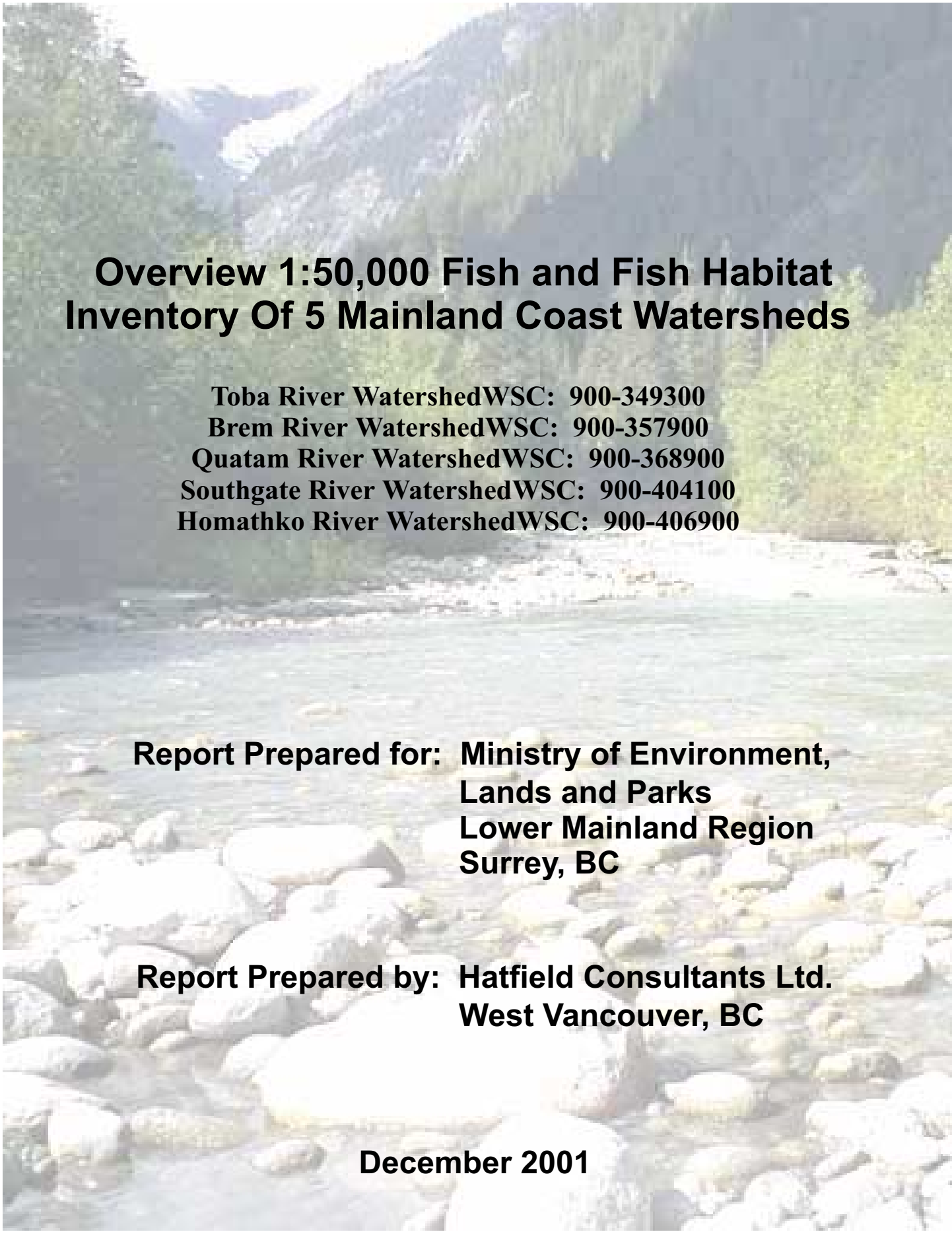




Overview 1:50,000 Fish and Fish Habitat Inventory Of 5 Mainland Coast Watersheds

Toba River WatershedWSC: 900-349300

Brem River WatershedWSC: 900-357900

Quatam River WatershedWSC: 900-368900

Southgate River WatershedWSC: 900-404100

Homathko River WatershedWSC: 900-406900

**Report Prepared for: Ministry of Environment,
Lands and Parks
Lower Mainland Region
Surrey, BC**

**Report Prepared by: Hatfield Consultants Ltd.
West Vancouver, BC**

December 2001

Overview 1:50,000 Fish and Fish Habitat Inventory Of 5 Mainland Coast Watersheds

Toba River Watershed	WSC: 900-349300
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Prepared for:
Ministry of Environment, Lands and Parks
Environment and Lands
Lower Mainland Region
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Surrey, BC
V3R 0R3

Prepared by:
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201-1571 Bellevue Ave.
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V7V 1A6

Approved by:

Alan Stockwell, R.P.Bio.

December 3, 2001

Project Reference Information

MELP Contract Number	CLM01-14
FDIS Project Number	02-TOBA-000003811-2000 (Toba River) 02-TOBA-000003810-2000 (Brem River) 02-TOBA-000003809-2000 (Quatam River) 02-HOMA-000003808-2000 (Southgate River) 02-HOMA-000003807-2000 (Homathko River)
FRBC Region	Pacific Region
MELP Region	02
FW Management Unit	2-15
Fisheries Planning Unit	Toba P.U. 6
DFO Sub-District	13 / 15
Forest Region	Vancouver Region
Forest District	Sunshine Coast District
Forest Licensee and Tenure #	Weyerhaeuser, International Forest Products Ltd. and Terminal Forest Products Ltd.
First Nations Claim Area	Homalco and Klahoose First Nations

Watershed Information

Parameter	Toba River	Brem River	Quatam River	Southgate River	Lower Homathko River
Watershed Group	TOBA	TOBA	TOBA	HOMA	HOMA
Watershed Name	Toba River	Brem River	Quatam River	Southgate River	Homathko River
Watershed Code	900-349300	900-357900	900-368900	900-404100	900-406900
UTM at Mouth	10. 404012. 5594880	10. 381684. 5588503	10. 362198. 5582527	10. 373922. 5638722	10. 369945. 5643444
Approximate Watershed Area	1759 km ²	261 km ²	162 km ²	2574 km ²	1773 km ²
Mainstem Stream Length	63.34 km	24.07 km	23.55 km	72.59 km	143.88 km
Stream Order (1:50,000 scale)	4	3	3	5	6
NTS Maps	92J/8, 92J/9, 92K/8, 92K/9, 92K/16	92K/7, 92K/10	92K/7, 92K/10	92J/13, 92K/9, 92K/15, 92K/16, 92N/9	92K/15, 92N/2, 92N/3, 92N/6
BEC Zone	CWH / MH / AT	CWH / MH / AT	CWH / MH / AT	CWH / MH / AT	CWH / MH / AT

Sampling Summary

Number of Sampling Sites	50 (: Homathko 15 sites; Southgate 6 sites; Quatam 4 sites; Brem 10 sites; and Toba 15 sites)
Field Sampling Dates	September 13 to September 19, 2000

Contractor Information

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Report Edited by:	<i>Name:</i>	Alan Stockwell
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	<i>Address:</i>	North Shore Environmental Services 73 Algoma Street, Thunder Bay, Ont.
	<i>Phone:</i>	(807) 345-9929
Genetic sample analysis by:	<i>Name:</i>	Dr. Eric Taylor, Anna Elz
	<i>Address:</i>	Dept. of Zoology University of British Columbia 6270 University Blvd., Vancouver, BC
	<i>Phone:</i>	(604) 822-9152
Voucher Species ID by:	<i>Name:</i>	Dr. Alex Peden
	<i>Address:</i>	Liparis Biological Services 4480 Shore Way, Victoria, BC
	<i>Phone:</i>	(250) 721-4356

Disclaimer

“This product has been accepted as being in accordance with approved standards within the limits of 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 classification, is subject to review by a statutory decision maker for the purposes of determining whether or not to approve an operational plan.”

Acknowledgements

Funding for this 1:50:000 overview fish and fish habitat inventory was provided by the Line Ministry Fund (LMF). The primary objective of the LMF is to ensure that the strategic priorities of provincial treaty negotiation are given support by line government ministries. The Ministry of Aboriginal Affairs administers the fund.

The contractors (Hatfield Consultants Ltd.) would like to express their appreciation to the Homalco and Klahoose First Nations for their cooperation during the project. Particular appreciation must go to the First Nations fisheries technicians Flavian Harry and Stanley Pielle for their contribution to the field data collection program. The contractors would also like to thank Mr. Duane Jesson, the MELP Fisheries Inventory Specialist in the Lower Mainland Region, for his informed technical guidance and administrative assistance during the implementation of this project.

