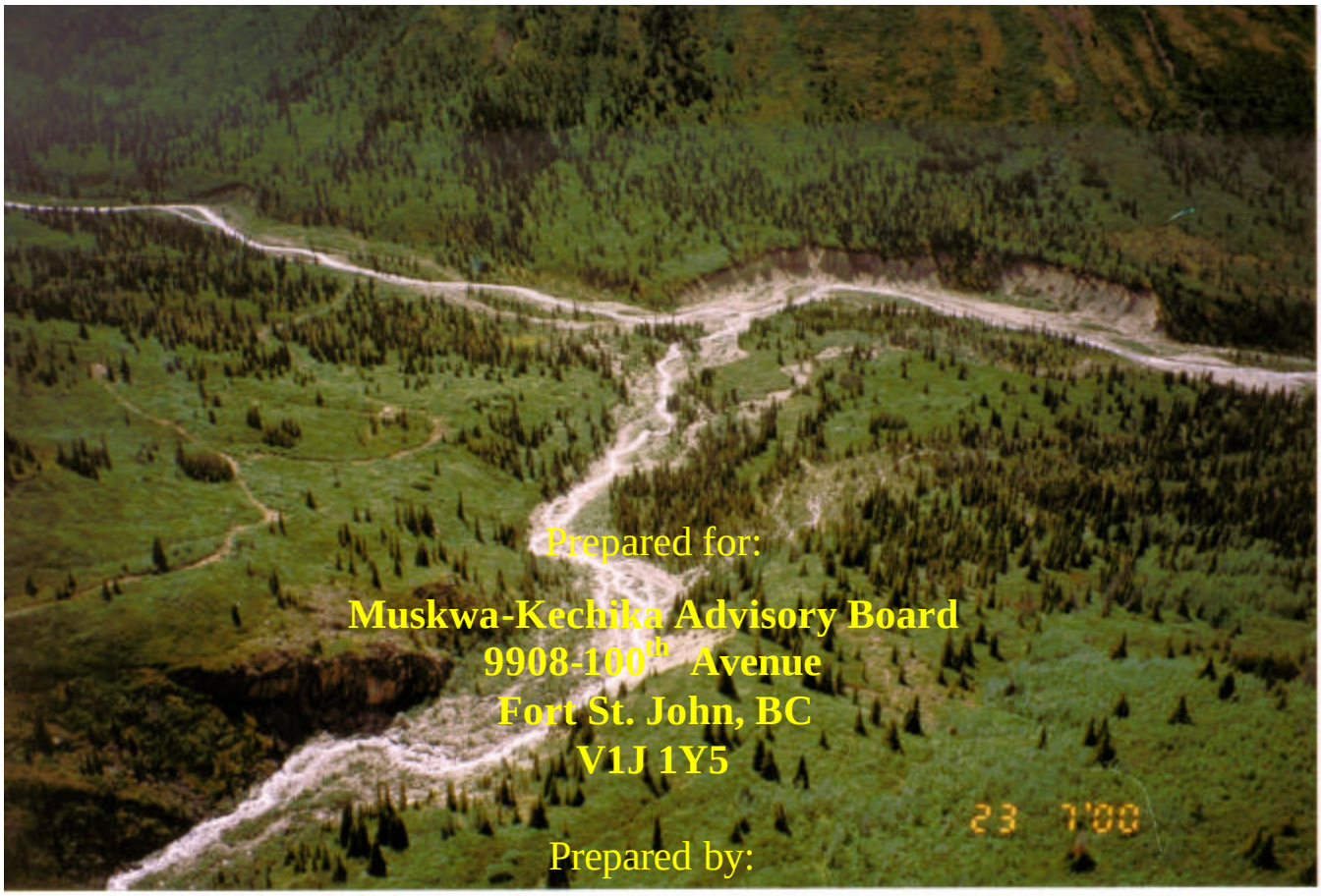
OVERVIEW FISH AND FISH HABITAT INVENTORY WITHIN THE VENTS AND UPPER TOAD WATERSHEDS



R.J. Sharples, B.Sc, R.M. Van Schubert, B.Sc., and J.D. Hamilton, M.Sc., R.P.Bio
EDI ENVIRONMENTAL DYNAMICS INC.
Suite 301- 1705, 3rd Avenue
Prince George, British Columbia
V2L 3G7

EDI Project No.: 704-01
March 2001.

PROJECT REFERENCE INFORMATION

Muskwa-Kechika Project Number	MK2000-01-47
FDIS Project Numbers	3958
FRBC Region	Omineca-Peace
MELP Region	Sub-Region 7B (Peace)
FW Management Unit	7-51
DFO Habitat Area	Northern BC Interior
Forest Region	Prince George
Forest District	Fort Nelson

SAMPLING DESIGN SUMMARY

Number of watersheds studied	2
Number of primary lakes surveyed	1
Number of secondary lakes surveyed	1
Total number of stream sites sampled	33
Field sampling dates	July 19 to July 25, 2000

CONTRACTOR INFORMATION

Proponent:	Name:	Muskwa-Kechika Advisory Board
	Address:	Muskwa-Kechika Advisory Board 9908 100th Avenue Fort St. John, BC V1J 1Y5
	Contract Monitor:	Paul Mitchell-Banks
	Contact Phone:	(250) 262-0065
Project manager:	Name:	J. D. Hamilton, M.Sc., R.P.Bio
	Address:	301-1705 3rd Avenue, Prince George, BC V2L 3G7
	Phone:	(250) 562-5412
Field crew:	Names:	J. D. Hamilton, R. J. Sharples, P. Tobler, R. M. Van Schubert, P. Jakesta (Kaska-Dene First Nation), M. I. Duda (Slocan Group, Fort Nelson Woodlands)
Data entry by:	Names:	R. J. Sharples
Report written by:	Names:	R. J. Sharples, J. D. Hamilton
Report edited by:	Names:	J. D. Hamilton, P. Tobler, R. M. Van Schubert
Maps prepared by:	Names:	C. McKee
FISS data prepared by:	Names:	R. J. Sharples
GIS services by:	Company:	EDI Environmental Dynamics Inc.
	Address:	Suite 301-1705 - 3rd Avenue Prince George, BC V2L 3G7
	Phone:	(250) 562-5412
Genetic sample analysis by:	Name:	N/A
Aging Structure Analysis	Name:	Birkenhead Scale Analysis
	Address:	Lone Butte, BC
Voucher species ID by:	Name:	N/A

ACKNOWLEDGEMENTS

The Muskwa-Kechika Advisory Board provided funding for the majority of this inventory. Slocan Group, Fort Nelson Woodlands and Forest Renewal BC donated helicopter time necessary to complete this inventory. Further gratitude is given to Slocan Group, Fort Nelson Woodlands for donating one of their employee's time and to Mary Duda, M.Sc., R.P.Bio. for volunteering her time as a field crew member for a portion of the field work.

Report approved by: _____

J. D. Hamilton, M.Sc., R.P.Bio.

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

LIST OF ATTACHMENTS AVAILABLE AT MUSKWA-KECHIKA ADVISORY BOARD OFFICE

The following attachments to this report are available at the Muskwa-Kechika Advisory Board office in Fort St. John, BC:

Attachment I -	Digital data for Vents River and upper Toad River watersheds
Attachment II -	Photodocumentation
Attachment III-	Biological samples, including aging structures, voucher samples, tissue samples
Attachment IV-	FISS Data Forms and Maps

The address and phone number are listed below.

Muskwa-Kechika Advisory Board
9908 100th Avenue
Fort St. John, BC
V1J 1Y5
(250) 262-0065

In order for this data to be incorporated into the Fisheries Information Summary System (FISS) database and maps, the following attachment was sent to BC Environment in Victoria:

1.0 PROJECT INTRODUCTION

The Muskwa-Kechika Management Area (M-KMA) is one of the most significant wilderness areas in North America (Muskwa-Kechika 2000). The M-KMA encompasses an area of approximately 4.45 million hectares of Crown Land where extensive boreal plains and muskeg of the east meet the Rocky Mountains of the west (BC Environment 2000a). Few places in the world match the natural features of the Muskwa-Kechika Management Area in terms of species groupings, remoteness and minimal development (BC Environment 2000a). In order to protect the natural integrity of the area, the Muskwa-Kechika Management Plan was developed in 1997 (BC Environment 2000a).

The Muskwa-Kechika Management Plan identifies objectives for the management of the M-KMA and specifies an integrated and coordinated planning structure to meet these objectives. With the development of the Management Plan, land use activities and resource extraction can proceed in specific resource management zones (RMZ); however, the Muskwa-Kechika Management Plan emphasizes that accommodating and protecting important wildlife and environmental values in the area must be considered (Muskwa-Kechika 2000).

Fish inventories are an essential step in managing a land base such as the M-KMA. EDI Environmental Dynamics Inc. conducted a 1:50,000 scale Overview Fish and Fish Habitat Inventory in two watersheds within the M-KMA in July 2000. The watersheds selected for the overview were the Vents River, Watershed Code (WSC) 210-547000 and upper Toad River (WSC 214). These watersheds were selected for study, as there was limited fish and fish habitat information present. The data generated from these inventories will provide essential fish and fish habitat information required for making management decisions and resource plans in these watersheds.

1.1 Project Scope and Objectives

The Overview Fish and Fish Habitat Inventory is a low intensity survey covering large watersheds as defined from the *1:50,000 BC Watershed Atlas* (BC Ministry of Fisheries 1999). This inventory is intended to provide information regarding fish species presence, probable distribution within the watershed and broad habitat classification for the interpretation of habitat sensitivity and capability for fish production (BC Ministry of Fisheries 1999). The drainage network for this overview inventory is depicted on the 1:50,000 scale *BC Watershed Atlas*. The data generated will provide essential fish and fish habitat information required for land-use planning and resource management decisions within the M-KMA.

