the Skeena River mainstem. This lower section of the sub-basin exhibits low gradients, and unconfined and decoupled channels. Two very small lakes are indicated on 1:50,000 scale, but these lakes represent a very low proportion of the area drained by Middle Creek watershed. Map interpretation indicates that the lower and middle reaches of Middle Creek offer the best accessible fish habitat.

Coho, chum and pink salmon spawning locations have been identified in the lower extent of Middle Creek, near the Skeena River. No fisheries information exists for Middle Creek or its tributaries upstream of Reach 1 (FISS).

Fish distribution in the Middle Creek sub-basin was limited by a combination of gradient barriers and dewatered channels at some sites sampled. A 6 meter high cascade was identified as a barrier to fish migration in reach 2 of Unnamed Creek (400-154700-14600) (Table 5), and no fish were captured upstream of this location. Fish distribution was also limited by the presence of dewatered (e.g. ILP 477 and ILP 476) and undefined channels (e.g. ILP 185, ILP 481, ILP 459) in tributaries to Middle Creek (Table 7).

Nine sites randomly chosen by FDIS, and six biased sites were sampled in the Middle Creek sub-basin. Some random sites were not sampled due to lack of access. Biased sites were added to the mainstem of Middle Creek since FDIS did not select any sites on this mainstem. The following sections provide further detail of the fisheries information that was attained in Middle Creek and its main tributary (Unnamed Creek 400-154700-14600).

5.3.2.1 Middle Creek Mainstem

Middle Creek is a fifth order tributary to the Skeena River, which is characterized by low gradient reaches in the lower section (below Unnamed Creek 400-154700-146000), situated in the Skeena River valley flat area. The gradient increases rapidly as the Middle Creek rises out of the Skeena River valley flat areas. However, most of the mainstem appears to be accessible to fish, as determined from map interpretation.

Previous fisheries information is limited to the mouth of Middle Creek, where coho, chum and pink salmon have been reported (FISS). Cutthroat trout, bull trout and Dolly Varden were captured in reach 2 of Middle Creek, located in the Skeena River valley flat. Dolly Varden were captured in all of the defined and wetted channels in the Middle Creek mainstem. The majority of the Middle Creek mainstem appears to be accessible to fish, and the best fish habitat was noted in the lower reaches of the system due to the sue of good spawning and rearing habitat by coho, chum, and pink salmon (FISS).

5.3.2.2 Unnamed Creek (400-152200-14600)

Unnamed Creek (400-152200-14600) is a fourth order tributary to Middle Creek. This major drainage is dominated by steep lands. Map interpretation indicates that the majority of the drainage has gradients in excess of 21%. Fish distribution in this relatively large system is limited to reach 1 of Unnamed Creek (400-152200-14600).

No previous fisheries information exists for Unnamed Creek (500-152200-14600). A six meter high cascade in reach 2 of the system was identified as a barrier to fish migration (Table 5), and extensive sampling upstream of this barrier did not result in the capture of any fish. However, tailed frogs, a blue listed species (CDC1995) were captured in Unnamed Creek (ILP 281), which drains into Unnamed Creek (400-152200-14600). Important fish habitat is limited to the lower reach of this relatively large systems, but all reaches above the barrier were identified to have a significant debris and sediment transport potential, due to their consistently moderate to steep gradients.

Table 7. Summary of habitat characteristics in reaches sampled in the Middle Creek sub-basin. (*For details see* Appendix 1).

Section	Stream	TRIM map	Reach	Species [4]	channel		Substrate [1]		Morphology [2]	Habitat [3]		
					gradient (%)	width (m)	Dominant	Sub-dominant		Rearing	Spawning	Overwinter
5.3.2.1	Middle Creek (400-154700)	103I.036	2	CT, DV, BT, CO	3	18.0	C	B	RP	G	M	
5.3.2.1	Middle Creek (400-157400)	103I.036	3	DV	4	9.8	B	C	CPB	G	G	G
5.3.2.1	Middle Creek (400-154700)	103I.036	4	DV	5	14.9	B	C	CPB	G	M	G
5.3.2.3	Unnamed Creek (trib to Middle Creek) (ILP 185)	103I.036	1	NFP	No defined channel							
5.3.2.1	Unnamed Creek (trib. to Middle Creek) (400-154700-14600)	103I.036	2	NFP	4-5	11.9	B	C	CP	G	F	G
5.3.2.2	Unnamed Creek (trib to 400-154700-14600) (400-154700-14600-45700)	103I.036	1	NFP	18	3.6	B	C	CP	M	F	M
5.3.2.2	Unnamed Creek (trib to 400-154700-14600) (ILP 477)	103I.036	1	NFP	23	2.1	B	F	CP	D	D	D
5.3.2.2	Unnamed Creek (trib. to 400-154700-14600) (ILP 481)	103I.036	1	NFP	No well defined channel							
5.3.2.2	Unnamed Creek (trib. to 400-154700-14600) (ILP 485)	103I.036	1	NFP	6	0.5	F	F	dry	N	N	N
5.3.2.2	Unnamed Creek (trib. to 400-154700-14600) (400-154700-14600-59700)	103I.036	1	NFP	10-12	2.7	C	G	CP	M	M	P
5.3.2.3	Unnamed Creek (trib. to Middle Creek) (ILP 379)	103I.036	1	NFP	9-10	0.6	F	F	SP	P	N	N

5.3.2.3	Unnamed Creek (trib. to Middle Creek) (ILP 459)	103I.036	1	NFP	32.5	No defined channel						
5.3.2.3	Unnamed Creek (trib. to Middle Creek) (ILP 476)	103I.036	1	NFP	18-23	4.8	B	F	dry	D	D	D
5.3.2.3	Unnamed Creek (trib. to Middle Creek) (ILP 583)	103I.036	1	DV	0.5-1.5	7.5	B	G	CPB	G	G	G

[1] R = bedrock, B = boulders, C = cobbles, G= gravels, F = fines
[2] RP = riffle pool; CP = cascade pool; CPB = cascade pool; boulder; SP = step pool
[3] G = good, M = moderate, F = fair, P = poor, N = nil, D = dry channel
[4] NFP = no fish present, DV = Dolly Varden, CT = cutthroat, BT = bull trout, CO = coho

5.3.2.3 Other Tributaries to Middle Creek

In addition to Unnamed Creek (400-152200-14600), five smaller tributaries to Middle Creek were sampled. The majority of smaller tributaries to Middle Creek are characterized by gentle to moderate gradients near their confluence with Middle Creek, with increasing gradients as the streams rise out of the Middle Creek valley flats. Most of the smaller tributaries draining into Middle Creek appear to be accessible to fish based on map interpretation.

Dolly Varden were captured in most of the defined and wetted reaches of the five small tributary streams draining in the Middle Creek. No fish were captured in Unnamed Creek (ILP 477) due to the lack of water at the time of survey (Table 7). No fish were captured in reach 1 of Unnamed Creek (ILP 379), despite the presence of suitable fish habitat. Overall, the majority of reaches of smaller streams draining into Middle Creek are accessible to fish, and may offer important habitat for Dolly Varden.

5.3.3 Whitebottom Sub-Basin

The Whitebottom sub-basin includes three streams (Whitebottom Creek, Unnamed Creek 400-160900, and Unnamed Creek (ILP 13)) that drain into the southern shore of the Skeena River. These systems are located between Middle Creek and the Lakelse River. The lower reaches of Whitebottom Creek and Unnamed Creek (400-160900), as well as the majority of Unnamed Creek (ILP13) are located in the Skeena River valley flat. These reaches exhibit low gradients, and primarily unconfined and decoupled channel morphology, as streams meander within the Skeena River valley. The section of these streams rising out of the Skeena River valley flats are characterized by moderate gradients. Channel slope and confinement increases in upstream reaches, and in tributaries. The majority of stream reaches within the Whitebottom Creek sub-basin are potentially accessible to fish, although gradients in the upper reaches of the mainstem, and in some tributaries exceed 20%, which indicates fish absence. The best fish habitat in this sub-basin appeared to be the lower reaches of both Whitebottom Creek and Unnamed Creek (400-160900), where low gradients, beaver ponds and side channels provide excellent rearing habitat, particularly for coho.

Pink, chum and coho have been identified in various reaches in Whitebottom Creek located in the Skeena River valley flats (reaches 1-7) (FISS). Coho have been reported spawning in the lower seven reaches of Whitebottom Creek. Pink and chum spawning locations have been noted in the lower kilometer of the stream. No historical fisheries information was available for Unnamed Creek (400-160900) or Unnamed Creek (ILP 13). Cutthroat trout and rainbow trout were captured in Whitebottom Creek, while bull trout, cutthroat trout, Dolly Varden, coastrange sculpins, redside shiners and threespine sticklebacks were captured in Unnamed Creek (400-160900). Cutthroat trout was the only species captured in Unnamed Creek (ILP 13). The highest species diversity was observed in Unnamed Creek (400-160900), which coincides with the only capture location of bull trout in the Whitebottom sub-basin.

Table 8. Summary of habitat characteristics in reaches sampled in the Whitebottom sub-basin (*for details see* Appendix 1).