TABLE OF CONTENTS

	Page
PROJECT REFERENCE INFORMATION	i
WATERSHED INFORMATION	i
CONTRACTOR INFORMATION	ii
DISCLAIMER	iii
ACKNOWLEDGEMENTS	iii
LIST OF TABLES	vi
LIST OF FIGURES	viii
LIST OF ATTACHMENTS AVAILABLE AT MOELP OFFICE	ix
1.0 INTRODUCTION	1/1
1.1 PROJECT SCOPE/OBJECTIVES	1/1
1.2 LOCATION	1/1
1.3 ACCESS	1/2
2.0 RESOURCE INFORMATION	2/1
3.0 METHODS	3/1
3.1 INVENTORY METHODS	3/1
3.2 DEVIATIONS FROM THE PROJECT PLAN	3/4
3.3 SAMPLING EQUIPMENT	3/7
4.0 RESULTS AND DISCUSSION	4/1
4.1 LOGISTICS	4/1
4.2 WATER QUALITY AND DISCHARGE	4/2
4.3 HABITAT AND FISH DISTRIBUTION	4/3
4.3.1 Brem River	4/3
4.3.2 Quatam River	4/6
4.3.3 Toba River	4/9
4.3.4 Southgate River	4/12
4.3.5 Homathko River	4/18
4.4 FISH SIZE, AGE AND LIFE HISTORY	4/22
4.4.1 Brem River	4/22

4.4.2	Quatam River	4/23
4.4.3	Toba River	4/23
4.4.4	Southgate River	4/25
4.4.5	Homathko River	4/27
4.5	SIGNIFICANT FEATURES AND FISHERIES OBSERVATIONS	4/28
4.5.1	Fish and Fish Habitat	4/28
4.5.2	Rare/Sensitive Species	4/29
4.5.3	Habitat Protection Concerns	4/32
	4.5.3.1 <i>Fisheries Sensitive Zones</i>	4/32
	4.5.3.2 <i>Fish Above 20% Gradients</i>	4/32
	4.5.3.3 <i>Restoration and Rehabilitation Opportunities</i>	4/32
4.6	FISH BEARING STATUS	4/32
4.6.1	Fish Bearing Reaches	4/32
4.6.2	Non-fish Bearing Reaches	4/35
4.6.3	Follow-up Sampling Required	4/36
5.0	BIBLIOGRAPHY	5/1

APPENDICES

Appendix A1	Watershed Features Identified from FISS
Appendix A2	FDIS Summary and Photographs
Appendix A3	Hardcopy Project Maps
Appendix A4	Stream Water Quality Laboratory Results

LIST OF TABLES

	Page
Table 1	Laboratory results from Southgate watershed water samples collected in 1998 by ARL (1999).....2/3
Table 2	Summary of salmon escapement data for the five project watersheds.....2/4
Table 3	Summary of existing fish distribution information for project watersheds.2/5
Table 4	Water quality sample site locations.3/2
Table 5	Stream sample sites for Toba River watershed.....3/5
Table 6	Stream sample sites for Brem River watershed.3/5
Table 7	Stream sample sites for Quatam River watershed.3/5
Table 8	Stream sample sites for Southgate River watershed.....3/6
Table 9	Stream sample sites for Homathko River watershed.....3/6
Table 10	Modifications to the sampling plan for the Mainland Coast inventory3/7
Table 11	Major equipment items used during field data collection program3/8
Table 12	Water quality in the Mainland Coast Project watersheds.4/2
Table 13	Summary of fish capture results for Brem River watershed.4/4
Table 14	Summary of historic and new barriers to fish migration found in the Brem River watershed.4/5
Table 15	Summary of fish capture results for Quatam River watershed.4/7
Table 16	Summary of historic and new barriers to fish migration found in Quatam River watershed.4/8
Table 17	Summary of fish capture results for Toba River watershed.....4/9
Table 18	Summary of historic and new barriers to fish migration found in Toba River watershed4/11
Table 19	Summary of fish capture results for Southgate River watershed.....4/13
Table 20	Summary of historic and new barriers to fish migration found in Southgate River watershed4/15

Table 21	Summary of fish capture results for lower Homathko River watershed4/18
Table 22	Summary of historic and new barriers to fish migration found in Homathko River watershed4/20
Table 23	Summary of length-at-age data from rainbow/steelhead sampled in the Brem River watershed, September 13-19, 20014/23
Table 24	Known presence and distribution of freshwater fish species of special concern in project watersheds.4/30
Table 25	Summary of data from surveyed fish bearing reaches in the Quatam Watershed4/33
Table 26	Summary of data from surveyed fish bearing reaches in the Toba River Watershed4/33
Table 27	Summary of data from surveyed fish bearing reaches in the Brem River Watershed4/33
Table 28	Summary of data from surveyed fish bearing reaches in the Southgate Watershed4/34
Table 29	Summary of data from surveyed fish bearing reaches in the Homathko Watershed4/34
Table 30	Summary of data from surveyed non-fish bearing reaches in the Quatam Watershed4/35
Table 31	Summary of data from surveyed non-fish bearing reaches in the Toba Watershed4/36
Table 32	Summary of data from surveyed non-fish bearing reaches in the Brem Watershed4/36
Table 33	Follow-up sampling required for classification of non-fish bearing reaches for Mainland Coast4/37

LIST OF FIGURES

	Page
Figure 1	Overview of the Mainland Coast Project Area.....1/3
Figure 2	Mainland Coast Overview Inventory sampling site locations1/4
Figure 3	Monthly mean discharge of the Homathko River at its mouth4/3
Figure 4	Length-frequency histogram for char (Dolly Varden) and rainbow/steelhead collected in the Brem River watershed September 14-15, 2000.....4/22
Figure 5	Length-frequency histogram for char (Dolly Varden) and rainbow/steelhead collected in the Toba River watershed September 12-13, 20004/24
Figure 6	Length-frequency histogram for chinook and coho salmon collected in the Toba River watershed September 12-13, 2000.....4/24
Figure 7	Length-frequency histogram for DNA confirmed Dolly Varden, bull trout and Dolly Varden/bull trout hybrids collected in the Southgate River watershed September 16, 2000.4/25
Figure 8	Length-frequency histogram for cutthroat and rainbow/steelhead collected in the Southgate River watershed September 16, 20004/26
Figure 9	Length-frequency histogram for chinook and coho salmon collected in the Southgate River watershed September 16, 2000.....4/26
Figure 10	Length-frequency histogram for Dolly Varden and cutthroat trout collected in the Homathko River watershed September 15 – 18, 20004/27
Figure 11	Length-frequency histogram for chinook and coho salmon collected in the Homathko River watershed September 15 – 18, 20004/28

LIST OF ATTACHMENTS AVAILABLE AT MELP OFFICE

Attachment 1 – Planning Documents

Mainland Coast Overview Fish and Fish Habitat Inventory Prefield Project Planning Report, including NTS Map Sheets: 92J/12, 92J/13, 92K/7, 92K/8, 92K/9, 92K/10, 92K/15, 92K/16, 92N/1, 92N/2, 92N/3, and 92N/6.

Phase Completion Report (Phases 1-3)

Phase Completion Report (Phase 4)

Project Completion Report

Attachment 2 – Field Notes

Original Hardcopy Fish Collection Forms (50)

Original Hardcopy Site Cards (50)

Attachment 3 – Fish Aging Structures and Aging Results

Labeled Structures (73 pelvic fin clips, 34 scale samples)

Table of Aging Results

Attachment 4 - Fish Voucher Specimens/DNA Samples and Results

Voucher and DNA Results Tables

Voucher Specimens: Char – 18 samples (lab disposed)
Rainbow trout/steelhead – 10 samples (lab disposed)
Cutthroat trout - 3 samples (lab disposed)
Chinook salmon – 10 samples (lab disposed)
Lamprey - 3 samples (lab disposed)

DNA Samples: char – 70 samples (lab disposed)
Rainbow trout/steelhead – 28 samples (lab disposed)
Cutthroat trout - 5 samples (lab disposed)
Chinook salmon – 1 sample (lab disposed)
Coho salmon – 3 samples (lab disposed)

Attachment 5 – Photodocumentation

3 Kodak Photo CDs (CD No. 2708, 2988 and 4865)

Photo Binder including: Indexed Negatives and Copies of Prints, Photo Index Form and Photo Survey Form 1 (Equipment Details)

Attachment 6 – Digital Data

Digital Report Files: Overview Title Page.doc
Overview TOC.doc
Overview Chap1.doc
Overview Chap2.doc
Overview Chap3.doc
Overview Chap4.doc
Overview Chap5.doc

Appendix A1 Table.xls
Appendix A4.xls
Photo Index Form.xls
Photo Survey Form.xls
Fish Summary.xls

FDIS Files: Fdisdat.mdb

GIS Data Files: A2200002.dbf and M2200002.dbf

Adobe Acrobat PDF files:

Project maps: Project_map01_92k07.PDF
Project_map02_92k08.PDF
Project_map03_92k10.PDF
Project_map04_92k09.PDF
Project_map05_92j12.PDF
Project_map06_92k15.PDF
Project_map07_92k16.PDF
Project_map08_92j13.PDF
Project_map09_92n03.PDF
Project_map10_92n02.PDF
Project_map11_92n01.PDF

Overview map: Overview_StudyArea_mcoast4.PDF
Overview_SamplingLocations_ovmain9.PDF

Project Completion Report: Project Completion Report.doc

Phase Costs Spreadsheet: Project Costs.xls

Attachment 7 – FISS Update Material

FISS Update Forms

Annotated 1:50k maps – 92J/12, 92K/7, 92K/9, 92K/10, 92K/15, 92K/16, 92N/2 and 92N/3.

1.0 INTRODUCTION

1.1 PROJECT SCOPE/OBJECTIVES

The five project watersheds (Toba, Homathko, Southgate, Brem and Quatam) have been identified by the BC First Nations and the BC Ministry of Environment, Lands and Parks (MELP) as being a priority for fisheries inventory/management. Therefore, MELP secured funding from the Line Ministry Fund to conduct an overview (1:50,000) fish and fish habitat inventory of these watersheds. This document, as well as the associated maps and attachments, provide a report on the findings of the inventory.

Primary objectives of the inventory were:

1. to describe watershed-wide fish distributions and habitat characteristics for all watersheds within the project area;
2. to identify the presence, distribution and habitat preferences for three high priority, provincially managed fish species located in the Klahoose and Homalco traditional territories, specifically, wild, indigenous steelhead (rainbow) trout, cutthroat trout and bull trout (char); and
3. to provide technical personnel from the Homalco and Klahoose First Nations with basic training in overview inventory field data collection methods and mapping/GIS, as well as a general understanding of all phases of the inventory process.

The field data collection component of the project included 50 stream reach sample sites. Distribution of sample sites is as follows: Homathko 15 sites; Southgate 6 sites; Quatam 4 sites; Brem 10 sites; and Toba 15 sites. No lake surveys were required as part of the inventory. An important component of the inventory was the collection and analysis of DNA samples from char and trout captured during the fish sampling program. A reconnaissance (1:20,000) fish and fish habitat inventory was previously completed in the Southgate River (ARL 1999), therefore, the DNA sampling was a primary objective in this system.