1.2 Location Summary

The M-KMA is located in the Prince George Forest Region and encompasses portions of the Fort Nelson, Mackenzie and Fort St. John Forest Districts. The study area is located in the Ministry of Environment Lands, and Parks (MELP) Sub-Region 7B (Peace) and the Fish and Wildlife Management Unit 7-51. The upper Toad River watershed is located in the Toad River Watershed Group and the Vents River Watershed is located within the Liard River Watershed Group.

1.3 Study Areas

The watersheds included in this inventory were the upper Toad River watershed and Vents River watershed (Figure 1.1). The waterbodies within the Vents River watershed include the sixth order Vents River mainstem and all tributaries, which encompass an area of approximately 138,700 hectares. Major sub-basins include Fishing Creek (WSC 210-547000-32000), a fifth order tributary and fourth order tributaries, Lapie Creek (WSC 210-547000-06100), Berg Creek (WSC 210-547000-22600), and Sick Wife Creek (WSC 210-547000-81700).

The study area within the upper Toad Watershed included the fifth order Toad River mainstem and all tributaries upstream of and including Moose Lake. The upper Toad River watershed has an area of approximately 75,500 hectares.

1.4 Structure of the Report

As the fieldwork for this overview inventory project was dispersed over two watersheds, each watershed is discussed individually. Introductory information pertaining to the project area, including the project scope and objectives, and a general location summary, study area information, access and resource information is provided in Sections 1.0 and 2.0. The methodology outlined in Section 3.0 is relevant to the whole project area, and includes data entry and presentation issues as well as a description of any modifications made to the sampling plan.

Field Data Information System (FDIS) provides specific site or fish information and photo documentation for sampled stream reaches or documented stream features and are provided in Appendix I. A mapped summary of this information is presented in Appendix II. Within each Appendix, the data is separated by watershed

Figure 1.1 Overview map of study areas within Vents River and upper Toad River watersheds.

2.0 PROJECT AREA RESOURCE INFORMATION

2.1 Resource Use

No significant resource extraction has occurred in the Vents River or upper Toad River watersheds. The M-KMA is known for its resource values, including timber harvesting, mineral exploration and mining, oil and gas exploration and recreational activities. The most popular recreational activities in the M-KMA include fishing hunting, photography, backpacking and hiking. Currently there is limited resource extraction in both of the target watersheds; however, as both of the watersheds are located in the RMZs that have been included in Special Management Categories, timber harvesting has been identified as a future management objective. Outfitter cabins are present on Skeezer Lake (210-547000-22600-82700-1560), Lapie Lake (WSC 210-547000-06100), Long Mountain Lake (WSC 210-547000-78200-30400) and Fishing Lake (WSC 210-547000-32000) in the Vents River watershed.

2.2 Fisheries Resources

Information on fish species known to be present in the two target watersheds was acquired from Fisheries Information Summary System (FISS) maps (BC Environment 1995) and the Fisheries Information Summary System (FISS) Report Server website (BC Environment 2000b). Reports on Fishing Lake and Long Mountain Lake were obtained from BC Environment in Fort St. John, BC. Previous lake surveys conducted in 1985 documented the presence of Arctic grayling (*Thymallus arcticus*) and lake trout (*Salvelinus namaycush*) in Long Mountain Lake (Coombes 1985a). Northern pike (*Esox lucius*), lake trout, burbot (*Lota lota*), lake whitefish (*Coregonus clupeaformis*) and slimy sculpins (*Cottus cognatus*) were documented in Fishing Lake in 1985 (Coombes 1985b).

The presence of Arctic grayling, mountain whitefish (*Prosopium williamsoni*), slimy sculpins, longnose sucker (*Catostomus catostomus*), burbot, and bull trout (*Salvelinus confluentus*) were documented in the lower portion of Vents River and bull trout and slimy sculpins in Lapie Creek, during surveys for the proposed Alaska Highway Pipeline (BC Environment 2000b). Northern pike have been documented in Fishing Creek, approximately 500 metres upstream from Fishing Lake and lake whitefish have been previously captured in Fishing Creek, downstream of Fishing Lake (BC Environment 2000b).

Previous fish information was not present for the upper Toad watershed.

3.0 METHODS

Stream inventories conducted during this project followed the *Overview Fish and Fish Habitat Inventory Methodology* (BC Ministry of Fisheries 1999) and the sampling plan prepared by *Environmental Dynamics Inc.* (2000). Any deviations from the project plan are outlined in Section 3.2 of this report.

Electrofishing, baited minnow traps, seine nets, gill nets, and angling with artificial flies and lures were the utilized fish sampling methods in the overview inventory conducted in July 2000. Field crews used their professional judgement in determining which methods were the most appropriate for the conditions found in a particular stream reach.

The following sampling equipment was used in this inventory project:

- Smith-Root 12B POW electrofishers (including accessories)
- 4 m Polaris inflatable boat powered by a 15 hp outboard motor
- Meridata Model 100 electronic depth sounder
- Trimble Pro-XL GPS (for georeferencing depth soundings)
- YSI Model 57 oxygen/temperature meter (measured oxygen/temperature profile of water column)
- pH (field) measurement: EM Science colored pH indicator strips
- Conductivity (field) measurement: Hand-held Oakton Model TDS-TESTR 3
- Van Dorn bottle type field water sampler
- Hach H_2S field sample kit for hydrogen sulphide detection
- Six-panel 91 metre sinking monofilament gill net ranging between 25-89 mm (BC Environment standard)
- Six minnow traps
- Camera (Pentax Zoom, 35 mm) (lens focal length 38 - 90 mm)

Data entry and mapping were conducted with

- The Field Data Information System (FDIS) version 7.3 for data entry
- Microsoft Excel was used to produce graphs from the spreadsheet calculations
- Contour interpolation was conducted using Vertical Mapper software in MapInfo
- MapInfo was run on a PC based computer platform
- Air photos were digitized using an HP ScanJet 6100C scanner
- Digitized air photos were annotated using MapInfo® software

The Photo CD deliverables provided with the final copy of the report were created as follows:

a) Only one upstream, one downstream, one or two feature photos (if applicable), one or two aerial overview photos of each site, and fish photos (if applicable) appear in the report; however, other photos will remain listed on field cards, and in FDIS and are present on the CD.
b) All photos taken in the field were scanned at 300 dpi, stored in tif format and copied onto labeled CDs.
c) Scanned photographs were assigned file names (on the CDs) which conform to the following character file naming convention: R436, Img00024.tif where:
    - R = R for roll
    - 436 = film roll number (up to 3 digits)

- Img00024 = Img for image number, for example image number 00024
- tif= computer file extension which is automatically assigned when the photograph is scanned

d) An index relating the roll and frame number of each scanned photograph to the watershed code, reach number, site number and direction the photograph was taken (i.e. upstream, downstream) is included on the CD.

3.1 Data Entry and Presentation

A number of issues were identified during the production of this report that altered the final products outlined in the overview standards (BC Ministry of Fisheries 1999). These issues are explained and the methods that *Environmental Dynamics* used to address each are presented within this section of the report.

The Field Data Information System (FDIS) is a digital data entry tool provided by BC Environment, developed in Microsoft Access 97 and designed to capture the reach (office) and site (field) data within digital databases. The input of field data for this project was performed using FDIS version 7.3. Please note that there were several anomalies associated with FDIS 7.3 that resulted in inconsistencies between the database and the original field cards; these were not addressed by *Environmental Dynamics*. The three major anomalies encountered with the FDIS and how they were dealt with for this project are presented below.

1. FDIS only accepts bankfull depth (W_b) values to one decimal place. It will terminate the data entry for that cell if more than one decimal place is entered. For example, if the W_b field value is 0.19, FDIS will only accept 0.1 as the value; therefore, the W_b values were rounded prior to entering the data. The accurate field measurements are retained only on the original field copy of the site card.

2. Fish cards in FDIS will round the stream width values to the nearest 0.1 m for presentation and hardcopy output. The accurate field measurements are retained in the database fields as originally entered.

3. Digital site cards do not accept a decimal place for temperature readings; however, digital fish cards do. Therefore, field temperature containing a decimal place are rounded up for entry into the digital site cards; however, the original information is retained on the field site and fish cards, as well as the digital fish card.

The digital and hard copy products generated by FDIS 7.3 form part of the deliverables for this project and are included in Attachment I.

3.2 Modifications to the Sampling Plan

Several modifications to the sampling plan (Environmental Dynamics 2000) were necessary and are summarized in Table 3.1. The following scenarios resulted in modifications to the sampling plan:

a) Due to the length of several reaches and the corresponding need for more extensive sampling, more than one sample site may have been conducted in a delineated reach.

b) Secondary lake survey of Skeezer Lake was conducted rather than the planned primary lake survey, as local guide-outfitters reported that there were no fish present in Skeezer Lake and aerial reconnaissance revealed that there was no outlet stream.

c) When there was a lack of helicopter landing locations, the sample site was moved to a site with similar characteristics where helicopter landing was accessible.

d) When the planned reach to be sampled had a dry channel at the time of sampling, the sample site was moved to a reach with similar attributes.

e) A primary lake was added to the plan due to local reports of fish presence in Lapie Lake. Lapie Lake was surveyed to obtain baseline fish information.

f) Moose Lake was not surveyed after field assessment confirmed that the lake resembled a wetland rather than a lake.

g) Judgement was used to determine that funds would be better spent surveying a different stream reach, after an aerial assessment of the planned site confirmed limited suitable fish habitat.

h) Sites were added for a more intensive survey in order to confirm fish presence and species diversity.

i) A stream reach was added to the sampling plan, as it was a tributary to one of the lakes that were surveyed.

j) Due to observations made in the field, several reach breaks were moved or added during field assessment.

k) A lake (WSC 214-910600-41800) was sampled instead of a stream reach, as it represented the best opportunity to determine fish presence/ absence above a barrier.

l) A sample site was moved downstream of barrier to assess fish distribution.

m) A site with low probability of fish presence, because of documented downstream barriers was replaced with lake (i.e., unnamed lake, 210-816000, at the upper limit of watershed) that was reported to contain fish.