Section	Stream	TRIM map	Reach	Species [4]	channel		Substrate [1]		Morphology [2]	Habitat [3]		
					gradient (%)	width (m)	Dominant	Sub-dominant		Rearing	Spawning	Overwinter
5.3.3.1	Whitebottom Creek (400-159700)	103I.036	7	RB/ST, CT	4-7	8.4	B	C	CPBW	G	P	G
5.3.3.1	Whitebottom Creek (400-159700)	103I.036	8	NFP	11-14	5.3	B	C	CP	M	P	M
5.3.3.1	Unnamed Creek (trib. to Whitebottom Creek) (400-159700-14300)	103I.036	1	NFC	2	2.0	C	G	RP	M	G	P
5.3.3.2	Unnamed Creek (400-160900)	103I.046	4	CAL, BT, CO	3	10.0	C	G	RP	M	P	M
5.3.3.2	Unnamed Creek (400-160900) (site 17)	103I.036	5	DV	13	9.0	B	C	CP	M	P	M
5.3.3.2	Unnamed Creek (400-160900) (site 18)	103I.036	5	NFC	16-20	11.4	B	C	SPB	M	P	P
5.3.3.2	Unnamed Creek (distributary to 400-160900) (ILP 35)	103I.046	1	CO, CAL, TSB	0.5-1	10.6	F	F	RP	G	N	M
5.3.3.2	Unnamed Creek (trib to 400-160900) (ILP 28)	103I.046	4	CO, CAL, TSB	10.5	4.5	B	C	CPB	D	D	D
5.3.3.2	Unnamed Creek (trib. to ILP 28) (ILP 46)	103I.046	2	NFC	1	1.8	C	G	RP	D	D	D
5.3.3.2	Unnamed Creek (trib. to ILP 28) (ILP 36)	103I.046	1	DV, CO, CT	1.5-2	2.2	C	G	RP	G	M	M
5.3.3.3	Unnamed Creek (trib. to Skeena River) (ILP 13)	103I.046	1	CT	1-2	4.2	F	F	RP	G	P	G

[1] R = bedrock, B = boulders, C = cobbles, G= gravels, F = fines, L = lava

[2] RP = riffle pool; CP = cascade pool; CPBW = cascade pool, boulder woody debris functioning; SPB = step pool, boulder
[3] G = good, M = moderate, F = fair, P = poor, N = nil, D = dry channel
[4] NFC= no fish captured, NFP = no fish present, RB/ST = rainbow trout/steelhead, CT = cutthroat trout, CO = coho, BT = bull trout, CAL = coastrange sculpin, DV= Dolly Varden, TSB = threespine sticklebacks

An extensive series of cascades in reach 8 of Whitebottom Creek were the only potential barriers to fish migration identified in this sub-basin (Table 5). Most of the reaches located in the lower half of the Whitebottom sub-basin appear to be accessible to fish.

Seven sites randomly chosen by FDIS, and four biased sites were sampled in the Whitebottom sub-basin. Minnow trapping for assessment of species presence was also conducted at an additional site (reach 1 of ILP 28), but no site card was completed. Some random sites were not sampled due to lack of access. The following sections provide more detailed fisheries information that was attained for Whitebottom Creek (400-159700) and Unnamed Creek (400-160900) and Unnamed Creek (ILP 13).

5.3.3.1 Whitebottom Creek (400-159700)

Whitebottom Creek has low gradient in its lower six reaches, within the Skeena River valley flats. A large portion of the sub-basin is dominated by steep lands, and moderate to steep gradients. Gradients in some tributaries, and in the upper reaches of Whitebottom Creek are too steep to offer valuable or accessible fish habitat. Map interpretation and fisheries information indicates that the lower reaches of Whitebottom Creek offer good fish spawning and rearing habitat.

The upstream distribution of coho spawners has been recorded up to and including reach 7 of Whitebottom Creek (FISS). Cutthroat trout and rainbow trout were captured in reach 7, but not in reach 8 of Whitebottom Creek. Cascades noted throughout reach 8 appear to form barriers to fish migration. The lack of fish in reach 8, upstream of the cascades, indicates a lack of resident fish in the upper reaches and tributaries of the Whitebottom drainage. The braided and low gradient nature of the lower reaches of Whitebottom Creek, within the Skeena River valley flats offer the best fish habitat in the Whitebottom drainage, particularly for coho.

5.3.3.2 Unnamed Creek (400-160900)

Unnamed Creek (400-160900) is a fourth order tributary to the Skeena River. The area drained by Unnamed Creek (400-160900) consists primarily of steep lands, but the lower reaches of the system are located within the Skeena River valley flats, and appear to offer some good fish habitat. The quality, quantity and accessibility of fish habitat in steeper gradient reaches in the middle and upper section of the mainstem and in tributaries is likely low. Reaches of the Unnamed Creek (400-160900) within the Skeena River valley flats appear to offer good spawning and rearing habitat for resident and anadromous fish.

Pink, chum, and chinook have been reported in the lower four reaches of Unnamed Creek (400-160900), and coho have been reported spawning in reach 5 of the system (FISS). No further historical fisheries information was found for the area drained by Unnamed Creek (400-160900).

Fish were captured in all but two of the reaches of the Unnamed Creek (400-160900) basin which were located in the Skeena River valley flats. Species captured in these reaches were cutthroat trout, bull trout, Dolly Varden, coho, redside shiner (*Richardsonius balteatus*) and threespine sticklebacks (*Gasterosteus aculeatus*). The area surrounding the lower sections of Unnamed Creek (400-160200), the distributary channel (ILP 35), and Unnamed Creek (ILP 28) should be considered a fisheries sensitive zone. The two reaches where no fish were present were both dry at the time of survey (ILP 28 and ILP 46, Table 8). Reach 5 of Unnamed Creek (400-160900) exhibits steeper gradients as the stream rises out of the Skeena River valley. A site near the lower extent of reach 5 was sampled during this study. Dolly Varden were captured at the lower extent of reach 5 (NID 638, Table 8), but no fish were captured at the upper extent of the reach (NID 641, Table 8). Gradient and confinement of Unnamed Creek (400-160900) increases rapidly within and beyond reach 5 (e.g. gradient = 27% in reach 6, from map interpretation), and no suitable helicopter landing locations could be found in this reach. Fish presence in the upper reaches of the system is unlikely due to steep gradients, and cascades within reach 5. The lower reaches of Unnamed Creek (400-160900) and its distributary channel (ILP 35) offered some of the best available habitat in the Whitebottom sub-basin.

5.3.3.3 Unnamed Creek (ILP 13)

Unnamed Creek (ILP 13) is a third order tributary to the Skeena River. The majority of this stream is located in the Skeena River valley flats, although upper reaches extent out of the valley flat into the higher gradient steep lands. These reaches exhibit moderate to steep gradients. A lake is located along the mainstem, just upstream of the Skeena River valley flats. Most of this system appears to be accessible to fish.

No previous fisheries information has been documented for Unnamed Creek (ILP 13). Reach 1 was sampled during this project, and was found to offer good rearing habitat with some spawning habitat. Thirty juvenile cutthroat trout were captured at the sample site, located within the Skeena River valley flat area. Since upper reaches were not selected by FDIS, no further sampling was conducted in the system, and the upper limit of fish distribution was not documented in the field. The gradient in reach 3 of ILP 13 is estimated to be 49% (map interpretation), indicating that reaches upstream of reach 2 are not fish bearing. However, the majority of this stream is located in the Skeena River valley flat area, and offers suitable fish spawning and rearing habitat.

5.3.4 White Creek Sub-Basin

White Creek is a fourth order tributary to the Lakelse River, which drains into the Skeena River approximately 30 km west of Terrace. White Creek drains into the western shore of the Lakelse River approximately 16 km upstream of the Skeena River. White Creek drains a small icefield on the northeastern side of Mount Catt in an easterly direction to the Lakelse River. The lower reaches of White Creek are situated in the Lakelse River valley flat area, but the majority of this drainage consists of steep lands. A small lake is located near the icefield at the headwater of the system, and no other lakes have been identified in the drainage on 1:50,000 scale. The lower portions of White Creek likely offers some valuable habitat, but the steeper reaches situated in the mid and upper portions of the drainage have limited potential for fish use. The lower reaches

of White Creek, and reaches of tributaries within the Lakelse River valley flats appear to offer the best accessible fish habitat, as determined from map interpretation, and fish distribution summarized in FISS.

Limited fisheries information exists for White Creek. The presence of chinook, steelhead, pink, coho, cutthroat trout, Dolly Varden and rainbow trout have been documented in the lower reaches of White Creek. Chinook, steelhead, pink and coho spawning locations have been identified in the lower reaches of White Creek, within the Lakelse River valley flat areas (FISS). Coho, cutthroat trout, rainbow trout/steelhead and Dolly Varden were captured in the White Creek drainage area during this study.

Table 9. Summary of habitat characteristics in reaches sampled in the White Creek sub-basin (*for details see* in Appendix 1).

Section	Stream	TRIM map	Reach	Species [4]	channel		Substrate [1]		Morphology [2]	Habitat [3]		
					gradient (%)	width (m)	Dominant	Sub-dominant		Rearing	Spawning	Overwinter
5.3.4	White Creek (420-332600)	103I.047	1	CO, RB/ST	1	20.5	G	C	RP	G	G	G
5.3.4	White Creek (420-332600)	103I.037	4	RB, CT, DV	7-8	8.4	C	G	CPB	G	G	M
5.3.4	White Creek (420-332600)	103I.037	5	NFP	7-19	26.5	B	R	SPBW	G	P	G
5.3.4	White Creek (420-332600)	103I.037	7	NFP	14-21	11.0	C	B	CPB	G	M	P
5.3.4	Unnamed Creek (trib. to White Creek) (ILP 30)	103I.047	1	CO, CT, DV	2	5.6	F	G	RP	G	G	G
5.3.4	Unnamed Creek (trib. to White Creek) (400-332600-08300)	103I.047	1	NFC	6-7	3.3	C	G	dry	D	D	D
5.3.4	Unnamed Creek (trib. to White Creek) (ILP 27)	103I.047	1	NFC	11-15	1.5	C	G	dry	D	D	D
5.3.4	Unnamed Creek (trib. to White Creek) (420-332600-47000)	103I.037	1	NFP	38-42	2.2	C	G	dry	D	D	D
5.3.4	Unnamed Creek (trib. to White Creek) (420-332600-57700)	103I.037	1	NFP	18-36	5.9	C	G	CP	P	P	P
5.3.4	Unnamed Creek (trib. to White Creek) (420-332600-73000)	103I.037	1	NFP	23-24	8.6	B	C	CPB	M	P	G

[1] R = bedrock, B = boulders, C = cobbles, G= gravels, F = fines

[2] RP = riffle pool; CP = cascade pool; CPB = cascade pool, boulder; SP = step pool; SPBW = step pool, boulder, woody debris functioning
[3] G = good, M = moderate, F = fair, P = poor, N = nil, D = dry channel
[4] NFP = no fish present, NFC = no fish captured, CO = coho, RB/ST = rainbow trout/steelhead, CT = cutthroat trout, DV = Dolly Varden

Several barriers to fish migration were identified in White Creek, including two waterfalls along the mainstem of the system (reaches 4 and 7, Table 5). Other barriers to fish migration included steep gradients (e.g. reach 1 of Unnamed Creek 420-3326000-47000, Table 5), cascades (e.g. Unnamed Creek 420-332600-57700, Table 5), and seasonal barriers in the form of dry channels (e.g. Unnamed Creeks 420-332600-08300, ILP 27, 420-332600-47000, Table 9).