1.2 LOCATION

The project watersheds are located approximately 175 to 200 km northwest of Vancouver. The closest communities are Campbell River, which is situated to the west on Vancouver Island, and Powell River to the south on the Sunshine Coast. Both the Southgate and Homathko rivers drain into Bute Inlet. Homathko River flows south and drains into the head of Bute Inlet (northwest side), whereas Southgate River flows west into the head of Bute Inlet (southeast side). For Homathko River, the project area included only the lower Homathko, which, for the purpose of this project, was the watershed downstream from Waddington Canyon. Quatam River flows west and drains into the east shore of Ramsay Arm. Both Toba and Brem drain into Toba Inlet.

Toba River flows west and drains into the head of the inlet, whereas Brem River flows south and drains into the north shore of the inlet. All watersheds in the project area have a history of past/present forest development activity. The general locations of the five project watersheds are shown on the overview map provided in Figure 1. The locations of stream sampling sites included in the inventory are shown on the map in Figure 2.

According to Meidinger and Pojar (1991), the Coastal Western Hemlock (CWH) biogeoclimatic zone predominates at lower elevations in the project watersheds, changing to Mountain Hemlock (MH) on the mountain slopes, and Alpine Tundra (AT) at higher elevations. The project watersheds are situated in the North Pacific Ranges ecosection, Cascade Ranges ecoregion, and the Coast Mountains ecoprovince.

1.3 ACCESS

Road accessible sites were few in the project area and helicopter support was required to carry out almost all field data collection activities during the inventory. The one exception was the Homathko, where several sites were accessed using the forest road network. While working on the Brem, Quatam and Toba watersheds accommodation and food for the two field crews and helicopter pilot were provided at the Interfor Brem River camp located at the mouth of the Brem River. Two of the four field crew members and the helicopter pilot flew to the base camp from the Campbell River Airport, while the remaining crew members and most of the field equipment were transported to the camp by boat from Squirrel Cove on Cortes Island. Initial access to Squirrel Cove was by the BC road and ferry system.

After completing the three Toba Inlet watersheds, the field crews and equipment were again transported using a combination of boat and helicopter to a camp at the mouth of the Homathko River operated by Terminal Forest Products Ltd. This camp was used as a base for completing the inventory work on the Homathko and Southgate Rivers.

Following completion of the work in the Homathko and Southgate systems, the field crews and equipment were transported by boat back to Cortes Island and the helicopter returned to its base in Campbell River.

Figure 1 Overview of the Mainland Coast project area.

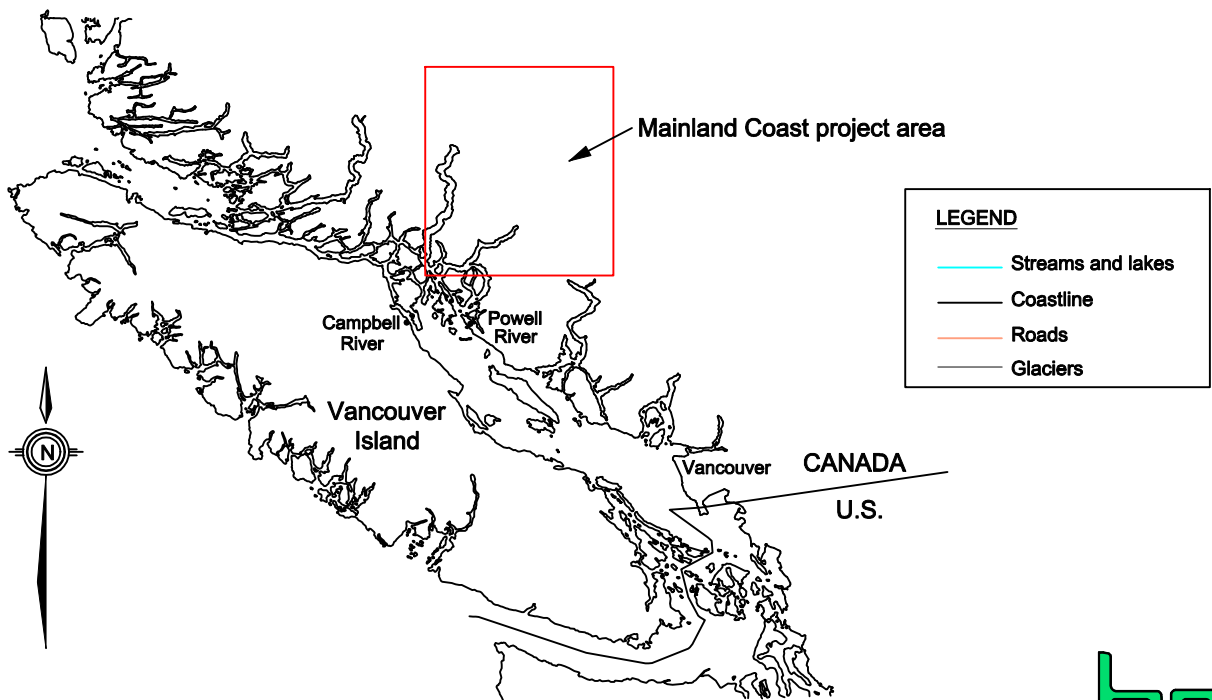
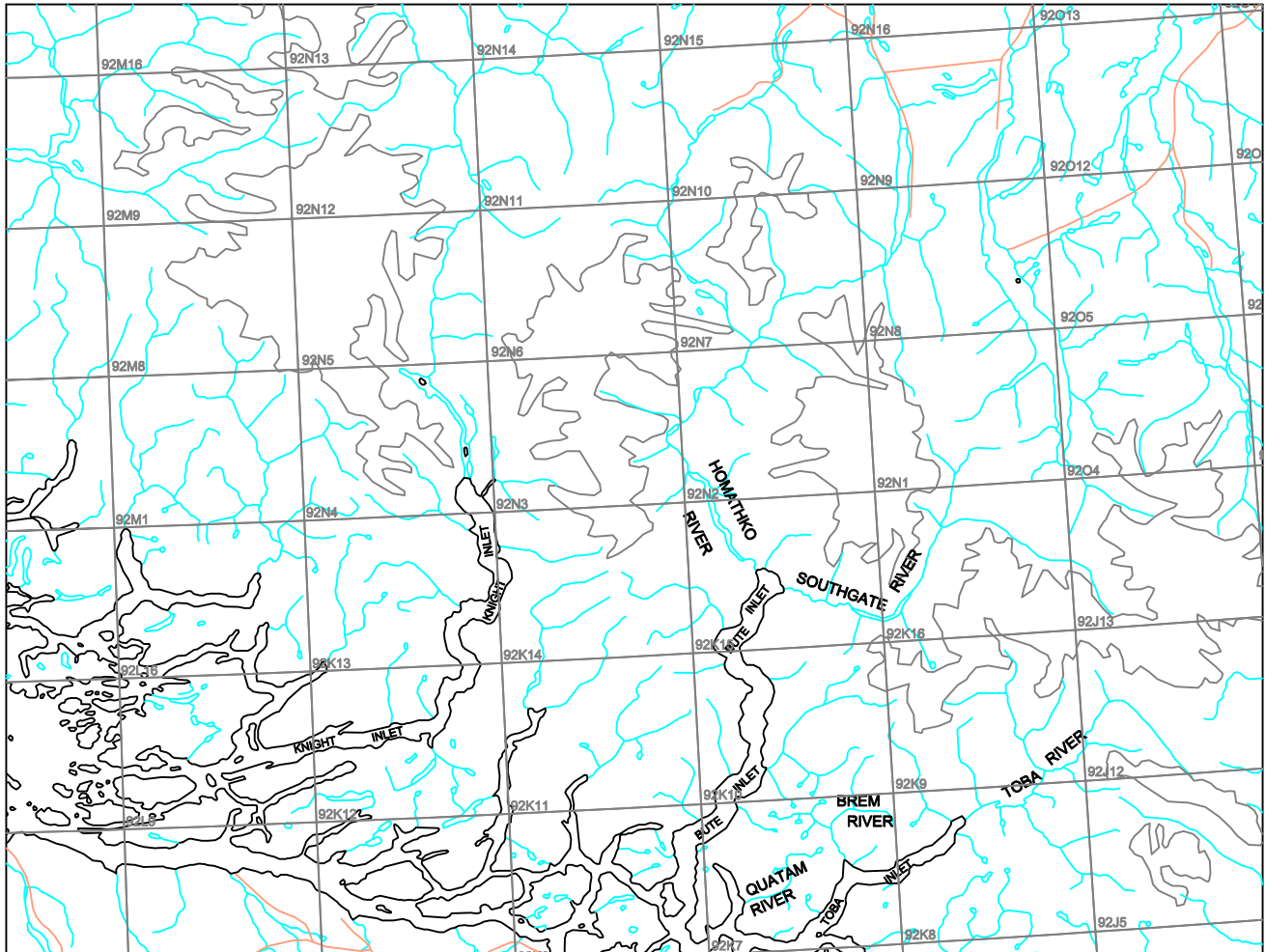


Figure 2 Mainland Coast Overview Inventory sampling site locations.

OVERVIEW MAP

Watershed Codes:

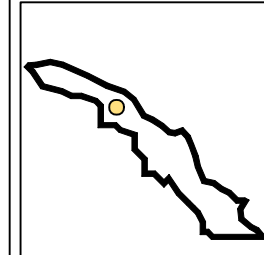
Toba River: 900-349300
 Brem River: 900-357900
 Quatam River: 900-368900
 Southgate River: 900-404100
 Homathko River: 900-406900

Projection: UTM Zone10

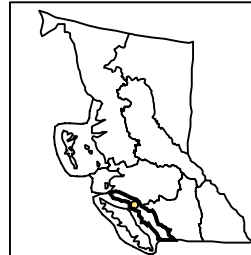
Date: 2001/09/28

Inventory Company: Hatfield Consultants Ltd.