Table 3.1 Changes to the 2000 sampling plan in the Vents River and upper Toad River watersheds.

WSC	Reach	Sampling Plan Alteration Scenario	Comments
210-547000	1	a	Third and fourth site was added to Reach 1.
210-547000-06100	1	h	Resulted in a more intensive survey of Lapie Creek by addition of Reach 1.
210-547000-06100	7	e	Local reports of fish in Lapie Lake.
210-547000-06100-17900	2	g	Very narrow channel width (<1.0 m wide). Limited fish habitat.
210-547000-32000	1	h	Site was added for more intensive fish survey.
210-547000-22600-17800	1	d	Reach was dry at time of sampling.
210-547000-32000-34000-4830	1	g	No visible channel; sample site was moved.
210-547000-22600-59000	2	j	Reach break was moved. Site was done in Reach 2, rather than Reach 1.
210-547000-06100-81700	1	i	Tributary to Lapie Lake.
210-547000-32000-72100	1	c	210-547000-32000 Reach 5 was surveyed instead.
214	1	h	Site was added for more intensive survey.
214	5	a	Second site was added to Reach 5.
214	2	f	Moose Lake resembled a wetland. Minnow traps were placed in Moose Lake but primary lake survey was not conducted.
214-785100	1	h, l	Site was added to reach 1, downstream of chute and cascades.
214-816600	7	e	Unnamed lake was sampled to confirm local reports of fish presence. Complete lake survey was not conducted.
214-816600-81500	1	m	Falls downstream of this site (in Reach 1 of WSC 214-816600. Crew decided to sample unnamed lake (WSC 214-816600, reach 7) instead.
214-910600-41800	1	k	Sampled lake instead of sampling stream.

4.0 VENTS RIVER WATERSHED

The Vents River watershed is located in northeastern British Columbia, west of Muncho Lake Provincial Park. The Vents River flows into the Liard River (WSC 210), approximately 15 kilometers upstream of the Lower Liard River Bridge, where the Alaska Highway crosses the Liard River. The major tributaries present within the study region include Sick Wife Creek, Lapie Creek, Fishing Creek, Berg Creek and Long Mountain Creek (Figure 4.1).

4.1. Study Area

Table 4.1 summarizes location and watershed information for the Vents River watershed.

Table 4.1 Watershed information for the Vents River watershed.

Watershed Code	UTM at Mouth	Watershed Area (ha)	Stream Length (km)	Stream Order	NTS Maps	TRIM Maps	BEC[2] Zone	Lake Area (ha)	Wetland Area (ha)
210-547000	9.651640 .6596780	137700	1441	6	094M/.08 094M/.07 094M/.01 094M/.02 094M/.10 094M/.06	094M.018-M.019 094M.026-M.029 094M.035-M.039 094M.045-M.049 094M.055-M.058	SWB AT	769	972

[1]Waterwshed information derived from BC Watershed Atlas (1997)
[2]Biogeoclimatic zone (BC Environment 1996)

The Vents River watershed is located within the Spruce-Willow-Birch (SWB) and Alpine Tundra (AT) biogeoclimatic zones (BC Environment 1996). The SWB biogeoclimatic zone is a sub-alpine zone occurring at elevations above the boreal forest and below the AT (MacKinnon et al. 1992). At lower elevations, open forests of primarily white spruce (*Picea glauca*) and subalpine fir (*Abies lasiocarpa*) characterize the zone, while upper elevations are dominated by deciduous shrubs including scrub birch (*Betula glandulosa*) and willows (*Salix* spp.; MacKinnon et al.1992). The AT biogeoclimatic zone is essentially a treeless zone characterized by a cold harsh climate, dominated by dwarf shrubs, herbs, mosses, and lichens (MacKinnon et al.1992).

Figure 4.1. Study area within the Vents River watershed.

4.2 Access

The Vents River watershed was accessed by helicopter from Muncho Lake, BC. For most sites, the helicopter was able to land on a bar in the river or stream, limiting the need for extensive walking by the field crew members.

4.3 Logistics

The field surveys were conducted between July 19 and July 25, 2000. No logistical problems were encountered during the inventory within the Vents River watershed.

4.4 Fish, Fish Habitat and Distribution

The following sections will discuss the fish distribution within the watershed, summarize fish habitat observations, and present the life history summaries.

4.4.1 Fish Distribution

Only six fish species were encountered during the surveys conducted in July 2000, these included Arctic grayling, bull trout, lake trout, lake whitefish, mountain whitefish, and slimy sculpin. The limited species diversity in this watershed was anticipated, as there appears to be a distinct distribution break in the upper Liard River watershed, which appears to be associated with the rapids in the Grand Canyon of the Liard River (McPhail and Carveth 1996; BC Environment 2000b).

Fish were captured in twelve stream sites and in one lake in the Vents River watershed. Most fish were found in the Vents River mainstem or in the mainstem sections of its major tributaries or in Lapie Lake. Bull trout and slimy sculpins also were found in several small tributaries (i.e., less than 2 m wide) to Sick Wife and Lapie Creek. These were the only two sites where fish were found in small streams (Tables 4.2 and 4.3).

Table 4.2 Summary of fish species encountered in the mainstem and tributary sites, Vents River, July 2000.

Fish Species	Species Code	Mainstem	Tributaries	Lakes
Arctic grayling	GR	✓		
Bull trout	BT	✓	✓	✓
Lake trout	LT			✓
Lake whitefish	LW		✓	
Mountain whitefish	MW	✓		
Slimy sculpin	CCG	✓	✓	✓

Arctic grayling and mountain whitefish were only found in the Vents River mainstem. Lake whitefish were found in Fishing Creek during the surveys conduct in July 2000 and are known to be in Fishing Lake (Coombes 1985b). Lake trout were only found in Lapie Lake during the lake sampling conducted as part of the present study, but are known to occur in several other lakes in the watershed (Coombes 1985a, 1985b). The distribution of burbot, lake whitefish, and northern pike appears to be restricted to Fishing Lake and portions of the Fishing Creek mainstem, in close proximity to the lake.

Table 4.3 Summary of fish distribution in reaches sampled in July 2000.

Gazetted Name	Watershed Code	Reach	Site	Species[1]
Vents River	210-547000	1	1	BT, CCG,GR
		1	2	BT, GR, MW
		1	3	CCG
		1	4	BT, CCG
Lapie Creek	210-54700-06100	1	1	CCG
Lapie Lake		7		BT, CCG, LT
		8	1	NFC[1]
	210-547000-06100-81700	1	1	CCG
Berg Creek	210-547000-22600	1	1	BT, CCG
	210-547000-22600-47900	1	1	BT
	210-547000-22600-50300	4	1	NFC
	210-547000-22600-59000	2	1	NFC
Fishing Creek	210-547000-32000	1	1	LW
		3	1	NFC
		5	1	CCG
	210-547000-32000-54200	1	1	NFC
	210-547000-32000-59800-2960	1	1	NFC
Long Mountain Creek	210-547000-78200	1	1	NFC
		2	1	NFC
	210-547000-78200-44000	2	1	NFC
Sick Wife Creek	210-547000-81700	1	1	CCG
	210-547000-81700-52100	1	1	BT, CCG

[1]species codes: BT= bull trout, CCG= slimy sculpins, LW= lake whitefish, LT= lake trout, GR= Arctic grayling, NFC = no fish captured

Bull trout of different life stages were captured upstream from the cascades in Reach 1 of the Vents River. Although adult bull trout may migrate upstream past the cascades in Reach 1, it has been assumed that all stages of bull trout can overwinter upstream from the cascades. Bull trout were captured in the Vents River mainstem, Berg Creek, Lapie Creek, and Sick Wife Creek (Table 4.3).

Slimy sculpin were ubiquitous in the Vents River watershed. Sculpins were found in Lapie Lake and in most streams and occurred in all of the major sub-basins, except Long Mountain Creek (Table 4.3).

The largest numbers of fish captured in this watershed were located in Lapie Lake (WSC 210-547000-06100, Reach 7). Lake trout, bull trout and slimy sculpins were captured during a primary lake survey using a variety of different fish sampling methods. Lake trout were the most abundant species in the catch, with an average fork length of 311 mm and an average weight of 349 grams (Sharples 2001). Aging structures (otoliths, scales and fin rays) were taken from most of the captured adult lake trout. Refer to Sharples and Hamilton (2001) for more detailed information regarding Lapie Lake.

Due to the reported absence of fish in Skeezer Lake (WSC 210-547000-22600-82700-1560, Reach 4), a secondary, rather than a primary lake survey was conducted. During the secondary lake survey, the crew observed that there was no outlet stream at the west end of the lake due to a 10 metre high ridge. Local guide-outfitters report of fluctuating water levels in the lake and the presence of a 20 m deep "hole" at the west end of the lake lead the field crew to believe that there is subsurface flow out of the lake. The presence of a subterranean outlet is supported by the presence of a wide (approximately 3 m) stream below the ridge at the west end of the lake. The stream downstream from Skeezer Lake had an

extremely high gradient channel and through large cascades which would be a barrier to fish migration. Refer to Tobler and Hamilton (2001) for more detailed information regarding Skeezer Lake.

Natural obstructions were found to play an important role in dictating fish distribution within the Vents River watershed. Table 4.4 describes the eight new barriers observed within the study area. During an overview flight, two sets of cascades (Figure 4.1 and 4.2) and one beaverdam were documented in Reach 1 of the Vents River. Although it was difficult to determine the exact sizes of the cascades, the crew was able to give height and length estimates based on observations made from the helicopter. The series of cascades in Reach 1 may not be a barrier to all species, but definitely influence fish distributions in this watershed, particularly for the Arctic grayling population. Adult Arctic grayling, mountain whitefish, and bull trout were angled from a pool at the Lapie Creek confluence, which is located downstream of the falls in Reach 1. Arctic grayling adults and juveniles were only encountered at sites below the falls in Reach 1 of the Vents River (Table 4.3).