Nine randomly chosen sites (FDIS) and one biased site were sampled in the White Creek sub-basin. Some of the random sites chosen by FDIS were not sampled due to lack of access. Coho, cutthroat trout, rainbow trout/steelhead and Dolly Varden were captured in the White Creek sub-basin, with the highest density of fish in the reaches of White Creek and tributaries located within the Lakelse River valley flats (i.e. reach 1 of White Creek, reach 1 of ILP 30). No fish were captured in White Creek or tributaries upstream of the 15 meter high water fall located in reach 4 (Table 5), thus reaches upstream of this waterfall can be classified as non fish bearing. The best fish habitat was noted in lower reaches of White Creek and tributaries below the barrier to fish migration (reach 4), particularly in reaches located in the Lakelse River valley flats.

5.4 FISH AGE, SIZE AND LIFE HISTORY

Cutthroat trout, rainbow trout and Dolly Varden were the most common species encountered in the study area. Coho and chinook salmon were also encountered frequently in the lower reaches of tributaries to the Skeena River and Lakelse River. Bull trout, redside shiners, coastrange sculpins, and threespine sticklebacks were also captured. The following sections present interpretations of data and discussion of size and inferred age distribution and life history strategies for cutthroat trout, rainbow trout/steelhead, Dolly Varden, bull trout, coho, chinook, threespine sticklebacks, redside shiners and coastrange sculpins.

5.4.1 Cutthroat trout

Cutthroat trout captured in this study area belong to the coastal cutthroat trout sub-species (*Oncorhynchus clarki clarki*) (Behnke 1992). Cutthroat trout were commonly found in reaches sampled within the Middle, Whitebottom, and White sub-basins. This species was not captured in the Dasque sub-basin (Figure 2).

Length frequency analysis was conducted for all fish captured by combining data for reaches sampled within the four sub-basins distinguished between in the study area (Figure 2, Table 10). Length frequency data indicates that age distribution of cutthroat trout was variable among the three basins in which the species was captured. Three distinct age classes are present in the Middle Creek sub-basin (ages 0+, 1+, 2+), while three or four distinct age classes appear to be represented in the Whitebottom sub-basin (ages 0+, 1+, 2+, 3+). Cutthroat trout captured in the White Creek sub-basin appear to represent only two age classes (ages 0+ and 1+). The 0+ age

class is dominant in the White Creek and Middle Creek sub-basins, while older age classes appear to dominate in the Whitebottom sub-basin. This difference in age class strength may be due to different habitat preferences. Length frequency data for cutthroat trout in the study area appears to fall within the lower portion of the range previously reported in the literature (Scott and Crossman 1973) and in the Tseax and Cedar watersheds (SKR 1998b, SKR 1998c). Ages were not determined empirically, and the size range of 0+ cutthroat trout in the study area may be underestimated. Alternatively, growth rate in the study area may be lower than that observed in the Tseax and Cedar watersheds due to differences in life history strategies and/or differences in habitat quality and competition. Of the species captured in this study area, cutthroat trout was the dominant species, occurring within the lower and mid reaches of several streams.

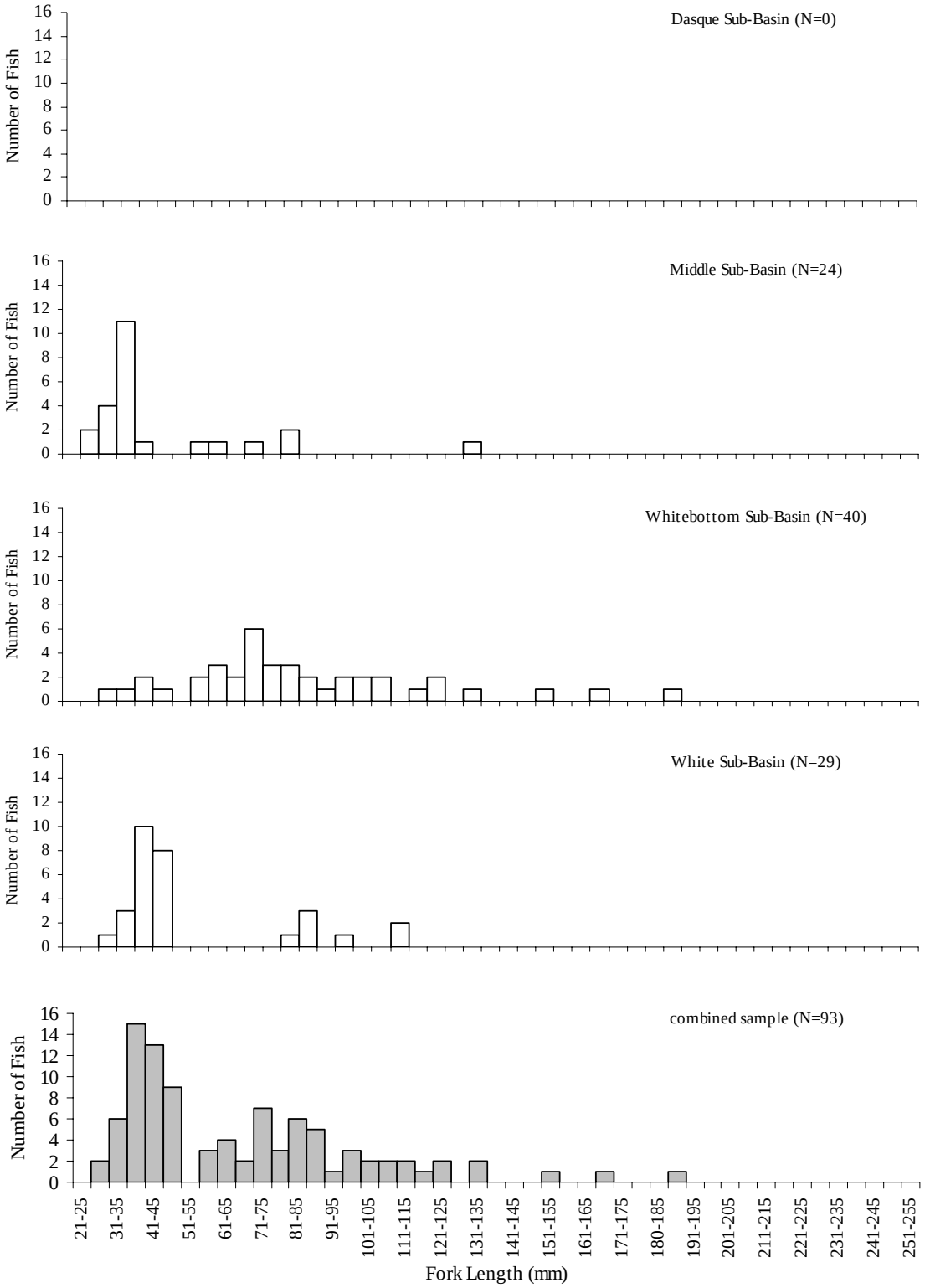

Dasque Sub-Basin (N=0)
Middle Sub-Basin (N=24)
Whitebottom Sub-Basin (N=40)
White Sub-Basin (N=29)
combined sample (N=93)
Number of Fish
Fork Length (mm)
21-25
31-35
41-45
51-55
61-65
71-75
81-85
91-95
101-105
111-115
121-125
131-135
141-145
151-155
161-165
171-175
180-185
191-195
201-205
211-215
221-225
231-235
241-245
251-255

Figure 2. Length frequency of cutthroat trout captured in selected Skeena River and Lakelse River drainages.

Table 10. Mean and standard deviation (SD) of fork length for cutthroat trout captured in selected Skeena River and Lakelse River tributaries. Age categories are estimated based on length frequency distribution (Figure 2).