● sample site



Position of Study Area in Region

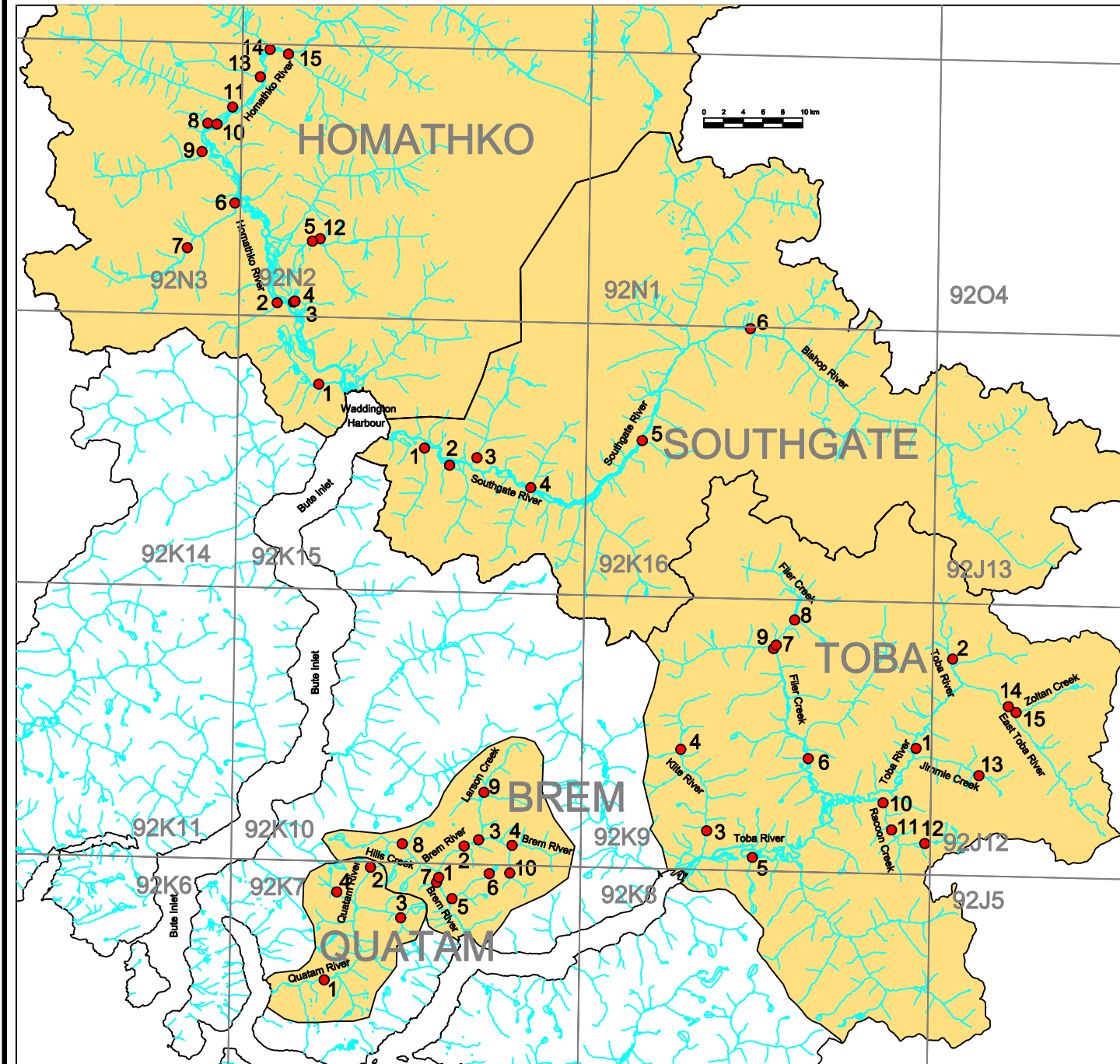


Position of Study Area in Province

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MAP SOURCE INFORMATION BOX

BASE: NTS STR SYM: INV
 LOC: FDG LK SYM: N/A
 HAB: INV
 FISH: INV
 DATE INV: 2000/09/13 to 2000/09/19
 INV MGNT: OTH



2.0 RESOURCE INFORMATION

- **First Nations Issues and Interests**

According to current Statement of Intent maps prepared by the BC Ministry of Aboriginal Affairs most of the Homathko River and the Southgate River watersheds lie within the traditional territory claimed by the Homalco First Nation, while the Klahoose First Nation is claiming traditional rights to the Quatam, Brem and Toba watersheds. The Homalco and Klahoose use these watersheds for traditional food gathering and are involved in monitoring anadromous fish populations and forest development activities throughout the area.

The most prominent First Nation issue in the area concerns access to the existing forest service road network in the Toba River watershed. The road system for much of TFL 10 originates on Klahoose reserve land at the mouth of the Toba River. Since 1988, there has been no agreement between the Klahoose and the current licensee, International Forest Products Ltd. (Interfor), over access through the reserve. As a result, the road network has not been maintained or properly deactivated. In parts of the TFL the roads have deteriorated to the point that damage could occur to the environment, and valuable infrastructure is threatened (FPB 1998).

Both the Klahoose and Homalco First Nations have had recent involvement in the implementation of fisheries projects in the project area. Projects carried out by the Klahoose First Nation include the following:

- ❑ 1992 Stream Restoration Assessment and Planning in the Brem River watershed – planning for off-channel restoration/enhancement and improved fish access (funded by DFO).
- ❑ 1999-2000 Toba Inlet / Cortez Island Klahoose First Nation Stock Assessment – fish stock assessment in the Brem River (funded by FRBC).
- ❑ 1999-2000 Toba Inlet / Cortez Island Klahoose First Nation Stock Assessment, Inventory-Escapement – salmon escapement estimates for the Quatam, Little Toba, Klite and Brem Rivers (funded by FRBC).
- ❑ 2000 Toba Inlet / Cortez Island Mapping and Fish Habitat Assessment – Watershed Restoration Program Fish Habitat Assessment Procedure (FHAP) for the Quatam and Brem Watersheds (funded by FRBC).

The Homalco First Nation has been involved in one recent fisheries project in the Homathko and Southgate watersheds as follows:

- ❑ 1999 Homathko River / Bute Inlet Salmon Stock Assessment – enumeration of salmon stocks using fish wheels and index sites in the Homathco and Southgate watersheds (funded by DFO).

- **Development and Land Use**

The primary development and land use activity in the project area is forestry. Forest harvesting was most active in the project watersheds during the 1960s and 1970s, although Weyerhaeuser and Terminal Forest Products Ltd. are still active in parts of the Homathko River watershed. Both of these companies operate logging camps in the Homathko watershed and maintain an extensive forest access road network. As indicated above, forest harvesting activities in the Toba River watershed ceased in the late 1980s. The lower part of the Southgate watershed was logged extensively during the 1970s, but has been left essentially undisturbed during the intervening years to date. Currently, some logging activity has resumed in the lower Southgate. The upper Southgate and Bishop rivers were never logged because of the prohibitive cost of road construction along the steep canyon walls (ARL 1999). International Forest Products Ltd. (Interfor) is actively logging in the Brem River watershed and operates a camp near the mouth of the river.

- **Other Developments**

Other developments in the project area include guiding and outfitting operations setup to service the hunting and fishing sector.

- **Impacts and Uses by Wildlife**

Wildlife populations in the project area are expected to be consistent with those found in coastal western cedar and mountain hemlock biogeoclimatic ecosystem zones (see Meidinger and Pojar 1991). Wildlife observations during the field data collection component of the inventory included grizzly bear, black bear, moose, and deer. Grizzly bears and black bears are attracted to these systems and other streams in the area during the salmon spawning migration, which begins for some species as early as the later part of August. Small herds of mountain goats are present in the project watersheds, however, no sightings of these animals were made during the field data collection program.

- **Existing Water Quality Data**

A number of water quality parameters were measured during the Reconnaissance (1:20,000) Fish and Fish Habitat Inventory of the Southgate River carried out by ARL (1999). Mean water temperatures ranged from a high of 6.3 °C in the lower Southgate River to a low of 4.0 °C in the Bishop River. Results obtained from the analysis of water samples collected in the Southgate River watershed are provided below in Table 1. Several water quality parameters were also analyzed from samples collected in the Little Toba watershed during a Reconnaissance (1:20,000) Fish and Fish Habitat Inventory conducted by HCL (2000a). The results of these laboratory analyses are also provided in Table 1. Water temperatures during the study ranged from 4.0 °C to 15.0 °C in the Little Toba watershed. No other substantive records of water quality data were found for any of the project watersheds in the FISS database or the MELP files.

Table 1 Laboratory results from water samples collected in the Southgate watershed in 1998 by ARL (1999) and in Little Toba watershed in 1999 by HCL (2000a).

Watershed	Sample Location	pH	Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Total Alkalinity (mg/L)
Southgate River	Southgate River mainstem immediately upstream from confluence with the Bishop River	6.41	23	46	9.8
	Bishop River mainstem immediately upstream from confluence with the Southgate River	7.00	24	41	10.9
	Southgate River mainstem immediately downstream from confluence with the Bishop River	7.00	24	24	11.5
	Southgate River mainstem near mouth	6.35	21	32	10.3
Little Toba River	Little Toba River mainstem Reach 3	6.37	5	<10	2
	Lunar Creek mainstem near mouth (Reach 1) and confluence with Little Toba River	6.39	8	<10	2

- **Existing Fish Information**

A wide range of fish and fish habitat sampling activities have been carried out in the project watersheds. The FISS database effectively summarizes important information concerning fish species presence, distribution, escapements and physical features generated from these sampling efforts. A list of features (e.g. falls, cascades, etc.) and their characteristics recorded in FISS for the five project watersheds is provided in Appendix A1. Recent fish and fish habitat sampling in the project area included reconnaissance (1:20,000) fish and fish habitat inventories carried out on the Southgate River (ARL 1999) and the Little Toba River (HCL 2000a), as well as a Watershed Restoration Program (WRP) overview assessment and preliminary fish sampling conducted on the lower Homathko River watershed in 1998 (EBA 1998; Marshall and Michenko 1998).