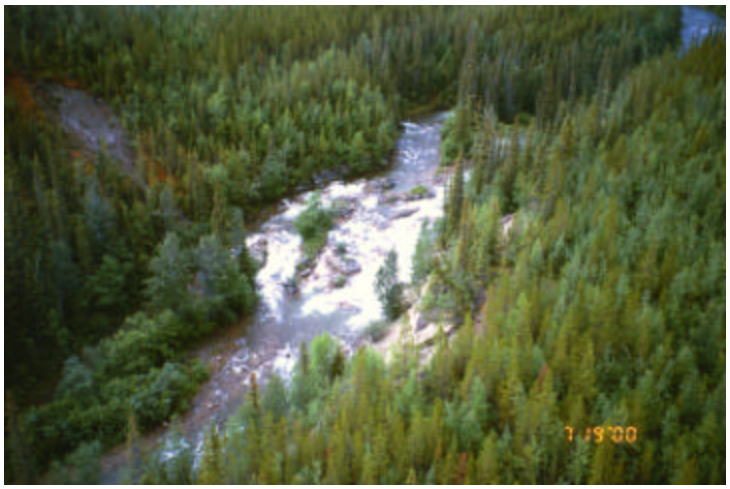


Figure 4.1 First set of cascades and falls on the Vents River, upstream of the Lapie Creek confluence.

Figure 4.2 Second set of cascades and falls on the Vents River, upstream of the Lapie Creek confluence.

Table 4.4 Barriers in the Vents River watershed.

Stream Name	WSC	Reach	Barrier Type	Approximate Height of Barrier (m)	New Barriers	Description of Barrier
Vents River	210-547000	1	Cascade (referred to as Cascade #1 in text)	See description.	Yes	Approximately 50 m in length
Vents River	210-547000	1	Cascade (referred to as Cascade #2 in text)	Approximately 1 m (difficult to measure from air).	Yes	Approximately 25 m in length
Vents River	210-547000	1	Beaverdam	>1.5	Yes	>1.5 m high, blocks full channel.
Lapie Creek	210-547000-06100	1	Falls	10	Yes	10 m high
Lapie Creek	210-547000-06100	9	Falls	8-10	Yes	8-10 m high
Unnamed Creek	210-547000-22600-82700-1560	3	Cascade	>20	Yes	Downstream of Skeezer Lake
Fishing Creek	210-547000-32000	4	Falls	2	Yes	2 m high
Long Mountain Creek	210-547000-78200	1	Falls	3	Yes	3 m high
Long Mountain Creek	210-547000-78200	1	Cascade	3	Yes	3 m high

Although Coombes (1985a) documented Arctic grayling in Long Mountain Lake, Arctic grayling were not captured upstream of the cascades in Reach 1 of the Vents River. One possible life history scenario involves Arctic grayling adults overwintering in the Liard River and making annual spawning migrations into the Vents River, with the cascades in Reach 1 limiting upstream fish migration. Burrows (2000) and Blackman (2000) found that adult Arctic grayling overwintered in large rivers in two separate radio telemetry studies in north-central BC. The grayling documented in Long Mountain Lake (Coombes 1985a) may be a residual population that colonized the area prior to a major geological event.

The apparent lack of Arctic grayling in the reaches surveyed between Reach 1 of the Vents River and Long Mountain Lake would suggest that there may be an isolated population that is residing in Long Mountain Lake and using the lake tributary streams for spawning and rearing. As the population documented by Coombes (1985a) appears to be isolated from the Liard River meta population, the Long Mountain Lake population should be managed with some care.

A 3 metre high waterfall and a 3 metre cascade were documented in Reach 1 of Long Mountain Creek. Three sites were sampled upstream from the falls and cascade, and no fish were captured during fish sampling efforts. Coombes (1985a) captured lake trout and Arctic grayling in a study of Long Mountain Lake and unidentified sculpins were present in the stomach contents of some of the captured lake trout. In addition, Coombes (1985b) referenced a local guide-outfitter's previous documentation of Dolly Varden (*Salvelinus malma*), likely bull trout, in Long Mountain Lake. The lack of fish at the sites sampled downstream of Long Mountain Lake would suggest that fish were not actively moving out of the lake at the time of sampling.

The 1.5 metre high beaverdam previously mentioned in Reach 1 of the Vents River mainstem extends across and blocks the channel. This beaverdam was not considered a permanent barrier but likely impedes fish migration, especially juvenile life stages.

Waterfalls were observed in Reach 1 and Reach 9 of Lapie Creek. The first waterfall is located approximately 500 metres upstream from the confluence of Lapie Creek and the Vents River. This falls is approximately 10 metres high and is a barrier to upstream fish migration. It is assumed that the fish populations upstream from the falls in Reach 1 are isolated from downstream populations. The second observed falls, located in Reach 9, is approximately 8-10 metres in height. The apparent lack of overwintering habitat (i.e., deep pools) upstream would likely preclude fish presence above this barrier, unfortunately no fish sampling was conducted above this barrier due to the finite number of sampling sites in the overview assessment.

A 2 metre falls was observed in Reach 4 of Fishing Creek. Slimy sculpins were captured upstream from the falls, suggesting that an isolated fish population exist upstream of the falls.

4.4.2 Fish Habitat

The following section will provide an overview of the physical habitat found at each of the sample sites. Completed MELP Site Cards have been included in Appendix 1 of this report. The habitat features and fish distributions species within the fish bearing sites, as well as Lapie Lake is presented in Table 4.5.

Table 4.5 Summary of fish habitat data from surveyed reaches in the Vents River watershed.

Gazetted Name	Watershed Code	Reach	Site	Species[1]	Channel		Amount of Cover	Dominant Cover Type[2]	Fish Habitat Comments
					Width (m)	Gradient (%)			
Vents River	210-547000	1	1	BT, CCG, GR	31.2	0.5	Moderate	SWD	Good spawning. Varity of habitat for rearing limited by lack of deep pools.
Vents River	210-547000	1	2	GR, MW, BT	28.0	1.0	Abundant	DP	Overwintering, spawning and rearing habitat present. Site located large pool.
Vents River	210-547000	1	3	CCG	20.0	1.0			Slimy sculpins caught by minnow trapping, seine netting, and electrofishing.
Vents River	210-547000	1	4	BT, CCG	13.0	1.0	Abundant	DP	Good spawning, rearing and overwintering habitat.
Lapie Creek	210-547000-06100	1	1	CCG	10.8	0.0	Moderate	B	Rearing habitat limited by lack of pools. No spawning or overwintering potential.
Lapie Lake	210-547000-06100	7	1	LT, CCG, BT	n/a	n/a	n/a	n/a	Good conditions for fish.
Lapie Creek	210-547000-06100	8	1	NFC	5.6	0.5	Moderate	DP	Good rearing and spawning habitat.
Unnamed Creek	210-547000-06100-81700	1	1	CCG	1.8	3.5	Moderate	OV, IV,	Slimy sculpins caught by electrofishing.
Berg Creek	210-547000-22600	1	1	BT, CCG	10.3	2.8	Trace	B	Fair spawning and rearing, limited gravels and cover.
Unnamed Creek	210-547000-22600-47900	1	1	BT	4.3	3.0	Moderate	OV	Moderate habitat for bull trout limited by turbulent flow.
Unnamed Creek	210-547000-22600-50300	4	1	NFC	1.6	2.5	Moderate	OV	Fair habitat. A steep gradient downstream likely restricts fish presence.
Unnamed Creek	210-547000-22600-59000	2	1	NFC	1.8 .	5.5	Trace	OV	No spawning or overwintering habitat. Rearing poor due to high velocities and lack of structure.
Fishing Creek	210-547000-32000	3	1	NFC	13.8	0	Trace	OV	Fair habitat, wetland variety best suited to species not present in watershed.
Fishing Creek	210-547000-32000	5	1	CCG	5.4	3.0	Moderate	DP	Moderate rearing and poor spawning habitat.
Fishing Creek	210-547000-32000	1	1	LW	18.2	0.0	Trace	IV	Moderate rearing, no spawning, slow moving large channel morphology.
Unnamed Creek	210-547000-32000-54200	1	1	NFC	2.8	2.8	Moderate	LWD	Fair rearing and spawning habitat, reach impacted by beaver activity.
Unnamed Creek	210-547000-32000-59800-2960	1	1	NFC	2.4	0.5	Trace	OV	Poor overall fish habitat.
Skeezer Lake	210-547000-547000-22600-82700-1560	2	1	NFC	n/a	n/a	n/a	n/a	Lake had suitable conditions for fish. Barrier downstream.
Long Mountain Creek	210-547000-78200	2	1	NFC	6.0	0.5	Moderate	DP	Moderate habitat, rearing limited by low number of pools. Spawning habitat good.
Long Mountain Creek	210-547000-78200	1	1	NFC	8.12	1	Trace	B	Fair habitat, due to fast turbulent flow and a lack of pools.
Unnamed Creek	210-547000-78200-44000	2	1	NFC	4.4	2	Moderate	OV, B	Rearing fair, turbulent flow. Some patches of gravels suitable for spawning.
Sick Wife Creek	210-547000-81700	1	1	CCG	4.8	2.5	Moderate	DP	Good spawning habitat at the outlet of pools. Rearing is moderate, limited by a low number of pools.
Unnamed Creek	210-547000-81700-52100	1	1	CCG, BT	3.3	1.5	Moderate	OV	Poor spawning, moderate rearing. Wetland riparian area.