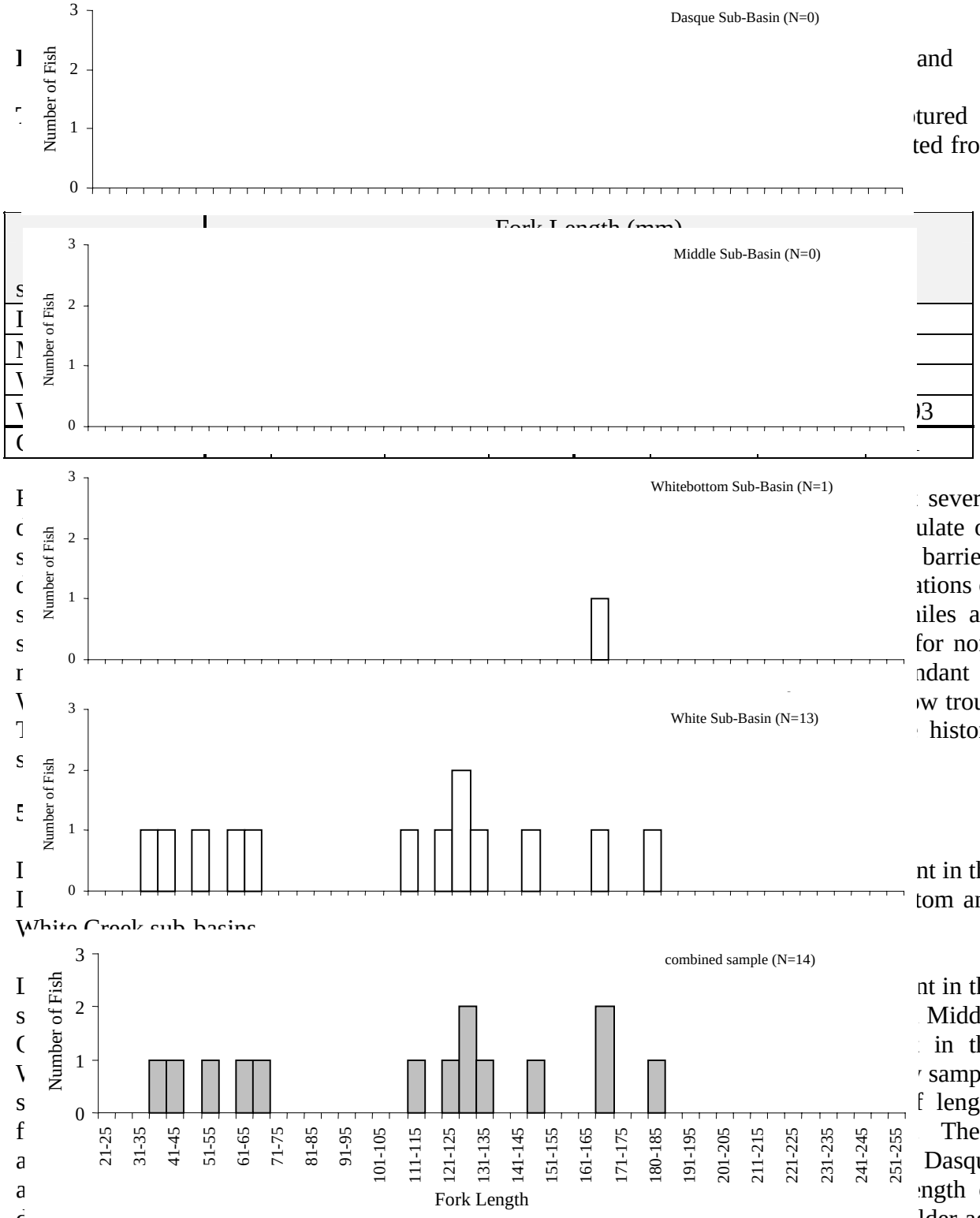
	Fork Length (mm)							
	0+ years				≥ 1+ years			
sub-basin	N	**Range**	Mean	SD	N	**Range**	Mean	SD
Dasque	0	-	-	-	0	-	-	-
Middle Creek	18	**29-45**	36.1	3.69	6	**59-132**	82.8	26.09
Whitebottom	5	**33-46**	40.8	5.89	35	**60-187**	93.4	30.90
White Creek	22	**35-49**	43.6	3.49	7	**84-115**	96.6	12.61
Combined	45	**29-49**	40.3	5.22	48	**59-187**	92.5	28.25

Cutthroat trout are known to exhibit a variety of life histories including anadromy, lacustrine, and fluvial – adfluvial forms (Behnke 1992). It is unlikely that the cutthroat trout in the study area are anadromous since sea-run coastal cutthroat trout are generally found in close proximity to salt water (Behnke 1992). Cutthroat trout caught in the study area may be stream resident, lacustrine-adfluvial or fluvial-adfluvial. The presence of older age classes in the Middle Creek and Whitebottom sub-basins indicates the presence of non-migratory populations in these systems. Older age classes were lacking from the White Creek sub-basin, which implies the presence of a migratory population of cutthroat trout. Cutthroat trout captured in White Creek likely utilize the nearby lake habitat offered in Lakelse Lake, which has been reported to support cutthroat trout (FISS). Several life history strategies, including lacustrine-adfluvial (White Creek), stream resident, and fluvial-adfluvial (Middle Creek and Whitebottom sub-basins) are represented in the streams sampled.

5.4.2 Rainbow Trout/Steelhead

Compared to cutthroat trout, rainbow trout/steelhead were present at lower densities in reaches sampled in the study area. Rainbow trout/steelhead were most abundant in the White sub-basin, which drains into Lakelse River. Only one rainbow trout/steelhead was captured in Whitebottom Creek, while no rainbow trout/steelhead were captured in the remaining Skeena River tributaries sampled.

Fork lengths of rainbow trout/steelhead in the Cedar watershed appear to fall within those reported by Scott and Crossman (1973) for rainbow trout aged 0+ to 2+ (Figure 3, Table 11). Fork lengths in speculated age categories are also within the range reported for steelhead/rainbow trout captured in Kitwanga, Morice, Sustut, Kispiox, Zymoetz (Bustard 1992, 1993, Baxter 1997b) and Cedar rivers (SKR 1998c). In addition, fork lengths ranges of speculated age groups are similar to fork lengths reported for these age groups in some Nass River tributaries, including the Bell-Irving/Bowser (Saimoto 1998b), Tseax (SKR 1998b), Damdochax (Triton 1994a), Kwinageese (Triton 1994b). No unusual growth or condition attributes were noted for the sampled of rainbow trout/steelhead collected.



different age categories, making the distinction between 0+ and 1+ fish difficult. The older age classes occupy a wider range of lengths than the 0+ and 1+ age class. Coupled with the smaller sample sizes for the older age classes, the distinction between 3+ and 4+ Dolly Varden is

difficult. Ranges in fork length for the 0+ age group in the study area appears similar to those reported for the Kemess watershed (Bustard 1995, 1996) and the Cedar River (SKR 1998c), all of which are located in the Skeena drainage. In addition, Dolly Varden size ranges appear similar to those reported for some Nass River tributaries, including the Bell-Irving River (Saimoto and Saimoto 1998), Damdochax Creek (Triton 1994a), Tseax (SKR 1998b) and the Kwinageese River (1994b).

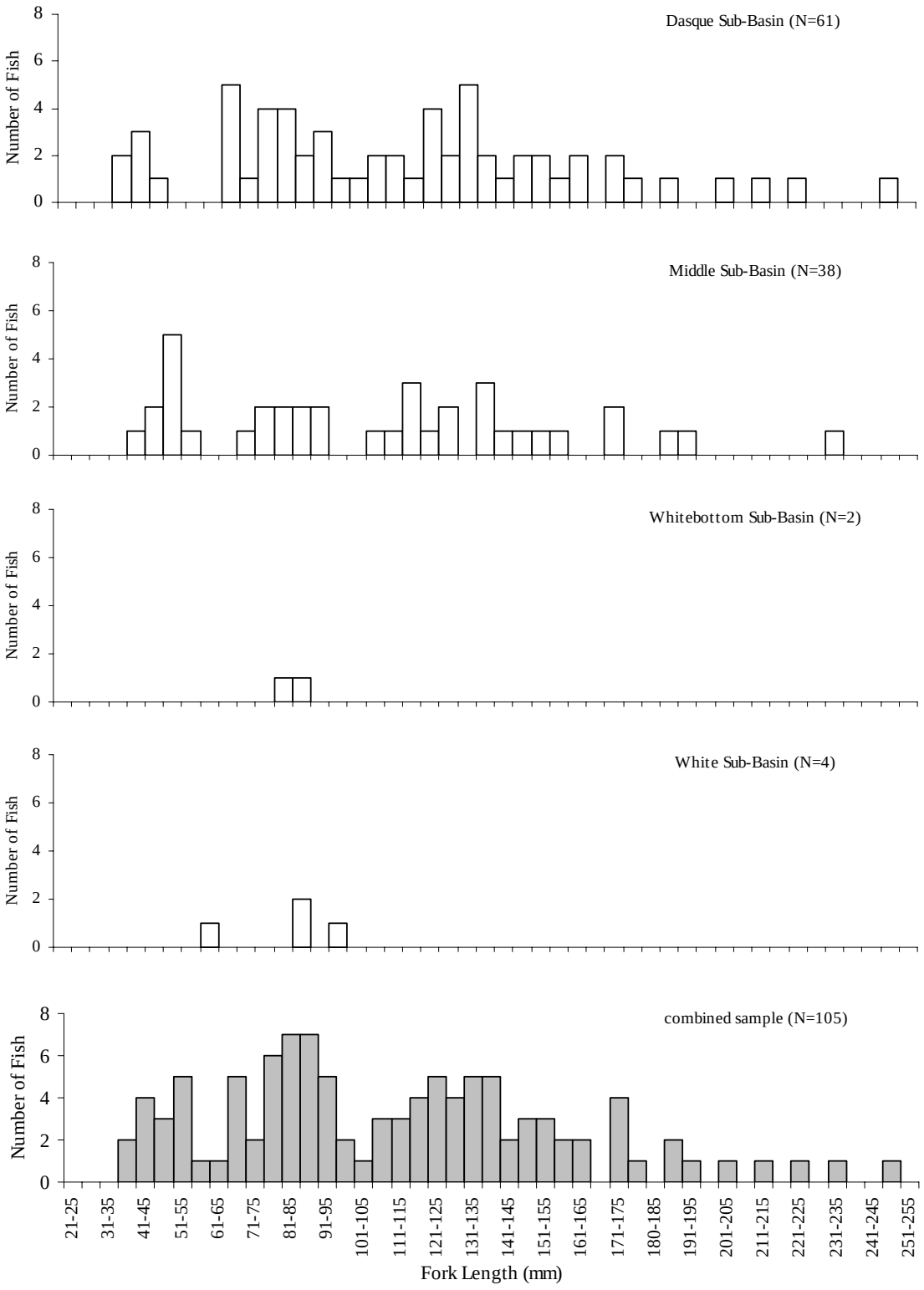


Figure 4. Fork length distribution of Dolly Varden captured in selected Skeena River and Lakelse River drainages.

Table 12. Mean and standard deviation (SD) for fork length of Dolly Varden captured in selected Skeena River and Lakelse River tributaries. Size at age was estimated from fork length distribution.