A full range of anadromous and resident salmonid fish species is present in all five of the project watersheds. Species that are present or have been observed historically include coho (*Oncorhynchus kisutch*), chinook (*Oncorhynchus tshawytscha*), chum (*Oncorhynchus keta*) and pink (*Oncorhynchus gorbuscha*) salmon, steelhead and rainbow trout (*Oncorhynchus mykiss*), fluvial and anadromous forms of coastal cutthroat trout (*Oncorhynchus clarki*) and char [Dolly Varden (*Salvelinus malma*), bull trout (*Salvelinus confluentus*), and Dolly Varden-bull trout crosses].

Salmon escapement data derived from estimates provided in FISS for the most recent ten-year period are listed below in Table 2 for the five project watersheds.

Table 2 Summary of salmon escapement data for the five project watersheds.

Species	Brem		Quatam		Toba		Southgate		Homathko	
	10 Year Period	Mean/ Max.	10 Year Period	Mean/ Max.	10 Year Period	Mean/ Max.	10 Year Period	Mean/ Max.	10 Year Period	Mean/ Max.
Chinook	1989/ 1998	2 / 2	1988/ 1997	0 / 0	1989/ 1998	32 / 32	1985/ 1994	1,700/ 6,500	1988/ 1997	1,040/ 2,000
Chum	1989/ 1998	184 / 361	1988/ 1997	1,734/ 10,000	1989/ 1998	600/ 600	1989/ 1998	63,444/ 175,000	1988/ 1997	9,350/ 18,000
Coho	1985/ 1994	0 / 0	1988/ 1997	114/ 300	1983/ 1992	289/ 1,000	1989/ 1998	625/ 850	1988/ 1997	517/ 1,500
Pink	1989/ 1998	1,252/ 2,500	1988/ 1997	1,124/ 5,000	1984/ 1993	0 / 0	1985/ 1994	60,000/ 60,000	1988/ 1997	100 / 100
Sockeye	-	-	1984/ 1993	12 / 12	-	-	1985/ 1994	0 / 0	1988/ 1997	100/ 100

In general, the distribution of chum and pink spawners is limited to the lower reaches of the mainstem systems, while coho and chinook salmon adults tend to move further up in the watersheds to spawn. Obstructions, such as cascades and small falls in the first several reaches of the mainstem, often mark the upstream limit of chum and pink distribution. Although severely reduced in numbers, summer and/or winter runs of steelhead appear to be present in all project watersheds. Resident and anadromous populations of char and coastal cutthroat trout and to a lesser extent, resident rainbow trout, are widely distributed in most of the project watersheds.

A summary of existing information on fish distribution in the project watersheds is provided below in Table 3.

Table 3 Summary of existing fish distribution information for project watersheds.

Species	Watershed Distribution and References				
	Toba River	Brem River	Quatam River	Southgate River	Lower Homathko River
Coho Salmon	Spawning to impassable cascade located at 59.7 km (Chahley <i>et al.</i> 1976; observations by Fishery Officer).	Have been found in the mainstem to the confluence with Larson Creek, at approx. km 14. May use Reach 2 of Larson Creek for spawning (Scott 1980).	Presence noted at 14.9 km, with spawners observed below falls at km 11 (Brown <i>et al.</i> 1977; observations by Fishery Officer).	Observed spawning at 48.8 km. There is an impassable falls at 51.5 km, 2 km upstream from confluence with Bishop River (Brown <i>et al.</i> 1977; observations by Fishery Officer).	Spawning mainly below Waddington Canyon but may move above under appropriate flow conditions (Brown <i>et al.</i> 1977)
Pink Salmon	Spawning to impassable cascade located at 59.7 km (de Hrussochy-Wirth <i>et al.</i> 1977).	Generally confined to lower reach (first 1.5 km) due to cascades and small rock falls in Reach 2 (Scott 1980).	Main spawning area in lower reaches of river from 1-3.5 km (Brown <i>et al.</i> 1977; observations by Fishery Officer).	Historical presence with occasional sightings since the 1960's. Generally restricted to the lower reaches of the mainstem (ARL 1999).	Small number observed at km 8 in the mainstem (observations by Fishery Officer).
Chum Salmon	Observed spawning as far upstream as 39.3 km in mainstem but mostly confined to tributaries further downstream (de Hrussochy-Wirth <i>et al.</i> 1977; MELP files).	Generally confined to lower reach (first 1.5 km) due to cascades and small rock falls in Reach 2 (Scott 1980).	Main spawning area in lower reaches of river from 1-3.5 km. Spawners have been observed above first falls (about 5 km) at 8.2 km (Brown <i>et al.</i> 1977; observations by Fishery Officer).	Spawning from 14.5 km to 48.8 km in the mainstem (Brown <i>et al.</i> 1977).	Spawning mainly in the mainstem from 14.8 km to 44.3 km (Brown <i>et al.</i> 1977; Bengueyfield <i>et al.</i> 1984).
Chinook Salmon	Spawning to impassable cascade located at 59.7 km (Chahley <i>et al.</i> 1976; observations by Fishery Officer).	Have been found in the mainstem up to the confluence with Larson Creek, at approx. km 14. May use Reach 2 of Larson Creek for spawning (Scott 1980).	Native populations severely depressed. Some enhancement efforts with Phillips Arm stocks. Distribution mostly similar to coho (MELP files).	Observed spawning at 48.8 km (Brown <i>et al.</i> 1977; observations by Fishery Officer).	Generally most of the chinook spawning occurs below Waddington Canyon. Mainly from 39.6 km to 44.3 km in tribs. and side channels (Brown <i>et al.</i> 1977; observations by Fishery Officer).

Species	Watershed Distribution and References				
	Toba River	Brem River	Quatam River	Southgate River	Lower Homathko River
Steelhead	Mainly winter run but may be low numbers of summer run. Observed in the Klite River. and lower Toba River (MELP files; observations by Fishery Officer).	Winter and summer runs have been found in the mainstem to the confluence with Larson Creek, at approx. km 14. May use Reach 2 of Larson Creek for spawning (Scott 1980).	Winter runs present with summer runs suspected. Observed above first falls to km 10.9 (Brown <i>et al.</i> 1977; observations by Fishery Officer).	Winter run observed in low numbers at 30.2 km of the mainstem (Brown <i>et al.</i> 1977; observations by Fishery Officer).	Winter run spawning mainly below Waddington Canyon but may move above under appropriate flow conditions – early spring low flows (Brown <i>et al.</i> 1977)
Rainbow Trout	Most likely distributed throughout the system (de Hrussochy-Wirth <i>et al.</i> 1977).	Most likely distributed throughout the system (Scott 1980).	Most likely distributed throughout the system. Observed at 14.9 km (MELP files).	Uncertain about the presence of resident rainbow trout. May be present at least in the lower reaches of the mainstem and associated tributaries (ARL 1999).	Generally low numbers throughout the watershed (MELP files).
Dolly Varden	Resident (fluvial) form most likely distributed throughout the system (de Hrussochy-Wirth <i>et al.</i> 1977).	Resident (fluvial) form most likely distributed throughout the system. May be anadromous forms present (Scott 1980).	Resident (fluvial) form most likely distributed throughout the system (MELP files).	Confirmed resident (fluvial) form, most likely distributed throughout the system (MELP files). Anadromous forms suspected but not confirmed.	Resident (fluvial) form distributed throughout the watershed. Anadromous form spawn up to Waddington Canyon (MELP files).
Bull Trout	No noted presence in watershed.	No noted presence in watershed.	No noted presence in watershed.	Confirmed presence throughout the watershed to the falls at km 51.5 on the mainstem and cascades at km 12 of Bishop R. (ARL 1999).	Confirmed present in Scar Creek ¹ . Suspected presence throughout the watershed.
Dolly Varden / Bull Trout hybrid	No noted presence in watershed.	No noted presence in watershed.	No noted presence in watershed.	Confirmed presence in several tributaries to the mainstem (ARL 1999).	No noted presence in watershed.
Coastal Cutthroat Trout	Presence noted in the lower reaches of the system (de Hrussochy-Wirth <i>et al.</i> 1977). Most likely anadromous form.	Resident (fluvial) form most likely distributed throughout the system. May be anadromous forms present (Scott 1980).	Resident (fluvial) form most likely distributed throughout the system. Observed at 10.9 km (MELP files). Anadromous form angled at mouth.	Present in a number of tributaries (MELP files).	Both fluvial and anadromous forms found up to Waddington Canyon (MELP files).

1. DNA analysis of tissue sampled from char captured in the Homathko River mainstem, in the vicinity of Scar Creek, concluded that the fish captured were bull trout. Scar Creek is a tributary to the Homathko River entering the river at approximately 38 kilometres upstream of its mouth (Duanne Jesson, *pers. comm.*)

3.0 METHODS

3.1 INVENTORY METHODS

The overview inventory was carried out in accordance with the current versions of the Resources Inventory Committee (RIC) standards and procedures, which included the following documents. These documents are cited in the Bibliography section of this report.