[1]Species codes: BT= bull trout, CCG= slimy sculpin, LW= lake whitefish, LT= lake trout, GR= Arctic grayling, NFC= No Fish Captured

[2]Cover type codes: LWD= large woody debris, SWD small woody debris, B= boulder, OV= over hanging vegetation, DP= deep pool, IV= instream vegetation

Site 1 was located approximately 400 meters upstream from the confluence with the Liard River, and was described as having fair to moderate quality fish habitat. Rearing potential was present, as side channels and some slow shallow areas were available for fry. Both "pea-sized" and larger gravels were present for spawning. Overwintering habitat was limited to a few deep pools in this site, but more suitable overwintering habitat was available immediately downstream in the Liard River. It is important to note that this was the only site in the watershed where immature Arctic grayling were captured, indicating that Arctic grayling spawn in the lower portion of the Vents River, below the cascades.

Site 2 was located at the confluence of the Vents River and Lapie Creek and had excellent overwintering and holding habitat and some spawning gravels suitable for salmonids. Cover was abundant, with deep pools being the dominant cover source and boulders and undercut banks as the subdominant cover sources. The pool at this site was the only major pool between the mouth of the Vents River and Cascade #1. The low abundance of pools in the lower section of Reach 1 on the Vents River mainstem was a major factor limiting the quality of adult rearing and overwintering habitat. Adult Arctic grayling, mountain whitefish and bull trout were captured by angling the deep pool at Site 2.

Site 3 was located downstream from the confluence with Berg Creek and exhibited fair to moderate quality fish habitat. There was good spawning bed material available for all salmonids and moderate holding habitat for adult fish. Overwintering and rearing habitat quality was limited due to a lack of fish cover and deep pools.

Site 4 had good quality fish habitat as deep pools provided good overwintering habitat and abundant cover, while side channels and several sections of slower water provided rearing habitat. Spawning habitat for salmonids was good due to the presence of several pockets of small gravels.

Slimy sculpins were the only species captured in Reach 1 of Lapie Creek below the falls. Above the falls, slimy sculpins were captured in an unnamed tributary (WSC 210-547000-06100-81700) of Lapie Lake. In both reaches, the overall habitat quality was poor, as there was limited fish cover and rearing potential and a lack of overwintering or spawning areas. No fish were captured in Reach 8, upstream from Lapie Lake, although suitable fish habitat existed.

The habitat quality in Reach 1 of Berg Creek was considered fair, with occasional pockets of suitable spawning gravels, fair cover and overwintering potential. Overall, the fish habitat in this tributary was most suited to bull trout due to turbulent flow. One juvenile bull trout was caught by electrofishing in the first reach of a tributary to Berg Creek, WSC 210-547000-22600-47900.

Three reaches (Reach 1, 3 and 5) were surveyed on Fishing Creek. Lake whitefish fry were visually observed and captured by electrofishing in Reach 1. This reach was a slow moving glide (large channel morphology) most suited for cyprinids or possibly northern pike. The lake whitefish fry were captured near the mouth of the stream where gravel bed materials were present. It is likely that this habitat is a spawning location for the lake whitefish population from Fishing Lake. A beaverdam and wetland riparian habitat characterized Reach 3 and fish habitat was considered moderate. This type of habitat is commonly used by cyprinids; however, no cyprinids were present in this watershed. No fish were caught in Reach 3. Reach 5 had moderate habitat quality, with deep pools providing overwintering potential and cover, slow moving water allowing rearing and small gravels providing spawning habitat.

Overall, fish habitat quality in reach 1 of Sick Wife Creek was moderate, with deep pools, a limited amount of clean spawning gravels and moderate rearing habitat. This reach had riffle-pool morphology. One adult bull trout and two juvenile slimy sculpins were captured by electrofishing in the first reach of a tributary (WSC 210-547000-817000-52100) to Sick Wife Creek. This reach lacked spawning and overwintering habitat, but had moderate rearing habitat and cover. This reach was not typical of adult bull trout habitat, as it was a small stream (3.28 m wide) with wetland riparian habitat and minimal spawning habitat.

4.4.3 Fish Size and Life History

Table 4.6 summarizes the distribution, life history and characteristics of fish caught in the Vents River Watershed. No histograms were constructed in this report due to the low numbers of fish captured in the stream sites. A histogram for lake trout captured during a primary lake survey of Lapie Lake is presented in Sharples and Hamilton (2001).

Bull trout, slimy sculpins, Arctic grayling, mountain whitefish, lake whitefish, and lake trout of different life stages were captured in the Vents River watershed (Table 4.6). In this watershed, adult Arctic grayling, bull trout, mountain whitefish, lake trout and slimy sculpins were captured, while juvenile bull trout, slimy sculpins, lake trout, lake whitefish and Arctic grayling were also captured.

The adult Arctic grayling had an average fork length of 283 mm, while adult bull trout had an average fork length of 344 mm and the mountain whitefish was 344 mm in length. The juvenile bull trout ranged from 35 to 145 mm in length while the juvenile Arctic grayling ranged in length from 35 to 43 mm. Scale and fin ray samples and otoliths, used for aging purposes, were taken from many of the adult Arctic grayling, lake trout, bull trout and mountain whitefish.

Most of the bull trout and slimy sculpins have fluvial or resident life histories, while most species captured in or near the lakes are adfluvial or lake residents. It was thought that adult fish, especially Arctic grayling would utilize the habitat within the lower portions of the Vents River and stay in close proximity to the Liard River, where they likely overwinter.

Table 4.6 Summary of data from fish sampled in the Vents River watershed.

Watershed Code	Reach/Site Number[1]	Species[2]	Life Stage	Number Of Fish Captured	Suspected Life History[3]	Range of Fork Lengths (mm)
210-547000 (Vents River)	1/2	GR	A	11	Fluvial	240-337
		MW	A	1	Fluvial	344
		BT	A	2	Fluvial	333-355
210-547000 (Vents River)	1/4	BT	J	1	Fluvial	80
		BT	A	1	Fluvial	340
		CCG	J	4	Resident	63-82
210-547000 (Vents River)	1/1	BT	J	1	Fluvial	75
		CCG	J	10	Resident	38-74
		GR	F	3	Fluvial	35-43
210-547000 (Vents River)	1/3	CCG	J	12	Resident	22-84
210-547000-06100 (Lapie Creek)	1	CCG	J	2	Resident	52-55
210-547000-06100 (Lapie Lake)	7	LT	J	105	Lake resident	89-355
		LT	A	38	Lake resident	305-402
		BT	A	1	Adfluvial	320
		CCG	J	6	Adfluvial	48-62
210-547000-06100-81700 (Trib. to Lapie Lake)	1	CCG	J	2	Resident	48-52
210-547000-22600 (Berg Creek)	1	BT	J	2	Resident	141-145
		CCG	J	1		33
210-547000-22600-47900 (Trib. to Berg Creek)	1	BT	J	1	Resident	35
210-547000-32000 (Fishing Creek)	5	CCG	J	8	Resident	49-71
210-547000-32000 (Fishing Creek)	1	LW	J	1	Adfluvial	45
210-547000-81700 (Sick Wife Creek)	1	CCG	J	2	Resident	45-46
			A	3	Resident	75-85
210-547000-81700-52100 (Trib. to Sick Wife Creek)	1	CCG	J	2	Resident	50-60
		BT	A	1	Resident	310

[1] Where applicable

[2] Species codes: BT= bull trout, CCG = slimy sculpins, LW= lake whitefish, LT= lake trout, GR= Arctic grayling

[3] Definitions for life history stages: e.g. fluvial – undertakes major migrations between Liard River and Vents Watershed; resident – minor migrations within the Vents Watershed; adfluvial – migrations between lakes and tributary streams.

Fish aging structures, consisting of otoliths, scale samples and/or fin ray samples, were taken from some captured bull trout, Arctic grayling and lake trout. In the Vents River watershed, nine aging structures were taken from both captured bull trout and Arctic grayling; however, the fin ray samples were not used in the age analysis. In general, the bull trout, except for one captured in Lapie Lake, were quite small and were in the 1+ or 2+ age group (Table 4.7). The Arctic grayling were all captured in Reach 1 of the Vents River mainstem, and ranged from 3+ to 6+ years in age. Ninety-seven structures were taken from lake trout, all captured in Lapie Lake. The ages of the lake trout ranged from 1+ to 15+ years. Refer to Sharples and Hamilton (2001) for more detailed information regarding the lake trout captured in Lapie Lake. Table 6 describes the lengths and ages of fish caught in streams in the Vents River watershed.

Table 4.7 Fish Length and Age in Streams in the Vents River watershed.

Watershed Code	Species	Length (mm)	Age Structure[1]	Age[2]	Comments
210-547000	BT	333	FR	n/a	Fin ray structure; not aged.
210-547000	BT	355	FR	n/a	Fin ray structure; not aged.
210-547000	BT	80	SC	1+	
210-547000	BT	340	FR	n/a	Fin ray structure; not aged.
210-547000	BT	75	SC	1+	
210-547000	GR	243	SC	3+	
210-547000	GR	337	SC	n/a	Scale regenerated, not readable
210-547000	GR	320	SC	6+	
210-547000	GR	328	SC	6+	
210-547000	GR	304	SC	6+	
210-547000	GR	277	SC	5+	
210-547000	GR	290	SC	5+	
210-547000	GR	255	SC	5+	
210-547000	GR	280	SC	5+	
210-547000	MW	344	SC	n/a	Scale is unreadable. Approximate age is 9+.
210-547000-22600	BT	145	SC	2+	
210-547000-22600	BT	141	SC	2+	
210-547000-22600-47900	BT	35	SC	1+	

[1]Where FR=Fin Ray, SC= Scale, OT=otolith
[2]Where n/a= not applicable

4.4.4 Relative Abundance

Overall abundance of fish was extremely low, with only 76 fish captured during the survey conducted in July 2000 (Table 4.8). The relatively low numbers of fish captured during the survey was surprising, as the overview sampling methodology concentrates on areas where fish would be expected to occur. It is hypothesized that the low abundance of fish in this watershed is possibly a result of the limited habitat diversity in many areas of the watershed. For example, the mainstem of the Vents River is dominated by long (5-10km) sections of riffle habitat (i.e., shallow, fast water, usually with large cobble or boulder bed material), with little habitat diversity. Similarly, many of the tributary streams also lack habitat complexity and are dominated by long, uniform sections of riffle type habitat. This type of habitat would have less capacity to support fish than a stream with a more complex habitat.