	Fork Length (mm)							
	0+ years				≥ 1+ years			
sub-basin	N	**Range**	Mean	SD	N	**Range**	Mean	SD
Dasque	6	**38-49**	43.2	3.97	55	**66-250**	123.5	43.51
Middle Creek	8	**42-54**	51.1	4.12	30	**56-235**	124.7	41.36
Whitebottom	0	**-**	-	-	2	**83-88**	85.5	3.54
White Creek	0	**-**	-	-	2	**62-100**	84.8	16.15
Combined	14	**38-54**	47.7	5.65	91	**56-250**	121.4	42.31

Dolly Varden are known to exhibit anadromous, fluvial-adfluvial, lacustrine-adfluvial and stream resident life history patterns (Scott and Crossman 1973). Information collected in this study is insufficient to conclusively determine which life history strategies are present in the study area. However, the lacustrine – adfluvial and fluvial – adfluvial life histories are speculated to account for some, if not all, of the life history types present. Dolly Varden were reported previously in Lakelse Lake, which is in relative close proximity to White Creek. However, Dolly Varden abundance in White Creek appears to be low. The majority of Dolly Varden were common in tributaries to fluvial reaches of the Skeena River. The predominance of Dolly Varden in upper reaches of the Dasque and Middle Creek sub-basins, coupled with the wide ranges in fork lengths (ages) captured indicates that non-migratory populations are likely present.

5.4.4 Bull Trout

Bull trout were rare in the tributaries to the Skeena and Lakelse rivers sampled. Bull trout were captured in the Dasque, Middle and Whitebottom sub-basins, but were not encountered in White Creek. Bull trout fork length ranged between 65 and 170 mm for fish captured in the study area. Bull trout populations have been reported to reach a mean size between 60-70 mm at the end of their first summer, mean length increases to greater than 100 mm by the end of the second summer and fork length approaches 200 mm by the end of the third summer (Pratt 1992, McPhail and Baxter 1996). However, fork length of bull trout in the Thautil River (Bustard 1995) and the Kemess watershed (Baxter 1995) are smaller than those found in this study. These fish were aged from fin rays (Thautil watershed, Bustard 1995) and otolith (Kemess watershed, Baxter 1995), and length at age ranged between 32 and 60 mm at age 0+, 55-93 mm at age 1+ and age 96-110 mm at age 2+. Westcott and Standen (1993) report that several of the scales used for aging bull trout of the North Thompson River, the Jordan River, and Williston Lake tributaries were missing the first annulus, and that scale aging may have a negative bias. Since no bull trout ages were determined from aging structures, and since bull trout abundance is low, the estimated age distribution of bull trout in the study area can only be speculated. Based on information in the literature, the 65 mm bull trout (middle sub-basin) is estimated to be age 1+, the 82 mm bull trout (Whitebottom sub-basin), and the 88 mm bull trout (middle sub-basin) are estimated to be 2+ years. The 139 mm (middle sub-basin) and the 170 mm bull trout (Dasque sub-basin) are estimated to be 3+ and 4+ respectively.

Bull trout exhibit a variety of life history strategies, including fluvial-adfluvial, stream resident and lacustrine-adfluvial forms (McPhail and Baxter 1996). The lack of bull trout in the White sub-basin indicates that the lacustrine-adfluvial form is likely not common in the study area. The lack of other lakes in the study area indicates that the presence of lacustrine-adfluvial bull trout in the Dasque, Middle and Whitebottom sub-basin is unlikely. The presence of maturing bull trout in the Dasque sub-basin implies that some bull trout may be stream resident. Both, stream resident and fluvial-adfluvial forms are the suspected bull trout life history strategies represented in streams sampled.

5.4.5 Coho

Coho salmon were captured in the lower reaches within the Middle, Whitebottom and White sub-basins. No coho were captured in the Dasque sub-basin. Fork length were recorded for all coho captured. The range in fork length falls within the range reported for 0+ and 1+ coho by Sandercock (1991). Fork length frequency distribution (Figure 5) indicates considerable overlap among the two age groups that are speculated to be present (0+ and 1+). Consequently, fork length data summarized in Table 13 is not separated by age. Although juvenile coho are known to spend up to four winters in fresh water before migrating to sea (Sandercock 1991), the predominance of 0+ fish in the Middle Creek, Whitebottom Creek and White Creek sub-basins suggest that the majority of juvenile coho in study area smolt after one winter.

Table 13. Mean and standard deviation (SD) for fork length of coho captured selected Skeena River and Lakelse River tributaries. All coho are estimated to be age 0+ and 1+.

		Fork Length (mm)		
Basin	N	Range	Mean	SD
Dasque	0	-	-	-
Middle Creek	29	48-102	60.4	16.32
Whitebottom	63	48-112	77.9	13.08
White	42	31-85	58.9	14.29
Combined	134	31-112	68.1	16.85

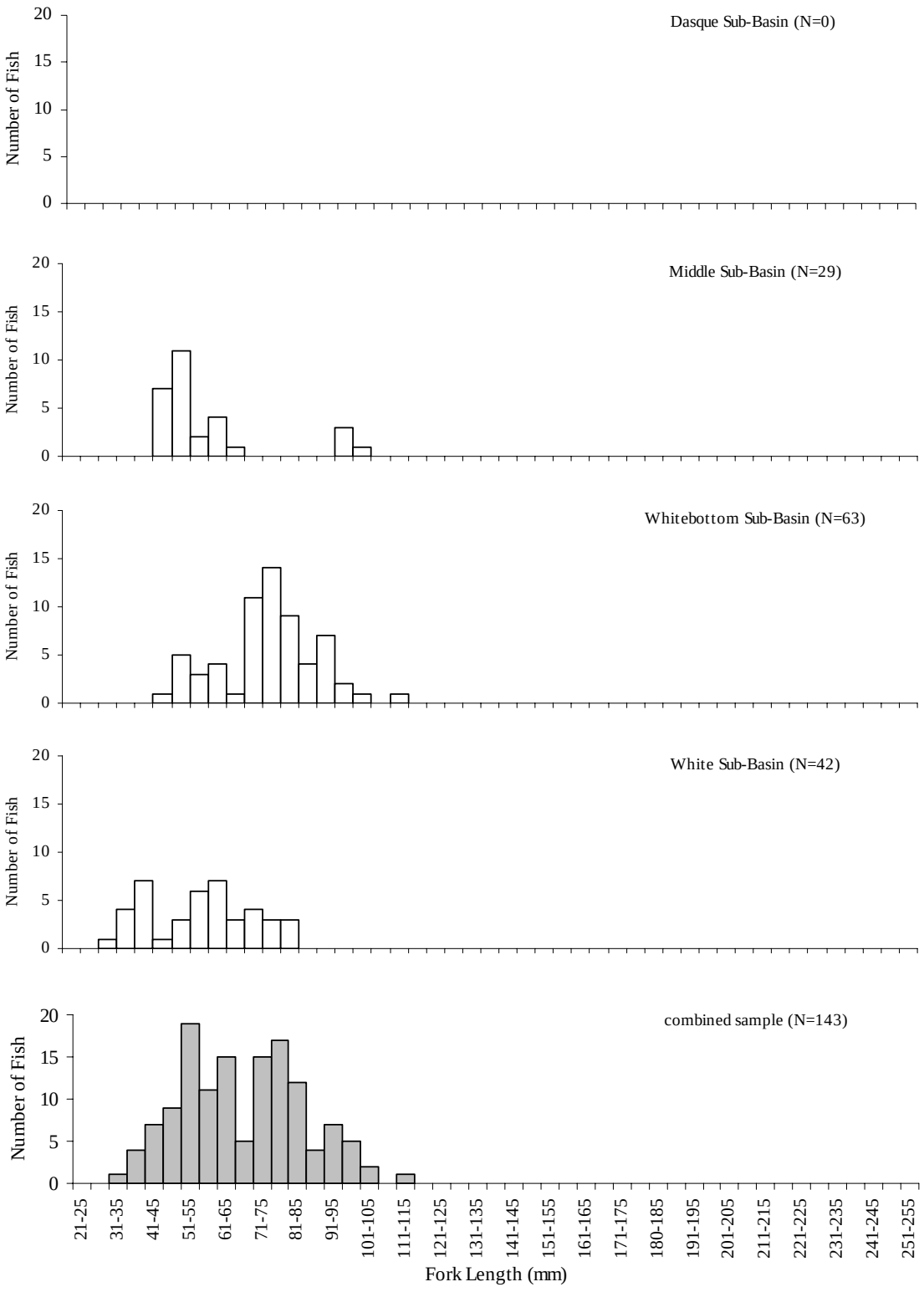


Figure 5. Fork length distribution of coho captured in selected Skeena River and Lakelse River tributaries.

5.4.6 Chinook

Chinook were only captured in reach 1 of Dasque Creek, the largest system (i.e. channel width) of streams examined (Tables 6 to 9). Chinook appeared to be present at low densities in this system. It is interesting to note that chinook and coho juvenile distribution was not found to overlap in the sub-basins sampled. Coho were not captured in the Dasque sub-basin, and chinook were not captured in the Middle, Whitebottom or White sub-basins where coho were found to be present. Ranges in chinook fork length (Table 14) fall within those reported in the literature for 0+ chinook (Healey 1991).

Table 14. Mean and standard deviation (SD) for fork length of chinook captured selected Skeena River and Lakelse River tributaries. All chinook are estimated to be age 0+.

		Fork Length (mm)		
Basin	N	Range	Mean	SD
Dasque	6	57-71	63.3	5.50
Middle Creek	0	-	-	-
Whitebottom	0	-	-	-
White	0	-	-	-
Combined	6	57-71	63.3	5.50

Chinook may migrate to estuaries in their first year of life ("ocean type"), but "stream type" populations have been reported to delay migration to estuaries until the first or second spring after emergence (Healey 1991). The low sample size of chinook captured in the systems sampled makes speculations on life history strategies difficult. The lack of, or low abundance of 1+ chinook in the streams sampled in the study area indicate that chinook migrate to the ocean as yearlings (1+). However, chinook are known to migrate from natal streams to larger systems for overwintering (Healey 1991), which would also account for a low frequency of 1+ year old juveniles in the moderate size tributaries that were examined in this study. Due to the relatively low abundance of chinook juveniles in streams sampled, it appears that these systems are of limited importance to chinook spawning and rearing.