1. *Overview Fish and Fish Habitat Methodology*, Version 1, RIC March 1999.
2. *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures*, Version 1.1, RIC April 1998.
3. *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures*, Version 1.1, RIC April 1998. Errata March 1999, Errata April 2000.
4. *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Site Card Field Guide*. Version 1.0, RIC 1999; Errata March 2000.
5. *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Fish Collection Form Field Guide*. Version 1.0, RIC 1999; Errata March 2000.
6. *Fisheries Information Summary System (FISS): Data Compilation and Mapping Procedures*. Federal/Provincial Fish Habitat Inventory and Information Program. Draft 3 October 1997.
7. *User Guide to the British Columbia Watershed/Waterbody Identifier System*, Version 2.2, RIC April 1998.
8. *Fish Collection Methods and Standards*, Version 4.0, RIC January 1997.
9. *Fish Collection Methods and Standards*, Version 4.0, RIC January 1997. Errata March 1999.
10. *Field Key to Fresh Water Fishes of British Columbia*, RIC 1994.
11. *A Guide to Photodocumentation for Aquatic Inventory*, RIC March 1996.
12. *Standards for Fish and Fish Habitat Maps*, RIC May 1998.
13. *Standards for Fish and Fish Habitat Maps*, Version 2.0, RIC May 1999; Errata May 1999; Errata December 1999.
14. *Ambient Fresh Water and Effluent Sampling Manual*, RIC July 1994.
15. *BC Standards, Specifications and Guidelines for Resource Surveys Using GPS Technology*, RIC Draft 1995.
16. *Freshwater Biological Sampling Manual*, RIC 1997.

Additional detail on inventory methods was provided in the Project Plan submitted to MELP at the end of Phase 3 (HCL 2000b) and in the Schedule A of the MELP Service Contract #CLM01-

14. There was no significant deviation from RIC standards and procedures during the field data collection program.

In order to provide baseline water quality data for the project and quality assure field measurements, water samples were collected at two locations within the five watersheds for laboratory analysis. These data supplement the water quality information gathered in the field and recorded on individual site cards. The details on the water sample collection sites are provided below in Table 4. Samples were analyzed for total alkalinity, pH, specific conductance and total dissolved solids (TDS).

Table 4 Water quality sample site locations.

	Sample Site #1	Sample Site #2
Waterbody Name	Brem River	Homathko River
Watershed Code	900-357900	900-406900
NTS Map #	92K/7	92K/15
UTM	10. 379200. 5594000	10. 369100. 5645800

In addition to the site/fish data that were gathered as per the RIC standards and the Schedule A of the MELP Services Contract, there were related Ministry Representative Specifications. In particular, there were fish sampling specifications as follows:

Fish Age, Growth and Identification:

- species, life stage and fork length will be determined for all fish captured;
- species, life stage and fork length will be determined for all fish captured;
- appropriate non-lethal aging structures will be taken over a representative range of lengths for each species of anadromous salmonids and freshwater game fish;
- fish weight (to the nearest 0.1 gram) will be obtained using a calibrated electronic balance over a representative range of lengths for each species of anadromous salmonids and freshwater game fish;
- up to 30 ages and weights from anadromous salmonids and freshwater game fish are required for each species from each watershed within the project area;
- scales and other structures used for age determination will be submitted in labeled envelopes with the final report;
- microfiche reader prints of magnified scales used for age determination will accompany the final report;
- scale annuli will be clearly marked and fish age will be shown on labeled microfiche prints;
- a downstream stop net should be considered when electroshocking glacial stream systems; and

- final watershed reporting to include a fork length at age summary (table) for anadromous salmonids and freshwater game species.

Fish Voucher Specimens:

- fish voucher specimens are required for all abnormal fish, unidentifiable fish or fish outside of its normal range of distribution;
- fish voucher specimens are required for all species sampled up to three (3) samples per species for each watershed within the project area;
- preservation, handling and labeling of voucher specimens are to follow RIC standards, only specimens delivered in leak-proof polyethylene containers will be accepted;
- accidental mortalities should be given preference in the selection of individual voucher specimens;
- avoid submitting large specimens (>20 cm forklenght) unless the fish is abnormal, unidentifiable or outside of its normal range of distribution;
- the contractor is responsible for arrangements and payment for expert voucher identification services as per the attached note and submission form, and will incorporate results into final reporting.

Fish DNA Samples:

- fish tissue samples for DNA analysis will be collected from char (bull trout/Dolly Varden), rainbow trout and cutthroat trout;
- for each species, collect up to ten (10) tissue samples from a minimum of two (2) sites from each watershed within the project area. The exception is for char in the Southgate River watershed where up to 30 (thirty) tissue samples are required from each sample site;
- samples will be collected, preserved, labeled and reported as per MELP specifications;
- the contractor is responsible for arrangements and payment for expert DNA analytical services, and will incorporate results into final reporting.
- for char that are a minimum of 10 cm forklenght, and from which DNA samples are collected, provide close-up photographs of the head as a side view; include metric ruler (with millimeters) in photo for scale.
- weight and age information, to sample limits identified above under Fish Sampling, should include those fish from which DNA was collected for char, rainbow and cutthroat.
- voucher specimens should be comprised of those fish from which DNA was collected for char, rainbow and cutthroat.

3.2 DEVIATIONS FROM THE PROJECT PLAN

The extent and scope of the stream sampling plan was defined in part by specifications contained in the *Overview Fish and Fish Habitat Methodology* (Version 1, March 1999). In particular, stream/fish sampling sites were to be selected based on the following criteria:

- two sample sites in the mainstem of each project watershed;
- one sample site in each major tributary (one order lower than mainstem);
- one sample site in one 3rd, 2nd, and 1st order tributary in each 4th order basin where habitat (e.g. gradient) is suitable to support fish; and
- sampling should investigate fish species presence above barriers on major tributaries or stream sections deemed capable of supporting resident populations.

As required for budgetary purposes, MELP further defined the sampling program by limiting the number of sample sites as follows:

Watershed	No. of Sample Sites Recommended by RIC Standards	Number of Sample Sites Specified by MELP	Difference
Toba River	2 x mainstem (4 th order) 4 x next lowest order tribs. (3 rd order) 4 x 2 nd order 4 x 1 st order	15	+ 1
Total	14		
Brem River	2 x mainstem (3 rd order) 5 x next lowest order tribs. (2 nd order) 5 x 1 st order	10	- 2
Total	12		
Quatam River	2 x mainstem (3 rd order) 5 x next lowest order tribs. (2 nd order) 5 x 1 st order	4	- 8
Total	12		
Southgate River	2 x mainstem (5 th order) 1 x next lowest order trib. (4 th order) 5 x 2 nd order 5 x 1 st order	6	- 7
Total	13		
Homathko River	2 x mainstem (5 th order) 5 x next lowest order tribs. (3 rd order for lower river) 5 x 2 nd order 5 x 1 st order	15	- 2
Total	17		

After a thorough review of existing fish and fish habitat data, as well as project map information, sample sites were assigned as follows for each of the five watersheds:

Table 5 Stream sample sites for Toba River watershed.

Site #	Gazetted Name	Watershed Code	NTS Map #	Macroreach #	UTM Coordinates
1	Toba River	900-349300	92K/9	41	10. 427500. 5607275
2	Toba River	900-349300	92J/12	54	10. 431300. 5616310
3	Klite River	900-349300-03300	92K/9	1	10. 406375. 5598820
4	Klite River	900-349300-03300	92K/9	15	10. 403790. 5606900
5	Boyle Creek	900-349300-17500	92K/9	1	10. 411000. 5596000
6	Filer Creek	900-349300-42200	92K/9	29	10. 416700. 5606000
7	Filer Creek	900-349300-42200	92K/9	68	10. 413450. 5617600
8	Filer Creek	900-349300-42200	92K/9	74	10. 415290. 5620110
9	Headwall Creek	900-349300-42200-60500	92K/9	1	10. 413000. 5617240
10	Racoon Creek	900-349300-52900	92K/9	4	10. 424250. 5601650
11	Racoon Creek	900-349300-52900	92K/9	6	10. 425000. 5598870
12	Racoon Creek	900-349300-52900	92K/9	11	10. 428500. 5597400
13	Jimmie Creek	900-349300-67200	92J/12	5	10. 434000. 5604300
14	East Toba River	900-349300-85000	92J/12	3	10. 437000. 5611325
15	Zoltan Creek	900-349300-85000-29300	92J/12	1	10. 437850. 5610750

Table 6 Stream sample sites for Brem River watershed.

Site #	Gazetted Name	Watershed Code	NTS Map #	Macroreach #	UTM Coordinates
1	Brem River	900-357900	92K/7	20	10. 379150. 5594000
2	Brem River	900-357900	92K/10	27	10. 381750. 5597160
3	Brem River	900-357900	92K/10	29	10. 383200. 5597800
4	Brem River	900-357900	92K/10	36	10. 386500. 5597260
5	-----	900-357900-18600	92K/7	1	10. 380500. 5591825
6	-----	900-357900-18600	92K/7	4	10. 384400. 5594460
7	-----	900-357900-28300	92K/7	1	10. 379000. 5593450
8	Hillis Creek	900-357900-33900	92K/10	5	10. 375500. 5597380
9	Larson Creek	900-357900-59100	92K/10	9	10. 383800. 5602700
10	-----	900-357900-71400	92K/7	4	10. 386400. 5594580

Table 7 Stream sample sites for Quatam River watershed.

Site #	Gazetted Name	Watershed Code	NTS Map #	Macroreach #	UTM Coordinates
1	Quatam River	900-368900	92K/7	13	10. 367500. 5583575
2	Quatam River	900-368900	92K/7	40	10. 372150. 5595200
3	-----	900-368900-69900-64000	92K/7	1	10. 375200. 5589860

Site #	Gazetted Name	Watershed Code	NTS Map #	Macroreach #	UTM Coordinates
4	-----	900-368900-73900	92K/7	2	10. 369000. 5592260

Table 8 Stream sample sites for Southgate River watershed.