In the Vents River mainstem and its tributary basins, slimy sculpin was the most abundant species, comprising 55% of the total catch. Arctic grayling and lake whitefish comprised 18% and 15% of the catch, respectively. Surprisingly, the contribution of bull trout and mountain whitefish was low, 11% and 1% respectively.

Only three species were encountered during the lake surveys, with lake trout dominating the catch (97%). Slimy sculpin and bull trout contributed the remaining three percent. The dominance of lake trout may be partially a result of the bias of the gill nets; however, the sole bull trout captured during the lake survey was captured in a gill net. Therefore, this would suggest that lake trout far out number bull trout population in Lapie Lake.

Figure 4.3 Representative section of Reach 1 of the Vents River.

Figure 4.4 Representative habitat in the first reach of Lapie Creek.

4.5 Significant Features and Fisheries Observations

There are a number of isolated fish populations in the Vents River watershed. These populations may be very vulnerable to change due to low densities and small gene pools. Any development in the Vents River Watershed should be carried out in such a manner to ensure that isolated populations are not impacted. Isolated populations of bull trout, slimy sculpins and lake trout were found in Lapie Lake (Sharples and Hamilton 2001). Arctic grayling and lake trout were documented upstream from two barriers in Long Mountain Lake by Coombes (1985b).

Sport fishing values were deemed to be fair in the Vents River watershed. Access to all of the lakes is limited and only accessible by helicopter or floatplane. While the lake trout were not large in size (Sharples and Hamilton 2001), Lapie Lake is occasionally used as a fly fishing opportunity by local guide-outfitters. Long Mountain and Fishing lakes are also used for fly-in fishing opportunities. Long Mountain Lake is primarily targeted for lake trout as large fish (i.e., >10 kg) are present in the lake (Coombes 1985a) and northern pike are the species of choice in Fishing Lake (Schildknecht pers. comm. 2000). The streams in the Vents River Watershed provided little sport fishing opportunities as a result

of low fish densities. Fish, especially adults, were generally associated with structure and pools. Limited fish cover and limited large woody debris (LWD) observed in many of the sample sites probably contributed to the low numbers of adult fish captured. Large woody debris was not abundant in the Vents River Watershed. Large woody debris is a very important habitat feature for salmonids and benefits all life stages as it provides physical structure that creates pools and undercut banks, deflects and breaks up stream flow and stabilizes the stream channel (Murphy and Meehan 1991). Spawning habitat is also created as LWD forms small dams and which prevent spawning gravels from being transported downstream (Murphy and Meehan 1991).

The lack of cover in this watershed could be a result of previous fires in the area, which burned some of the riparian vegetation and upland forests. While there has been no major anthropogenic disturbance in the watershed, there was significant evidence of several recent (likely within the last 75 years) fires. The watershed was made up of several pure stands of lodgepole pine (*Pinus contorta*), a pioneer species, which establishes after disturbances such as fire. While tree size was consistent within the stands, they were not consistent between stands indicating a number of separate fires had impacted the watershed.

4.6 Fisheries Sensitive Zones

No fisheries sensitive zones were identified during the inventory of this basin.

4.7 Fish Above 20% Gradient

Fish sampling did not occur in reaches with gradients over 20%.

Table 4.8 Percent composition of fish captured by species[1] in the Vents River watershed, by all capture methods, July 2000.

Gazetted Name	Watershed Code	Reach	Site	BT		CCG		GR		LT		LW		MW		Total No.
				No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Vents River Mainstem and Tributaries																
Vents River	210-547000	1	1	1	7	10	72	3	21							**14**
		1	2	2	14			11	79					1	7	**14**
		1	3			8	100									**8**
		1	4	1	20	4	80									**5**
Lapie Creek	210-54700-06100	1	1			2	100									**2**
		8	1													
	210-547000-06100-81700	1	1			2	100									**2**
Berg Creek	210-547000-22600	1	1	2	67	1	33									**3**
	210-547000-22600-47900	1	1	1	100											**1**
	210-547000-22600-50300	4	1													
	210-547000-22600-59000	2	1													
Fishing Creek	210-547000-32000	1	1									11	100			**11**
		3	1													
		5	1			8	100									**8**
	210-547000-32000-54200	1	1													
	210-547000-32000-59800-2960	1	1													
Long Mountain Creek	210-547000-78200	1	1													
		2	1													
	210-547000-78200-44000	2	1													
Sick Wife Creek	210-547000-81700	1	1			5	100									**5**
	210-547000-81700-52100	1	1	1	33	2	67									**3**
Vents River Mainstem and Tributaries Total				**8**	**11**	**42**	**55**	**14**	**18**			**11**	**15**	**1**	**1**	**76**
Lapie Lake																
Lapie Lake	210-54700-06100	7		1	1	4	2			143	97					**148**
TOTAL				**9**	**4**	**46**	**21**	**14**	**6**	**143**	**64**	**11**	**5**	**1**	**<1**	**224**

[1]species codes: BT= bull trout, CCG = slimy sculpins, LW= lake whitefish, LT= lake trout, GR= Arctic grayling.

5.0 UPPER TOAD RIVER WATERSHED

The upper Toad River watershed lies within the M-KMA in northeastern British Columbia, south of Muncho Lake Provincial Park. The study area includes the Toad River mainstem and all tributaries that flow into Toad River, upstream and including Moose Lake (Figure 5.1). West Toad River (WSC 214-642100) and its tributaries and Yedhe Creek (WSC 214-677900), east of Toad River, and its tributaries were not included in this study.

5.1 Study Area

The upper Toad River watershed has an approximate area of 75500 hectares. The study area included seven third order basins and one fourth order basin. Table 5.1 summarizes location and watershed information on the study area located within the upper Toad River watershed.

Table 5.1 Watershed information[1] for upper Toad River watershed.

Watershed Code	UTM at Mouth	Watershed Area (hectares)	Stream Length (km)	Stream Order	NTS Map #s	TRIM Map #s	BEC Zone	Lake (ha)	Wetlands[2] (ha)
214-000000	10.340300 .6508808	75500	635.3	5	094K/12 094K/11 094K/05 094K/06	094K.023-K.024 094K.031-K.034 094K.041-K.044 094K.051-K.053 094K.061-K.062	SWB AT	15.5	542.43[2]

[1]Information derived from BC Watershed Atlas.
[2]Includes 248.3 ha Moose Lake thought to be a wetland as it is too shallow to be considered a lake.

According to the biogeoclimatic classification system used by the British Columbia Ministry of Forests, the upper Toad River watershed lies within the spruce-willow-birch (SWB) and alpine tundra (AT) biogeoclimatic zones (BC Environment 1996). The SWB biogeoclimatic zone is a sub-alpine zone occurring at elevations above the boreal forest and below the AT (MacKinnon et al. 1992). At lower elevations, open forests of primarily white spruce (*Picea glauca*) and subalpine fir (*Abies lasiocarpa*) characterize the zone, while upper elevations are dominated by deciduous shrubs including scrub birch (*Betula glandulosa*) and willows (*Salix* spp.*;* MacKinnon et al.1992). The AT biogeoclimatic zone is essentially a treeless zone characterized by a cold harsh climate (MacKinnon et al.1992). This zone is dominated by dwarf shrubs, herbs, mosses and lichens (MacKinnon et al.1992).

While there has been no major anthropogenic disturbance in the watershed, there was significant evidence of several recent fires. The watershed was made up of several pure stands of lodgepole pine (*Pinus contorta*), a pioneer species that establishes after disturbances such as fire. While tree size was consistent within the stands, they were not consistent between stands indicating a number of separate fires had impacted the watershed.

Figure 5.1. Study area within the upper Toad River watershed

5.2 Access

The upper Toad River watershed was accessed by helicopter from Muncho Lake, BC. For most sites, the helicopter was able to land on a river or stream bar, limiting the need for extensive walking by field crew members.

5.3 Logistics

The field surveys were conducted on July 23 and July 24, 2000. There were no logistical problems encountered during the overview inventory within the upper Toad River watershed.

5.4 Fish, Fish Habitat and Distribution

The following sections will discuss the fish distribution within the watershed, summarize fish habitat observations, and present the life history summaries.

5.4.1 Fish Distribution

Fish were captured in four stream sites and in one lake in the upper Toad River watershed. Most fish were found in the Toad River mainstem or in the first reaches of the tributaries to the mainstem (Table 5.2), with an exception to bull trout which was captured in a small headwater lake (a stocked isolated population).

Table 5.2 Summary of fish species encountered in the mainstem and tributary sites, upper Toad River, July 2000.

Gazetted Name	Watershed Code	Reach	Species[1]
Toad River	214-000000	1 3	LKC, CCG BT, CCG
Unnamed	214-785100	1	BT, GR
Unnamed	214-816600	1 7	CCG, GR BT

[1]Species codes: BT= bull trout, CCG= slimy sculpin, LKC= lake chub, GR= arctic grayling

Of the eleven surveyed stream reaches in the upper Toad River watershed, fish were captured in only four sites. Fish distribution appeared to be limited by rugged terrain. Several barriers such as falls, cascades and steep gradients were documented and photographed in this watershed. Table 5.3 lists the barriers documented in the upper Toad River watershed.