5.4.7 Other Species

Other species captured in the study area include threespine sticklebacks, coastrange sculpins, and redside shiners. Lengths for these species are summarized in Table 15. All of these fish were captured in the Whitebottom sub-basin.

Little data exists for growth of coastrange sculpins, however, some information for growth of threespine sticklebacks is reported in the literature. Threespine sticklebacks live to about four years of age, and attain a length of approximately 70 mm (Scott and Crossman 1973, McPhail and Lindsey 1970). The fork length of sticklebacks captured in the Whitebottom sub-basin correspond to those reported for this species at the end of their first and second summer (Scott and Crossman 1973). Redside shiners have been reported to attain an age of 6 or 7 years. Fork

length for redside shiners in the Dasque sub-basin correspond to ranges reported for age 2 years to 4 years (Scott and Crossman 1973).

Table 15. Mean and standard deviation (SD) for fork length of threepsine sticklebacks and redside shiners, and total length for coastrange sculpins.

		Length (mm)		
Species	N	Range	Mean	SD
threespine sticklebacks	12	42-55	49.5	4.23
redside shiners	8	55-111	71.4	18.4
coastrange sculpins	10	68-100	86.1	13.0

5.5 SIGNIFICANT FEATURES AND FISHERIES OBSERVATIONS

5.5.1 Fish and Fish Habitat

Suitable and accessible fish habitat was noted primarily in the lower reaches of tributaries to the Skeena River, and in the lower reaches of White Creek (tributary to the Lakelse River, Skeena drainage). A considerable portion of the study area is inaccessible to fish. Steep gradients, confined or entrenched channels, waterfalls, cascades, and sections of underground flow in lower reaches of smaller streams (first or second order) were noted to limit fish use to primarily mainstem habitats.

Of the sub-basins examined, the lower 3 reaches of White Creek and the lower 3 reaches of Middle Creek sub-basins appear to offer the best fish habitat. Good spawning, rearing, and overwintering habitat was noted in reach 1 of Middle Creek and reach 1 of Unnamed Creek (ILP 583) in the Middle Creek sub-basin. Reach 1 of White Creek was also noted to offer good quality spawning, rearing and overwintering habitat. Good rearing habitat appeared to be more common in reaches examined than good spawning habitat. Only fair spawning habitat was identified in reaches surveyed in the Dasque sub-basin.

Bull trout, a blue listed species (CDC 1995) were captured in the Dasque, Middle and Whitebottom sub-basins. Bull trout were found to live in sympatry with Dolly Varden in the Middle Creek sub-basin. Although sympatric populations of Dolly Varden and bull trout are not common, they have been documented in other watersheds, including tributaries to the Nass and Skeena Rivers (Haas and McPhail 1991, Baxter 1995, Bustard 1995, 1996, 1997, McPhail and Baxter 1996, SKR 1998c).

5.5.2 Habitat Protection Concerns

5.5.2.1 Fisheries Sensitive Zones

No fisheries sensitive zones were identified during the current study. However, the Skeena River flood plain, particularly at the confluences with streams should be considered a fisheries sensitive zone. The lower reaches of Unnamed Creek (400-160900), Unnamed Creek (ILP 28)

and Unnamed Creek (ILP 35) area offer good spawning and rearing habitat, particularly for coho. These reaches, and intermittent tributaries in the general area are located in the Skeena River valley flat area, and should be incorporated into the Skeena River fisheries sensitive zone.

5.5.2.2 Fish above 20% gradient

No fish were captured in reaches with gradients greater than 20%. Gradient barriers, and water falls presented distinct limits on fish distribution, and few, if any resident populations appear to be present upstream of barriers in tributaries to the Skeena or Lakelse rivers.

5.5.2.3 Rare and Endangered Species

Bull trout and tailed frogs are two blue listed species (CDC 1995) which were captured in the drainage area sampled. Habitat concerns for bull trout have been eluded to in the previous section, and this section will focus on habitat concerns and management implications that arise from the presence of tailed frogs.

The tailed frog is vulnerable to population declines and/or local extirpation following habitat disturbances due to their stringent habitat and life history requirements. Tailed frog is the most primitive species of frog in North America, and is one of the few species of frogs that practices internal fertilization (Green and Campbell 1986, Dupuis and Friele 1996). Tailed frogs are long lived, metamorphosing in 4-5 years in the northerly portion of their range, and reaching sexual maturity at 7-8 years of age (Dupuis and Friele 1996). The distribution of this species is closely tied to cool, clear, high gradient streams (Green and Campbell 1986) that are often darkly shaded (Corkran and Thoms 1996). Breeding adults are sedentary, and have been documented to remain within a 20 meter stretch of stream for several years (Dupuis and Friele 1996). Tadpoles have a mouth adapted for suction which allows them to adhere to rocks within the fast flowing streams they are generally found in (Green and Campbell 1996, Corkran and Thoms 1996, Dupuis and Friele 1996). Due to the extended period of time at the tadpole stage, tailed frogs require permanently flowing streams (Dupuis and Friele 1996).

Clearcut logging has been found to negatively impact tailed frog populations in a number of studies (Dupuis and Friele 1996). These declines in tailed frog abundance have been attributed to increases in water temperature and/or increases in sedimentation following clear cut logging. Tailed frog distribution in pristine and harvested areas appears to be clustered, however, distribution appears to be relatively even at the microhabitat level (i.e. pool, riffle). Four year old tadpole distribution is closely tied to the presence of large cobbles and boulders under which this life stage hides. Dupuis and Friele found that un-buffered streams in logged areas exhibited a much lower tailed frog density than streams in old growth forests. However, streamside buffers appear to greatly reduce logging effects on tailed frog densities. Logging related impacts on tailed frog densities identified by Dupuis and Friele (1996) include increased sedimentation, decreased substrate size, reduced summer flows, increased peak flows. decreased riparian habitat for foraging by adult tailed frogs, increased biological oxygen demand (in small streams where increased organic material lowers oxygen concentrations), and increased water temperature.

Since tailed frogs can occur in streams that are not fish bearing, riparian management based on stream classification alone will not protect this species from the negative impacts documented to occur with harvesting. Stream side buffers are valuable tools to minimize impacts on the tailed frog populations in proposed harvest areas. However, on a landscape level, it is critical to take into account the clustered distribution of tailed frogs. Because tailed frog distribution is clustered between reaches and streams, the lack of tailed frogs in any one reach does not indicate the absence of the species in the watershed. In addition, several creeks within a drainage require protection to ensure that at least one can maintain a viable population of tailed frogs. Recolonization of buffered streams is more likely than recolonization of streams that have been harvested to the edge. Recolonization however, may only occur at certain life stages (i.e. after metamorphosis and prior to sexual maturation) if sexually mature adults are as sedentary as has been reported by Daugherty and Shelon (1982). Since tailed frogs were captured in the Dasque sub-basin (i.e. Unnamed Creek ILP 218), and in the Middle Creek sub-basin (i.e. Unnamed Creek ILP 281), the presence of this blue listed species in other reaches in the drainages examined cannot be precluded.

5.5.2.4 Restoration and Rehabilitation Opportunities

Some restoration and rehabilitation opportunities were identified, although this was not the main objective of this study. Natural and anthropogenic impacts on fish and fish habitat were noted in the Middle Creek, Whitebottom Creek and White Creek sub-basins.

Two restoration and/or rehabilitation opportunities were identified in the Whitebottom sub-basin. A powerline right of way was noted to have impacted the stream channel of Unnamed Creek (400-159700-14300) to such a degree as to impede fish passage. This tributary to Whitebottom Creek offers valuable fish habitat, and the channel at the right of way should be rehabilitated to provide adequate fish passage. In addition, a natural slide area was identified in reach 8 of Whitebottom Creek. This slide appears to contribute sediment and gravels to downstream reaches of the system.

One of the two culverts at the road crossing in reach 1 of Unnamed Creek (ILP 27), a tributary to White Creek was plugged at the time of sampling. This culvert should be cleared to ensure adequate drainage.

In addition to rehabilitation opportunities identified at reaches surveyed it was noted that most of the bridges along the Whitebottom Logging Road appeared to be in need of repair. Some of these crossings were hazardous. Particularly the collapsing bridge structures over an approximately 30 meter drop into the canyon at Middle Creek is in need of repair. Existing bridges presently pose a threat to the safety of vehicles and people in this area. The Whitebottom Logging Road should either be permanently de-activated or bridges should be replaced.

5.6 FISH BEARING STATUS

Fish distribution in the study area is limited by a combination of gradient barriers to fish migration, and intermittent channels. No fish were captured in high gradient streams (>21%), and none were captured upstream of barriers to fish migration in tributaries to the study area. Fish bearing reaches are summarized in Table 16, while proposed non-fish bearing reaches are summarized in Table 17. Reaches upstream of barriers to fish migration where no fish were captured are classified as non-fish bearing based on one season of sampling. The concern in such reaches is for resident populations, which should be present in these reaches at all seasons. Some reaches where no fish were captured, but no definite barrier to fish migration was observed, were noted to require further sampling to conclusively establish if they are fish bearing or not (Table 18).

5.6.1 Fish Bearing Reaches

Fish bearing status was assigned to all reaches in which species listed in the Forest Practices Code Fish Stream Identification guidebook were captured (FPC 1995). Table 16 summarizes reaches that were documented to be fish bearing during fish and fish habitat sampling during this study. Overall, the lower reaches of tributaries to the Skeena and Lakelse rivers were found to be fish bearing reaches. Other potential fish bearing reaches are indicated on the Interpretive Map (Appendix 4).

5.6.2 Non - Fish Bearing Reaches

Non-fish bearing status was assigned to reaches sampled upstream of barriers to fish migration in which no fish were captured in one season of sampling. This indicates a lack of resident fish upstream of these barriers. Other non-fish bearing reaches with gradients exceeding 20% are indicated on the interpretation map (Appendix 4).