Site #	Gazetted Name	Watershed Code	NTS Map #	Macroreach #	UTM Coordinates
1	-----	900-404100-07000	92K/15	1	10. 377800. 5637700
2	-----	900-404100-12100	92K/15	2	10. 380200. 5635860
3	Elliot Creek	900-404100-16200	92K/15	1	10. 383000. 5636550
4	-----	900-404100-28700	92K/15	1	10. 388600. 5633700
5	Raleigh Creek	900-404100-50400	92K/16	1	10. 400600. 5638150
6	-----	900-404100-66700-15500	92K/16	1	10. 410900. 5649775

Table 9 Stream sample sites for Homathko River watershed.

Site #	Gazetted Name	Watershed Code	NTS Map #	Macroreach #	UTM Coordinates
1	Cumsack Creek	900-406900-00600	92K/15	5	10. 365400. 5645190
2	Smith Creek	900-406900-08700	92N/2	1	10. 362800. 5652350
3	Heakamie River	900-406900-10500	92N/2	5	10. 363850. 5654940
4	Heakamie River	900-406900-10500	92N/2	23	10. 368300. 5658350
5	Jewakwa River	900-406900-11600	92N/2	10	10. 365000. 5660300
6	Brew Creek	900-406900-16700	92N/3	1	10. 358500. 5662475
7	Brew Creek	900-406900-16700	92N/3	13	10. 353700. 5658000
8	-----	900-406900-16700-80000	92N/3	2	10. 347300. 5655350
9	Whitemantle Creek	900-406900-21700	92N/3	1	10. 355300. 5667810
10	Whitemantle Creek	900-406900-21700	92N/3	11	10. 346700. 5665275
11	Scar Creek	900-406900-24900	92N/3	1	10. 358200. 5672320
12	Scar Creek	900-406900-24900	92N/3	14	10. 349550. 5675800
13	Coola Creek	900-406900-28400	92N/2	3	10. 360500. 5675425
14	-----	900-406900-30300	92N/2	1	10. 362000. 5678325
15	Klattasine Creek	900-406900-31500	92N/2	1	10. 363900. 5677760

Due to logistical and safety issues, a total of nine site substitutions had to be made during the field sampling program. One site was in the Southgate River watershed, and eight sites were located in the Homathko watershed. The Ministry Representative was consulted on the selection of alternate sites. Details on the nine site substitutions are provided below in Table 10.

As much as possible replacement sites were selected based on their physical similarity to the original sites specified in the Project Plan. In particular, efforts were made to match-up basin type, gradient and channel characteristics.

Table 10 Modifications to the sampling plan for the Mainland Coast inventory.

Site No.	Original Site	Replacement Site	Map No.	Comments
<i>Southgate River Watershed</i>				
5	900-404100-50400 Macroreach 1	900-404100 Macroreach 137	92K/16	Hazardous flow conditions at original site
<i>Homathko River Watershed</i>				
1	900-406900-00600 Macroreach 5	900-406900-00600 Macroreach 1	92K/15	Original site located in flooded wetland, inaccessible by helicopter,
3	900-406900-10500 Macroreach 5	ILP 2, Macroreach 1	92N/2	Original site inaccessible by helicopter or on foot from heli landing site
4	900-406900-10500 Macroreach 23	ILP 3, Macroreach 1	92N/2	Original site inaccessible by helicopter or on foot from heli landing site
5	900-406900-11600 Macroreach 10	ILP 1, Macroreach 1	92N/2	Original site inaccessible by helicopter or on foot from heli landing site
8	900-406900-16700-80000, Macroreach 2	900-406900-22700 Macroreach 1	92N/3	Original site inaccessible by helicopter or on foot from heli landing site
10	900-406900-21700 Macroreach 11	900-406900 Macroreach 135	92N/3	Original site inaccessible by helicopter or on foot from heli landing site
12	900-406900-24900 Macroreach 14	900-406900-10500-39600 Macroreach 1	92N/2	Original site inaccessible by helicopter or on foot from heli landing site
13	900-406900-28400 Macroreach 3	900-406900-28400 Macroreach 2	92N/2	Unsafe electrofishing conditions

Due to problems in collection and preservation of ageing structures during the project, fin rays collected from char could not be aged. Fin rays were not removed close enough to their base and therefore annular rings were too close together to allow ageing to be completed with sufficient accuracy. Additionally, the fin rays were preserved in ethanol, which caused samples to dry out and become brittle or shrivel. Once dried out, the fin rays could not be sectioned adequately which added to the difficulty in age determination.

3.3 SAMPLING EQUIPMENT

Specifications for the major equipment items used during the field data collection phase of the inventory are provided below in Table 11. A number of other smaller equipment items, such as

measuring tapes, hip chains, fish measuring boards, and metre sticks were also used during the field data collection component of the inventory.

Table 11 Major equipment items used during field data collection program.

Equipment Item	Model	Specifications
Electrofishing Units	Smith Root Model 12-b POW	100 to 1000 V DC
Global Positioning System (GPS)	Garmin 45XL	12 Channel
Fish Traps	Gee Minnow Traps	Standard Mesh Size (1/8 ")
Thermometers	Alcohol	Temperature Range –35 to 50 °C
pH Measurement	LaMotte Comparator Test Kit	pH Range of 4.5 to 9.5
Clinometer	Suunto Model PH-5/360 PC	
Camera	Pentax Zoom 90-WR	Automatic Range Finder with 35-90 mm Zoom
Conductivity Meter	TDS Testr 3 Waterproof	0 to 1990 microsemens per cm
Electronic Balance	Ohaus CT1200	Toploading Balance with Capacity of 1200 gm

4.0 RESULTS AND DISCUSSION

4.1 LOGISTICS

A number of logistical problems occurred during implementation of the field data collection program. However, the problems encountered were generally minor and did not affect the original study design drastically. As a result of these problems, nine original sampling sites had to be replaced by alternates that were more accessible. Some of these sites were moved to completely different streams with similar characteristics, while others were simply moved to other reaches of the same stream. The replacements ensured that a total of 50 sites were sampled in the project watersheds as outlined in the original project plan.

- ❑ **Helicopter Time:** The original project plan assumed that helicopter support would be required to complete most of the sampling sites. A low proportion of sampling sites was to be completed using road access. However, due to recent road deactivation activities, access to these proposed sampling sites was lost. In an effort to remain within the original helicopter budget, alternate sites were selected that required minimal flying time or road access. Replacement sites were approved by the Ministry Representative and selected based on their physical similarity to the original sites specified in the Project Plan.
- ❑ **High Stream Flows:** The combination of a comparatively high snow pack and abundant precipitation prior to and during the sampling period resulted in high flows in the project watersheds. The elevated water levels caused unsafe sampling conditions at several sites. High flow conditions also limited the level of fish sampling (particularly electrofishing) that could be carried out at a number of sites throughout the watersheds, particularly in the larger tributaries. Appropriate follow-up sampling recommendations have been made. The high water levels also made crossing some streams to access specified sampling sites too hazardous, and as a result, alternate sites had to be assigned.
- ❑ **Access:** The geography of the Homathko River watershed presented some logistical problems in accessing sites. Due to the extensive Homathko River floodplain, several tributary reach 1 sites were inaccessible due to dense vegetation grow, which limited helicopter and on-foot access. In one circumstance, helicopter access was not possible, as the site was located in a flooded wetland. This site was relocated to another reach of the same tributary.
- ❑ **Weather:** Poor weather was also a factor in deviations from the original sampling site plan. Fog or low cloud cover were the major weather problems that prevented helicopter access to a number of higher elevation sites. At the discretion of the helicopter pilot, these sites were abandoned in favor of lower reaches of other streams with similar channel characteristics.

4.2 WATER QUALITY AND DISCHARGE

Water quality parameters measured at each sampling site included temperature, pH, specific conductance and turbidity (water clarity). In addition to the *in situ* measurements, two water samples (one from the Brem River and one from the Homathko River) were analyzed in the laboratory for specific conductance, total dissolved solids, pH and total alkalinity. The original chemical analysis report and the chain of custody/analytical request form are provided as attachments to this report. The range (max./min) of *in situ* water quality values for the entire watershed are presented below in Table 12. The specific laboratory and *in situ* results are also shown for the two quality assurance sites.

Table 12 Water quality in the Mainland Coast Project watersheds.