Four barriers appeared to limit fish distribution to less than half the area of the upper Toad River watershed. No fish were captured above a five metre high cascade on Reach 4 of the upper Toad River mainstem or above a fifteen metre falls located near the mouth (Reach 1) of the fourth order system 214-816600 (with the exception of an isolated stocked lake). A six metre high cascade on Reach 2 of the third order system 214-785100 is a definite barrier to fish passage. One site was sampled upstream from the cascade and fish were not captured. The third order stream, 214-777500, had a ten metre falls in Reach 1. Although sampling did not occur upstream from this falls, it is unlikely that fish are present due to a lack of good quality rearing and overwintering habitat.

Table 5.3 Barriers in upper Toad River watershed.

Watershed Code	Reach	Barrier Type	Height of Barrier[1] (m)	Newly Documented Barriers	Description of Barrier
214	4	Cascade	5	Yes	5m high, 4 m long.
214	9	Steep Gradient	n/a	Yes	Steep gradient.
214-777500	1	Falls	10	Yes	10 m falls
214-785100	2	Cascade	6	Yes	6 m high, 2 m long.
214-785100-40700	1	Falls	6	Yes	6 m falls.
214-816600	1	Falls	15	Yes	15 m falls upstream from sample site in Reach 1.
214-910600	1	Falls	10-15	Yes	10-15 m falls.
214-925400	1	Falls	10 m	Yes	10 m falls.
214-925400	1	Steep Gradient	n/a	Yes	Steep gradient.
214-951900	1	Falls	20	Yes	20 m falls.

[1]where n/a=not applicable

The remaining documented barriers were all located upstream from one of the four above mentioned barriers; therefore, have little or no significance in terms of fish distribution.

Steep gradients, defined as gradients over 20%, were documented in several first order tributaries. Fish sampling did not occur upstream from the steep gradients, but the steep gradients and in some cases, the associated falls, would be considered barriers to fish passage.

5.4.2 Fish Habitat

The following section will provide an overview of the physical habitat found at each of the sampling sites. Completed MELP Site Cards have been included in Appendix 1 of this report. The habitat features and fish species within the fish bearing sites are presented in Table 5.4.

Fish presence and the most suitable fish habitat were limited to third or fourth order streams with large channel widths and relatively flat gradients. Fish habitat was considered poor in all surveyed first or second order streams, where waterfalls and steep gradient barriers in some first order streams especially limited fish habitat.

Two of the fish-bearing sites in the upper Toad River watershed were located on Reach 1 and Reach 3 on the Toad River mainstem. Reach 1 was sampled at the outlet of Moose Lake. Reach 1 had only a trace of cover and a lack of overwintering habitat, with long sections of riffles and runs and no deep pools. The average channel width of this site was 40 metres and the average gradient was 1%. Slimy sculpins were captured by electrofishing and lake chub were captured by minnow traps, although the lake chub could be considered residents of Moose Lake. Fish were also not captured in another unnamed lake (WSC 214-91600-41800 Reach 2).

Toad River, Reach 3, had a trace of cover, and a lack of overwintering habitat. In this reach, side channels were present for rearing, but spawning habitat was poor. The average channel width was 38.5 metres and the average gradient was 0.5%. Bull trout and slimy sculpins were captured in Reach 3 by electrofishing. Table 5.4 summarizes data from the stream reaches sampled in the in the upper Toad River watershed.

Table 5.4 Summary of fish habitat data from surveyed reaches in the Toad River Watershed.

Gazetted Name	WSC	Reach	Site	Species[1]	Channel		Amount of Cover	Dominant Cover Type[2]	Fish Habitat Comments
					Width (m)	Gradient (%)			
Toad River	214	1	1	LKC CCG	40	1	Moderate	DP, B	Rearing habitat present, but limited by low percentage of pool area.
Moose Lake	214	2	1	NFC	n/a	n/a	n/a	n/a	Good rearing habitat for Cyprinids. Likely too shallow to provide overwintering habitat for salmonids.
Toad River	214	3		BT CCG	38.5	0.5	Trace	LWD	Side channels present for rearing. Spawning rated as poor due to high fine content and compacted gravels.
Toad River	214	5	1	NFC	39.0	1	Abundant	DP, B	Deep pools provide rearing habitat, some spawning potential. Barrier downstream.
Toad River	214	5	2	NFC	36.8	0	Moderate	DP	Good rearing habitat for juveniles in side channels. Moderate spawning habitat. Barrier downstream/
	214-785100	1	1	GR BT	53	5	Abundant	DP	Good rearing, fair spawning habitat at site location.
	214-816600	1		CCG GR	24	0.75	Trace	U	Fair rearing and spawning habitat, due extensive riffle areas.
	214-816600	7		BT	n/a	n/a	n/a	n/a	Suspect good lake conditions, as it supports an isolated population of bull trout.
	214-777500	1	1	NFC	16.5	7	Trace	B	Poor spawning, fair to moderate rearing for bull trout. High water velocities limit habitat use.
	214-910600-41800	2	1	NFC	n/a	n/a	n/a	n/a	Lake appeared suitable for fish use; however, did not conduct a full survey. Barriers downstream.
	214-778300	1	1	NFC	14.9	8	Moderate	B	Fair rearing and spawning limited by fast turbulent flow.
	214-816600-57200	1	1	NFC	4.5	2	Trace	LWD	Poor habitat due to turbulent flow and lack of structure. Barrier downstream.
	214-816600-39300	1	1	NFC	3.5	6	Trace	B	Poor habitat due to high water velocities and limited cover.
	214-816600-61300	2	1	NFC	2.8	2	Trace	U	Poor habitat due to high water velocities and limited cover.
	214-785100	1	1	NFC	8.8	10	Abundant	B	Good step pool rearing habitat with abundant boulders. Some spawning potential. Barriers downstream.

[1]species codes: BT= bull trout, CCG= slimy sculpin, LW= lake whitefish, LT= lake trout, GR= Arctic grayling, NFC= No Fish Captured

[2]cover type codes: LWD= large woody debris, SWD small woody debris, B= boulder, OV= over hanging vegetation, DP= deep pool, U= undercut banks

A third order tributary to Toad River, WSC 214-785100, Reach 1, had good habitat quality, with abundant cover, excellent overwintering and rearing but fair spawning habitat. At the site location, a slide of material from a hoodoo created an excellent pool, which was the only large pool found within the reach. The morphology in this reach was cascade-pool, and the dominant and subdominant bed materials were boulders and cobbles, respectively. The average channel width was 53 metres due to a wide and active floodplain. Adult Arctic grayling and juvenile bull trout were captured in this reach.

Below the fifteen metre falls in the fourth order tributary to Toad River, WSC 214-816600, Reach 1, slimy sculpins were the only species captured by electrofishing, although one 250 mm long Arctic grayling was visually observed jumping out of the water. In this reach, the habitat quality was poor to fair, with only a trace of stream cover and limited overwintering habitat. The morphology was riffle-pool and the dominant and subdominant bed materials were gravels and fines, respectively. A 15 metre falls was documented upstream from the sample site (Refer to Table 5.3). Fish were not captured in the three sample sites above the falls; however bull trout were captured in a stocked, isolated lake, WSC 214-816600, Reach 7, locally known as Ram Lake (Woods 2000).

Angling in Ram Lake captured several adult bull trout. It has been reported that guide-outfitters had previously stocked this lake with bull trout, approximately 20-25 years ago (Webster 2000). This lake lacked an above ground outlet stream, which restricted fish to the lake.

5.4.3 Fish Size and Life History

Bull trout, slimy sculpins, Arctic grayling and lake chub were captured in the upper Toad River watershed. Adult Arctic grayling captured had an average fork length of 333.5 mm and an average weight of 450 grams, while the adult bull trout ranged in size from 160-410 mm and had an average weight of 595 grams in Ram Lake (Table 5.5). The single juvenile bull trout captured in Reach 3 of the Toad River mainstem was 39 mm in length. Scale and fin ray samples, and/or otoliths, were taken from many of the adult Arctic grayling and bull trout and used for aging purposes.

Most fish in this watershed were thought to utilize large streams and have a fluvial life history, as there was only one lake with fish captured in this watershed. According to Page and Burr (1991), Arctic grayling inhabit clear, medium to large rivers and lakes, but enter rocky creeks to spawn and bull trout inhabit lakes and deep pools in large cold rivers. It was thought that adult fish would utilize the habitats within the lower portions of the Toad River. As Moose Lake is shallow, it likely has limited overwintering potential for adult salmonids. Although fish were not captured in the minnow traps set in Moose Lake, lake chub were captured in the lake's outlet stream near Moose Lake. Lake chub likely use the wetland habitat found in Moose Lake, rather than the fast streams in this watershed.

As mentioned previously, the bull trout captured in Ram Lake were an isolated population and appear to be reproducing in the lake.

Table 5.5 Summary of data from fish sampled in the upper Toad River watershed.

Watershed Code	Species[1]	Life Stage	Number of Fish Captured	Suspected Life History[2]	Range of Fork Lengths (mm)
214	LKC CCG	J J	4 1	Adfluvial	50-120 40
214	BT CCG	J J	1 5	Fluvial	39 31-73
214-785100	GR BT	A A	2 1	Fluvial	332-335 160
214-816600	CCG	A	1	Fluvial	86
214-816600	BT	A	6	Lake Resident	360-410

[1]Species codes: BT= bull trout, CCG= slimy sculpin, LKC= lake chub, GR= arctic grayling
[2]Definitions for life history stages: Fluvial – undertakes migrations within streams in the Toad watershed; Adfluvial – migrations between lakes and tributary streams; Lake Resident—live in lake exclusively.