5.6.3 Follow – Up Sampling Required

Several reaches sampled in study area during the reconnaissance fish and fish habitat inventory project conducted in September 1998 could not be classified conclusively (Table 18). These reaches require re-sampling to indicate if seasonal fish use is present and to confirm fish absence as determined under Forest Practices Code standards (FPC 1995). In some of these streams, barriers to upstream fish migration were not identified, and extra efforts should be made during re-sampling to identify potential barriers to fish migration.

Table 16. Summary of data from surveyed fish bearing reaches in tributaries to the Skeena and Lakelse rivers, September 1998 (*for details see* Appendix 1).

Sub-Basin	Stream name	Watershed Code	TRIM map	Reach	Species	Channel			
						Width (m)	Site gradient (%)	Proposed Riparian Class	Comments
Dasque Creek	Dasque	400-152200	103I.036	1	BT, CH, CAL	47	2.5-3.0	**S1**	
	Dasque	400-152200	103I.036	3	DV	50.5	2.5	**S1**	
	Dasque	400-152200	103I.026	5	DV	47.5	7-11.5	**S1**	
	Dasque	400-152200	130I.026	6	DV	34.2	6-7	**S1**	
	Unnamed	ILP 218	103I.036	1	DV	1.2	12-27	**S4**	
	Unnamed	ILP 284	103I.036	1	DV	4.6	19-21	**S3**	
	Unnamed	ILP 375	103I.036	1	DV	5.7	2	**S2**	
	Unnamed	400-152200-50500	103I.035	1	DV	9.2	16-18	**S2**	

Middle Creek	Middle	400-154700	103I.036	2	CT, DV, BT, CO	18.0	3	**S2**	
	Middle	400-154700	103I.036	3	DV	9.8	4	**S2**	
	Middle	400-154700	103I.036	4	DV	14.9	5	**S2**	
	Unnamed	ILP 583	103I.036	1	DV	7.5	0.5-1.5	**S2**	
Whitebottom Creek	Whitebottom	400-159700	103I.036	7	RB/ST, CT	8.4	4-7	**S2**	
	Unnamed	400-160900	103I.036	4	CAL, BT, CO	10	3	**S2**	
	Unnamed	400-160900	103I.036	5	DV	9.0	13	**S2**	
	Unnamed	ILP 35	103I.046	1	CO, CAL, TSB	10.6	0.5-1	**S2**	distributary of Unnamed Creek (400-160900), proposed fisheries sensitive zone
	Unnamed	ILP 28	103I.046	1	CO, RSC, TSB				minnow trapping, no site card, within Skeena River valley flats, proposed fisheries sensitive zone
	Unnamed	ILP 36	103I.046	1	DV, CO, CT	2.2	1.5-2	**S2**	
	Unnamed	ILP 13	103I.046	1	CT	4.2	1-2	**S3**	
White Creek	White	420-332600	103I.047	1	CO, RB/ST	20.5	1	**S1**	
	White	420-332600	103I.037	4	RB, CT, DV	8.4	7-8	**S2**	15 meter waterfall located upstream of sample site (Table 5)
	Unnamed	ILP 30	103I.047	1	CO, CT, DV	5.6	2	**S2**	

Table 17. Summary of data from surveyed Non-fish Bearing reaches in tributaries to the Skeena and Lakelse rivers, September 1998 (*for details see* Appendix 1).

						Electrofishing Specifications						
Stream Name	Watershed Code	Reach	TRIM map	Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Date (1998)	Proposed Riparian Class	Comments
Dasque sub-basin												
Middle Creek Sub-Basin												
Unnamed	ILP 185	1	103I.036	no defined channel						09/05	**n.a.**	no stream found
Unnamed	400-154700-14600	2	103I.036	4-5	11.9	70	675	14	9	09/05	**S5**	none captured in one season upstream of 6 m high falls (Table 5)
Unnamed	400-154700-14600-45700	1	103I.036	18	3.6	40	560	12	5	09/25	**S5**	none captured in one season upstream of 6 m high falls in reach 2 of mainstem (Table 5)
Unnamed	ILP 477	1	103I.036	23	2.1					09/25	**S6**	stream dry during initial sampling. No fish present upstream of 6 m falls in mainstem (reach 2 of Unnamed Creek 400-154700-14600) (Table 5)
Unnamed	ILP 481	1	103I.036	no well defined channel						09/25	**S6**	no well defined channel, intermittent reach. No fish present upstream of 6 m falls in mainstem (reach 2 of Unnamed Creek 400-154700-14600) (Table 5)
Unnamed	ILP 485	1	103I.036	6	0.5					09/25	**S6**	stream dry during initial sampling. No fish present upstream of 6 m falls in mainstem (reach 2 of Unnamed Creek 400-154700-14600) (Table 5)
Unnamed	400-154700-14600-59700	1	103I.036	10-12	2.7	75	518	12	7	09/25	**S6**	none captured in one season upstream of 6 m high falls in reach 2 of mainstem (400-154700-14600) (Table 5)
Unnamed	ILP 379	1	103I.036	9-10	0.6	120	319	32	10	09/05	**S6**	none captured in one season upstream of 6 m high falls in reach 2 of mainstem (400-154700-14600) (Table 5)

Unnamed	ILP 459	1	103I.036	32.5	not defined					09/24	**S6**	gradient barrier in this reach. No fish present upstream of 6 m waterfall in mainstem (400-154700-14600) (Table 5)

Table 17 cont.. Summary of data from surveyed Non-fish Bearing reaches in tributaries to the Skeena and Lakelse rivers, September 1998 (*for details see* Appendix 1).

						Electrofishing Specifications						
Stream Name	Watershed Code	Reach	TRIM map	Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Date (1998)	Proposed Riparian Class	Comments
Middle Creek Sub-Basin												
Unnamed	ILP 476	1	103I.036	18-23	4.8					09/24	**S5**	stream dry during initial sampling. No fish present upstream of 6 m falls in mainstem (reach 2 of Unnamed Creek 400-154700-14600) (Table 5)
Whitebottom sub-basin												
White-bottom	400-159700	8	103I.036	11-14	5.3	35	537	31	4.5	09/25	**S5**	cascades in this reach appear to be barriers (Table 5)
Unnamed	400-160900	6	103I.036	27	no access – see comments					09/25	**S5 or S6**	non-fish bearing status proposed due to steep gradient (map interpretation), and lack of fish in upper extent of reach 5 (100 m in 487 sec.) – see site card (site 18) of reach 5, Unnamed Creek (400-160900) for details
White Creek Sub-Basin												
White	420-332600	5	103I.037	7-19	26.5	124	669	20	6	09/25	**S5**	none captured in one season above 15 meter waterfall in reach 4 (Table 5)
White	420-332600	7	103I.037	14-21	11	135	487	20	5	09/25	**S5**	none captured in one season above 10 meter waterfall in this reach, and 15 meter waterfall in reach 4 (Table 5)
Unnamed	420-332600-47000	1	103I.037	38-42	2.2					09/25	**S6**	stream dry during initial sampling. Reach is a gradient barriers. No fish captured upstream of

												15 m waterfall located in mainstem downstream (Table 5)
Unnamed	420-332600-57700	1	103I.037	18-36	5.9	127	348	110	8	09/25	S5	no fish captured upstream of 15 m waterfall in White Creek, and cascade at mouth of this stream (Table 5)
Unnamed	420-332600-73000	1	103I.037	23-24	8.6	65	303	10	4.5	09/25	S5	gradient barrier in this reach. No fish captured upstream of 15 m waterfall in White Creek (Table 5)

Table 18. Follow - up sampling requirements for classification of non-fish bearing reaches in tributaries to the Skeena and Lakelse rivers, September 1998. This table excludes all reaches upstream of barriers to fish migration where no fish have been captured in one season of sampling (*for details see* Appendix 1).

Stream Name	Watershed Code	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
Dasque sub-basin								
Unnamed	ILP 81	1	103I.036	3.2	spring high flows	EF	**S3 default**	stream dry during initial sampling (1998/09/24)
Unnamed	400-522000-87900	1	103I.025	5.8	June – July	EF	**S2 default**	no fish captured during initial sampling (1998/09/24), DV map be present
Middle Creek Sub-Basin								
Whitebottom Sub-Basin								
Unnamed	400-159700-14300	1	103I.036	2.0	see comments	EF	**S3 default**	no fish captured in this reach during initial sampling (1998/09/06); unnatural barrier to fish migration identified. This barrier needs to be removed prior to re-sampling
Unnamed	ILP 28	2	103I.046	4.5	spring high flows	EF	**S3 default**	stream dry during initial sampling (1998/09/06); CO, RSC and TSB captured downstream (reach 1)
Unnamed	ILP 46	2	103I.046	1.8	spring high flows	EF	**S3 default**	stream dry during initial sampling (1998/09/06); CO, RSC and TSB captured downstream (reach 1, ILP 28)
White Creek Sub-Basin								
Unnamed	420-332600-08300	1	103I.047	3.3	spring high flows	EF	**S3 default**	stream dry during initial sampling (1998/09/25); CO, CT, DV captured in White Creek. Leaf litter in channel indicates that this stream rarely carries water
Unnamed	ILP 27	1	103I.047	1.5	spring high flows	EF	**S3 default**	stream dry during initial sampling (1998/09/25); CO, CT, DV captured in White Creek

6.0 REFERENCES

B.C. Conservation Data Center. 1995. Tracking lists for vertebrate animals, vascular plans and plant communities. Wildlife Branch, Ministry of Environment, Lands and Parks (referenced as CDC 1995).

B.C. Environment. 1997. British Columbia Recreational Atlas. Informap, Victoria, B.C.

B.C. Environment. 1998a. Trapline and guideoutfitter territory map at B.C. Environment office.

B.C. Environment. 1998b. **Error! Reference source not found.**.ca

B.C. Environment 1998c. Environmental Protection Branch, pers. comm.