Fish aging structures, consisting of otoliths, scale samples and/or fin ray samples, were taken from some bull trout and Arctic grayling captured in the upper Toad River watershed (Table 5.6). Four aging structures were taken from bull trout and two aging structures were taken from Arctic grayling, but fin ray samples could not be aged. In general, bull trout ranged from 2+ years old in 214-785100 to approximately 6+ years old in Ram Lake. The Arctic grayling captured in 214-785100 were approximately 6+ years.

Table 5.6 Length and age of fish captured in the upper Toad River watershed.

Watershed Code	Species[1]	Length (mm)	Age Structure[2]	Age[3]	Comments
214-785100	BT	160	SC	2+	
214-785100	GR	332	SC	6+	
214-785100	GR	335	SC	6+	
214-816600	BT	360	FR	n/a	Fin ray structure taken, not aged; caught in Ram Lake.
214-816600	BT	365	FR/OT	6+	Caught in Ram Lake.
214-816600	BT	410	FR	n/a	Fin ray structure taken, not aged; caught in Ram Lake.

[1]Species codes: BT= bull trout, CCG= slimy sculpin, LKC= lake chub, GR= arctic grayling
[2]Where FR=Fin Ray, SC= Scale, OT=otolith
[3]Where n/a= not applicable

5.4.4 Relative Abundance

Overall abundance of fish was extremely low, with only 15 fish captured within the streams in this watershed (Table 5.7). The extremely low numbers of fish captured during the survey was surprising, particularly when the overview sampling methodology concentrates on areas where fish would be expected to occur. It is hypothesized that the low abundance of fish in this watershed is possibly a result of the limited habitat diversity in most areas of the watershed. For example, the mainstem of the Toad River is dominated by long (5-10km) sections of riffle habitat (i.e., shallow, fast water, usually with

large cobble or boulder bed material), with little habitat diversity. Tributaries to the Toad River had high gradients with fast turbulent flow with limited structure such as wood. These types of habitat would have less capacity to support fish than a stream with more complex habitat.

In the mainstem of the Toad River and its tributary streams, slimy sculpin was the most abundant species, comprising 33% of the total catch. Although lake chub were captured at only one site, they comprised 27% of the catch. Arctic grayling and bull trout each comprised 13% of the catch.

Table 5.7 Percent composition of fish captured in the streams of the upper Toad River watershed, by all capture methods, July 2000.

Gazetted Name	Watershed Code	Reach	BT[1,2]		CCG[2]		GR[2]		LKC[2]		Total No.
			No.	%	No.	%	No.	%	No.	%	
Toad River	214-000000	1			1	20			4	80	**5**
		3	1	17	5	83					**6**
	214-816600	1			1	100					**1**
	214-785100	1	1	3			2	66			**3**
TOTAL			**2**	**13**	**7**	**33**	**2**	**13**	**4**	**27**	**15**

[1]Ram Lake was not included as it would give a false representation of natural densities.
[2]species codes: BT= bull trout, CCG= slimy sculpin, LKC= lake chub, GR= arctic grayling

5.5 Significant Features, Fisheries Observations

No critical habitats were identified in this watershed that require special habitat protection, although limited LWD, pools, low fish densities and previous fire history have affected fish distribution and densities in the upper Toad River watershed. Sport fishing values were deemed to be poor to fair in this watershed, as only one lake, Ram Lake had fish captured, and the fish densities were low in the surveyed streams. Access to Ram Lake is limited to either floatplane or helicopter.

5.6 Fisheries Sensitive Zones

No fisheries sensitive zones were identified during the inventory of this basin.

5.7 Fish Above 20% Gradient

Fish sampling did not occur in reaches with over 20% gradients.

6.0 SUMMARY AND CONCLUSIONS

The results of the sampling conducted in the summer of 2000 indicate that fish abundance in the streams and rivers of the two watersheds are very low, compared to other watersheds in northern B.C. The low abundance may be attributed to the natural lack of habitat complexity in the streams and rivers in these two watersheds. Waterfalls appear to limit the distribution of fish in both watersheds; however, waterfalls appear to play a greater role in limiting access to tributary streams in the Toad River watershed.

The lake surveys conducted in this and previous studies suggested that the lakes in the Vents River watershed support diverse fish populations. The data indicate that the lake trout, which are the main lake resident sportfish species, are growing very slowly and there are very few fish in the size range preferred by recreational anglers. This makes the management of these lakes very important, as it would be very easy to over fish these lakes.

High quality habitat areas in the mainstem Vents and Toad rivers are limited; in particular, deep pool type habitat appears to lacking in many reaches. Adult fish of many species prefer to hold and rear in pools. They will therefore be concentrated in small spatial areas, which make them susceptible to over exploitation. For example the pool located at the confluence of the Vents River and Lapie Creek was one of the highest quality habitats sampled during the surveys in 2001. This pool had the highest concentration of adult fish (i.e., 11 Arctic grayling, two bull trout, and one mountain whitefish) of any of the stream sites sampled. Of the 11 Artic grayling captured at this location, five were of legal size to keep. Based on the rate fish were being captured at this site, it would take three fishers less than one hour to remove the largest Arctic grayling from this pool. This concentration of fish could be easily over fished if care is not taken to manage the fish stocks in the watershed.

Therefore, if access to the low portion of the Vents River is improved or there is an increase in guide/outfitting activity, consideration should be given to establishing watershed specific daily catch quotas or catch and release regulations, particularly for Arctic grayling.

It is also recommended that the lake trout fishery of the mountain lakes (not just those in the Vents River) be assessed in order to determine if the current rate of harvest is having a significant effect on the growth and reproduction of these populations. This is also important in order to determine if changes in the fishing regulations may be necessary in the future, if the amount of fishing pressure (i.e., angler days) increases.

7.0 REFERENCES CITED

BC Environment. 1995. Fisheries Information Summary System (FISS) maps and data base. BC Environment, Prince George, BC

BC Environment. 1996. Digital biogeoclimatic maps for zones 9 and 10 downloaded from ftp site: ftp://ftp.env.gov.bc.ca/dist/arcwhse/wildlife.

BC Environment. 1997a. Terrain Resource Information Management (TRIM). 1:20,000 scale maps.

BC Environment. 2000a. Muskwa-Kechika Management Plan website.
http://www.luco.gov.bc.ca/slupinbc/frtnelsn/app7/app7main.htm#top.

BC Environment. 2000b. Fisheries Information Summary System (FISS) website. Located at http://www.env.gov.bc.ca:8100/fiss_pub.

BC Ministry of Environment, Lands and Parks. 1993. British Columbia Recreational Atlas. BC Ministry of Environment. Lands and Parks, Victoria, BC. 143 pp.

BC Ministry of Fisheries. 1999. Overview Fish and Fish Habitat Inventory Methodology. BC Ministry of Fisheries, Victoria, BC.

BC Ministry of Fisheries. 1998. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Standards and Procedures (April, 1998) including Errata, March, 1999. BC Ministry of Fisheries, Victoria, BC. 107 pp.

BC Ministry of Forests and BC Ministry of Environment. 1995. Fish-Stream Identification Guidebook. BC Ministry of Forests, Victoria, BC. 39 pp.

Blackman, Brian. 2000. Arctic Grayling studies in the Williston Reservoir watershed. Presented to Arctic Grayling Workshop, Prince George, BC.

Burrows, Jeff. 2000. Arctic Grayling movement patterns in the Halfway River and Sukunka River watersheds. Presented to Arctic Grayling Workshop, Prince George, BC.

Coombes, D. M. 1985a. A Reconnaissance Survey of Long Mountain Lake. Prepared by Recreational Fisheries Branch, Ministry of Environment and Parks.

Coombes, D. M. 1985b. A Reconnaissance Survey of Fishing Lake. Prepared by Recreational Fisheries Branch, Ministry of Environment and Parks.

Environmental Dynamics Inc. 2000. Project Plan for Overview Fish and Fish Habitat Inventory of Vents River and Upper Toad River Watersheds. Prepared for Muskwa-Kechika Advisory Board, Fort St. John, BC.

MacKinnon, A., J. Pojar and R. Coupe. 1992. Plants of Northern British Columbia. BC Ministry of Forests and Lone Pine Publishing, Vancouver, BC.

McPhail, J.D. and R. Carveth. 1996. Field key to the freshwater fishes of British Columbia. Prepared for the Resources Inventory Committee, Victoria, BC.

Muskwa-Kechika. 2000. Muskwa-Kechika Backgrounder available at the Muskwa-Kechika website. http://www.luco.gov.bc.ca/nrockies/backgrnd.htm

Page, Lawrence M. and Brooks M. Burr. 1991. Freshwater Fishes. The Peterson Field Guide Series. Boston, Mass., New York, New York.

Resource Inventory Committee. 1997. BC Watershed Atlas.

Schildknecht, U. 2000. Owner/Operator of the Northern Rockies Lodge and Liard Air Ltd., Muncho Lake, BC. Personal communication during a conversation with Mr. David Hamilton, Senior Fisheries Biologist, Environmental Dynamics, Prince George, B.C. July 2000.

Sharples, R. J. and J.D. Hamilton. 2001. Lake Inventory of Lapie Lake. Prepared by EDI Environmental Dynamics Inc., Whitehorse, YT for Muskwa-Kechika Trust Fund, Fort St. John, BC.

Tobler, P and J.D. Hamilton. 2001. Inventory of Skeezer Lake. Prepared by EDI Environmental Dynamics Inc., Whitehorse, YT for Muskwa-Kechika Trust Fund, Fort St. John, BC.

Webster, Bryan. 2000. Personal communications. BC Parks.

Woods, A. D. 2000. Historical fisheries information from the Muskwa-Kechika Management Area. Unpubl. Rep. for Fisheries Branch, Ministry of Environment, Lands and Parks, Fort St. John, BC.

APPENDIX I

FIELD DATA INFORMATION SUMMARIES AND PHOTOGRAPHS

APPENDIX II

FISHERIES PROJECT AND INTERPRETIVE MAPS