B.C. Treaty Commission. 1998. http://www.bctreaty.net

Bagenal T (ed.). 1978. Methods for assessment of fish production in fresh waters. IBP Handbook No. 3. Blackwell Scientific Publications. Toronto.

Baxter, J. 1995. Kemess South gold and copper project: 1994 fisheries studies. Unpubl. report produced by D. Bustard and Associates for Hallam Knight Piesold Ltd.

Baxter, J. 1997. Kispiox River steelhead: summary of current data and status review, 1997. Report for B.C. Environment Fisheries Branch, Smithers, B.C. Skeena Fisheries Report SK #90

Behnke, R. J. 1992. Native trout of western North America. American Fisheries Society Monograph 6. Bethesda, Maryland.

Bustard, D. 1992. Juvenile steelhead surveys in the Kitwanga, Morice, Sustut and Zymoetz rivers, 1991. Report prepared by David Bustard and Associates for B.C. Environment, Smithers, B.C.

Bustard, D. 1993. Juvenile steelhead surveys in the Sustut River, 1993. Report prepared by David Bustard and Associates for B.C. Environment, Smithers, B.C.

Bustard, D. 1997. Stream inventory: Thautil River watershed 1996. Volume 1. report produced by David Bustard and Associates for Houston Forest Products Ltd.

Corkran, C.C. and C. Thoms. 1996. Amphibians of Oregon, Washington and British Columbia: A Field Guide. Lone Pine Publishing, Vancouver, B.C..

Daugherty, C.H. and A.L. Sheldon. 1982. Age-specific movement patterns of the frog *Ascaphus truei*. Herpetologica 38 (4): 468-474 as in Dupuis and Friele (1996).

Dupuis, L. and P. Friele. 1996. Riparian Management and the Tailed Frog. Unpublished report prepared for Doug Steventon, MOF, Prince Rupert Region, Smithers, B.C..

Federal/Provincial Fish Habitat Inventory and Information Program. 1998. Fisheries Information Summary System Maps. Cited as FISS

Forest Practices Code of British Columbia. 1995. Fish – stream identification guidebook.

Green, D. M. and R. W. Campbell. 1986. The Amphibians of British Columbia. British Columbia Provincial Museum, Victoria, B.C.

Haas, G.R. and J.D. McPhail. 1991. Systematics and distributions of Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*) in North America. Can. J. Fish. Aquat. Sci. 48: 2191-2211.

Healey, M.C. 1991. Life history of chinook salmon (*Oncorhynchus tsawytscha*). in Pacific Salmon Life Histories. Groot and Margolis (eds). UBC Press, Vancouver, B.C.

Heard, W.R. 1991. Life history of pink salmon (*Oncorhynchus gorbusha*). in Pacific Salmon Life Histories. Groot and Margolis (eds). UBC Press, Vancouver, B.C.

McPhail, J.D. and J.S. Baxter. 1996. A review of bull trout (*Salvelinus confluentus*) life-history and habitat use in relation to compensation and improvement opportunities. Fisheries Management Report No. 104., 35 p.

McPhail, J.D. and R. Carveth. 1994. Field key to the freshwater fishes of British Columbia. Resources Inventory Committee

McPhail, J.D. and C.C. Lindsey. 1970. Freshwater fishes of northwestern Canada and Alaska. Fish. Res. Board Can. Bull 173: 381 pp.

Ministry of Employment and Investment. 1998. web page at **Error! Reference source not found.**

Ministry of Forests, Research Branch. 1988. Biogeoclimatic and ecoregion units of the Prince Rupert Forest Region. Victoria, B.C..

Ministry of Forests. 1997. Forest Service Recreation Map for the Kalum Forest District.

Paris, J. 1998. Personal communications. Kalum Forest District, Terrace, B.C.

Pratt, K. L. 1992. A review of bull trout life history. Pages 5 - 9 *in* Howell, P. J and D. V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Resource Inventory Committee. 1998a. 1:20,000 Fish and Fish Habitat Inventory Standards. Victoria, B.C.

Resource Inventory Committee. 1998b. Standards for Fish and Fish Habitat Mapping. Victoria, B.C.

SKR Consultants Ltd. 1998a. 1:20,000 Fish and Fish Habitat Inventory: Project Plan. Unpubl report prepared for Skeena Cellulose Inc. Terrace, B.C.

SKR Consultants Ltd. 1998b. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory of the Tseax Watershed. Watershed Code: 500-185700. Unpublished report prepared for Skeena Cellulose Inc., Terrace, B.C.

SKR Consultants Ltd. 1998b. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory of the Cedar Watershed. Watershed Code: 430-51300. Unpublished report prepared for Skeena Cellulose Inc., Terrace, B.C.

Saimoto, RK and R.S. Saimoto. 1998a. Reconnaissance level stream inventory of the Bell-Irving/Bowser watershed. Unpubl. report prepared by SKR Consultants Ltd., Smithers, B.C. for B.C. Environment, Smithers, B.C..

Saimoto,R.K. and R.S. Saimoto. 1998b. Blue River overview level (1:50,000) stream inventory. Unpubl. report prepared by SKR Consultants Ltd., Smithers, B.C. for B.C. Environment, Smithers, B.C.

Sandercock, F.K. 1991. Life history of coho salmon (*Oncorhynchus kisutch*). in Pacific Salmon Life Histories. Groot and Margolis (eds). UBC Press, Vancouver, B.C.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fish. Res. Board Can. Bull. 184: 966 pp.

Skeena Cellulose Inc. 1998. Five year development plan maps.

Triton Environmental Consultants Ltd. 1994a. Damdochax Creek Fisheries Inventory. Unpubl. report prepared for B.C. Environment, Skeena Region, Smithers, B.C..

Triton Environmental Consultants Ltd. 1994b. Kwinageese River Fisheries Inventory. Unpubl. report prepared for B.C. Environment, Skeena Region, Smithers, B.C..

Westcott, B. and J. Standen. 1993. Distribution, abundance, and growth of bull trout (Salvelinus confluentus) within north Thompson River tributaries above the Clearwater River. Draft report prepared for Ministry of Environment Fisheries and Wildlife Branch, Kamloops, B.C..

Wynrib. A. 1998. FDISMap version 2.0 Produced by Pacific Spatial Systems Ltd. for B.C. Environment.

Appendix 1. Sample Site Information including FDIS Reach Cards, Site Cards, Fish Cards, and Site Photographs.

Appendix 2. List of Voucher Specimens and DNA samples submitted to B.C. Environment.

Stream name	Watershed Code	Reach	Site	Genetic sample	Voucher	Species ID	Fork Length (mm)	Maturity	Verified ID	Comments
Dasque Creek	400-152200-00000-0000	3	1	1000	n/a	DV	92	?		
Dasque Creek	400-152200-00000-0000	6	1	1500	100	DV	131	?		
Dasque Creek	400-152200-00000-0000	6	1	1501	101	DV	125	?		MW2
Unnamed	ILP 13, 103 I.046	1	1	CT-01	n/a	CT	152	?		
Unnamed	ILP 13, 103 I.046	1	1	CT-02	n/a	CT	121	IM		
Unnamed	ILP 13, 103 I.046	1	1	CT-03	n/a	CT	125	IM		
Unnamed	ILP 13, 103 I.046	1	1	CT-04	n/a	CT	119	IM		
Middle Creek	400-154700	2	1	CT-01	n/a	CT	132	IM		
Middle Creek	400-154700	2	1	DV-04	n/a	DV	106	IM		22 branchiostegals
Middle Creek	400-154700	2	1	BT-01	n/a	BT	139	IM		27 branchiostegals
Middle Creek	400-154700	2	1		SKR 4	CT				
Middle Creek	400-154700	2	1		SKR 4	DV				
Middle Creek	400-154700	2	1		SKR 4	CO				
Middle Creek	400-154700	3	2	DV-01	n/a	DV	119	IM		
Middle Creek	400-154700	3	2	DV-02	n/a	DV	112	IM		
Middle Creek	400-154700	3	2	DV-03	SKR 3	DV	117	IM		
Unnamed	ILP 28	2			SKR 2	RSC	111			
White Creek	400-332600-00000-0000	4	1	4	102	DV	90	J		
White Creek	400-332600-00000-0000	4	1	3	n/a	CT	89	J		
White Creek	ILP 00030; Trim 103I.047	1	1	5	103	DV	88	J		
White Creek	ILP 00030; Trim 103I.047	1	1	6	n/a	CT	84	J		

Appendix 3. Photodocumentation Forms 1 and 2. Negatives and digital images of photos (2 copies) were submitted to B.C. Environment.

Photo Survey Form 1 – Equipment Details

Survey Start Date: 1998/09/05 Survey End Date: 1998/09/25
Agency: C141, C064
Crew: RS/ ML/ DK/ DS/ MB/ WS/ AC/ WS

Camera #1:
Make and Model: Canon Sureshot A1
Lense: 35 mm
Format: 135 mm, Kodak CD Rom, TIFF files

Camera #2:
Make and Model: Minolta Weathermatic
Lense: 35 mm
Format: 135 mm, Kodak CD Rom, TIFF files

Roll and or Batches Detail:

Roll #	CD #	Camera	Output Medium	Film Type	ISO
217	102	1	negative/CD Rom	colour print	200
408	103	1	negative/CD Rom	colour print	200
416	103	1	negative/CD Rom	colour print	200
850	105	2	negative/CD Rom	colour print	400
851	102	2	negative/CD Rom	colour print	400
950	104	2	negative/CD Rom	colour print	200
955	104	2	negative/TIFF files	colour print	400

Appendix 4. 1:20,000 Interpretive/Project Maps for the Whitebottom - Dane Watershed.

Note: Maps were drafted and edited by Applied Ecosystem Management Ltd. (Whitehorse, YK and Terrace, B.C.). Stream classifications indicated on the maps were not reviewed by SKR Consultants Ltd.. In cases of discrepancies between the maps and information presented in this report, the report should supercede the maps.