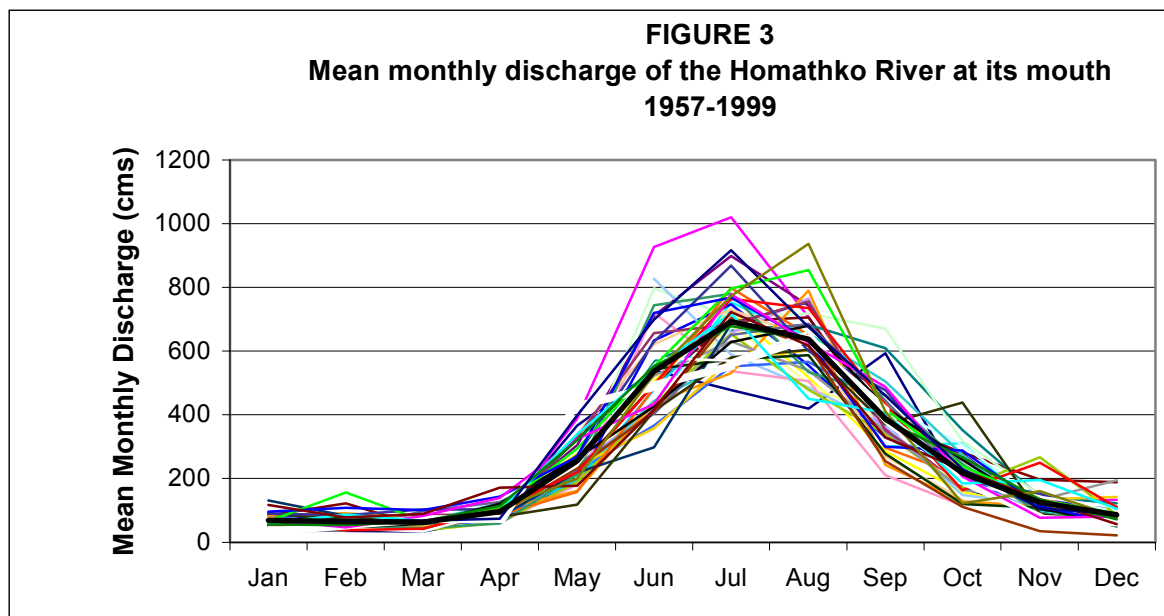
Parameter	Watershed				
	Brem	Quatam	Toba	Southgate	Homathko
Temperature (°C): <i>In situ</i> (max/min)	11 / 7	10 / 7	11 / 4	13 / 7	13 / 4
pH: <i>In situ</i> (max/min)	6.8 / 6.2	7.4 / 6.0	6.6 / 6.2	7.0 / 6.5	6.8 / 6.0
Site-specific Laboratory/ <i>In situ</i>	6.61/6.5	-	-	-	7.15/6.7
Specific Conductance (µS/cm): <i>In situ</i> (max/min)	20 / <10	20 / <10	20 / <10	30 / <10	70 / <10
Site-specific Laboratory/ <i>In situ</i>	27/20	-	-	-	29/30
Turbidity: <i>In situ</i> (max/min)	clear/low	clear	clear/turbid	clear/turbid	clear/turbid
Total Dissolved Solids (mg/L): Site-specific Laboratory	15	-	-	-	24
Total Alkalinity (mg/L): Site-specific Laboratory	9	-	-	-	7

In general, there was good agreement between the *in situ* values and those generated in the laboratory. The highest water temperature of 13 °C occurred in a small tributary to the Homathko River (900-4069-22700 Macroreach 1), as well as in an unnamed tributary to the Southgate River (900-404100-66700-15500 Macroreach 1). The lowest temperature of 4 °C was recorded in Filer Creek (900-349300-42200 Macroreach 74) a tributary to the Toba River, and in Brew Creek (900-406900-16700 Macroreach 13) a tributary to the Homathko River. Specific conductance was low throughout the project watersheds with an average value of less than 20 µS/cm. Several conductivity measurements in the Homathko and Southgate systems were higher due to glacial runoff in these watersheds. Low specific conductance values can limit the effectiveness of some electrofishing gear but the Smith Root Model 12-b POW units used in this inventory can operate effectively at low conductivity levels (Smith-Root Backpack Electrofishers Manual, June 1997). Very little variance in pH values was recorded, as almost all pH values

measured in the project watersheds were in the 6.5 to 7.0 range. A slightly acidic pH is to be expected given the granitic geology of the study area.

All water quality parameters measured in the five project watersheds were within the approved and working criteria for aquatic life established by the Water Quality Section of MELP (BC Environment 1998).

Mean monthly discharge patterns in the project watersheds are typical of medium to large size BC coastal rivers where climatic conditions are dominated by relatively long and cold winters, and short, moderate summers. Annual discharge patterns are typical of the data presented in Figure 3 for the Homathko River system. These data were collected at the Water Survey of Canada Station No. 08GD004 located at the mouth of the Homathko River (UTM 10. 365450. 5649875). Mean flow generally peaks in June or July, followed by a gradual decline until winter base-flow conditions are reached, usually in November or December. Base-flow conditions generally persist until around the middle of April when spring freshet usually begins.



Note: Dark line shows monthly mean discharges for the 42 year monitoring period.
Source: Canadian Hydrological Service, Water Survey of Canada

4.3 HABITAT AND FISH DISTRIBUTION

4.3.1 Brem River

4.3.1.1 Fish Distribution

FISS records show that seven species of fish use or have used the Brem River during some portion of their life cycle. These species are chinook (*Oncorhynchus tshawytscha*), coho

(*Oncorhynchus kisutch*), chum (*Oncorhynchus keta*) and pink (*Oncorhynchus gorbuscha*) salmon, rainbow trout/steelhead (*Oncorhynchus mykiss*), resident and anadromous coastal cutthroat trout (*Oncorhynchus clarki*), and resident and anadromous char, presumably Dolly Varden (*Salvelinus malma*). However, during the present inventory only Dolly Varden and rainbow trout/steelhead were captured at seven of the ten sampling sites in the watershed. Reaches where fish were captured in the Brem River watershed are listed below in Table 13.

Table 13 Summary of fish capture results for Brem River watershed.

Stream Name	Watershed Code / ILP	NTS Map	Macro-Reach	Site	Species Captured
Brem River	900-357900	92K/7	20	1	Dolly Varden and rainbow/steelhead
Brem River	900-357900	92K/10	27	2	Dolly Varden and rainbow/steelhead
Brem River	900-357900	92K/10	29	3	Dolly Varden and rainbow/steelhead
Brem River	900-357900	92K/10	36	4	Dolly Varden and rainbow/steelhead
Unnamed	900-357900-18600	92K/7	1	5	Dolly Varden and rainbow/steelhead
Hillis Creek	900-357900-33900	92K/10	5	8	Dolly Varden and rainbow/steelhead
Unnamed	900-357900-71400	92K/7	4	10	Dolly Varden

Dolly Varden are present in the Brem River mainstem up into the headwater area, and were captured at Site 10 located in the fourth macroreach of a headwater tributary to the Brem. Both Dolly Varden and rainbow/steelhead are present up to the 175 m rock falls located in macroreach 6 of Hillis Creek, one of the two main tributaries to the Brem. No fish were captured or observed upstream of the 3 m rock falls and cascade located in macroreach 3 of Larson Creek, the other main tributary to the Brem River. FISS records indicate that char and possibly rainbow/steelhead are present above this obstruction, however, this was not confirmed by the results of the fish sampling carried out during this inventory. No salmon species were captured in the Brem system during the inventory but it is assumed from historical information available in the FISS database that small numbers of pink and chum salmon use the lower reaches below the canyon in macroreach 2 for spawning, and coho and steelhead spawn and rear in much of the Brem mainstem and the lower reaches of the main tributaries.

Hardcopy project maps of the inventory area showing detailed site and reach information are provided in Appendix A2.

A total of 28 char tissue samples from the Brem River watershed were submitted to the University of British Columbia for analysis to determine whether specimens collected were either Dolly Varden, bull trout or hybrids. Each individual was assessed at 2 nuclear loci (growth hormone and metallothioneine) which have alleles diagnostic for Dolly Varden and bull trout. Results generated from the Brem samples showed that all fish were Dolly Varden as originally identified in the field (see Attachment 4). An additional 15 tissue samples from trout identified as rainbow/steelhead in the field were also submitted for DNA testing. Results of the testing

showed that no hybrids or crosses were present, and all fish were confirmed to be rainbow/steelhead.

Voucher specimens were collected of various species captured in the watersheds. The resulting identifications confirmed field identifications made and are provided as Attachment 4. The voucher specimen identifications have been incorporated into the FDIS database.

4.3.1.2. *Habitat*

Specific habitat characteristics recorded for the ten sampling sites are shown in the FDIS printouts provided in Appendix 1. A broader description of habitat conditions in the Brem River watershed can be found in Scott (1980). General habitat features are as follows:

- ❑ Approximately 1.5 km upstream from the mouth of the Brem River there is a canyon with a long series of cascades and low rock falls. This feature is thought to be a barrier to pink and chum salmon. Downstream of this obstruction there is limited spawning habitat for pink and chum, and holding pools for steelhead and coho salmon. The large flows occurring during the freshet limit char and trout rearing and spawning in this lower reach of the Brem.
- ❑ Upstream of the canyon there are substantial areas of salmonid rearing and spawning habitat present in the Brem River mainstem, particularly in the vicinity of the Hillis Creek confluence. There is also a 3-4 km stretch of the mainstem upstream and downstream of the Larson Creek confluence where substantial deposits of salmon spawning gravels and rearing habitat are present.
- ❑ A limited amount of char and rainbow rearing habitat is available in Hillis Creek downstream of the 175 m rock falls on this tributary.
- ❑ Fair salmonid spawning and rearing habitat is present below the cascade section in macroreach 4 in Larson Creek. No fish were caught in the present survey above this feature.

A summary of historic and new barriers to fish migration in the Brem River watershed is provided below in Table 14. Most of these features were noted from FISS and RAB data and many were verified in the field during a helicopter overflight.

Table 14 Summary of historic and new barriers to fish migration found in the Brem River watershed.

Stream Name	Watershed Code	NTS Map #	Macro-Reach	Barrier Type	Height (m)	Field Verified	Description
Brem	900-357900	92K/7	2	Canyon		Y	800 m length. Most likely a barrier to chum and pink salmon
Brem	900-357900	92K/10	25	Cascade		N	Char and rainbow confirmed above this obstruction. Coho, chinook and summer steelhead may be to negotiate.

Stream Name	Watershed Code	NTS Map #	Macro-Reach	Barrier Type	Height (m)	Field Verified	Description
Brem	900-357900	92K/10	33	Cascade		N	500 m length. Char and rainbow confirmed above this obstruction. Coho, chinook and summer steelhead may be to negotiate.
Unnamed	900-357900-01700	92K/7	2	Velocity		N	Local name is Question Creek. Likely barrier to all anadromous fish.
Unnamed	900-357900-18600	92K/7	2	Velocity		N	Local name Crystal Ck. Likely barrier to all anadromous fish.
Unnamed	900-357900-18600	92K/7	3	Rock Falls	10	Y	Barrier to all fish
Hillis	900-357900-33900	92K/7	1	Cascade		Y	3000 m length. Char and rainbow trout present above this obstruction.
Hillis	900-357900-33900	92K/10	5	Rock Falls	175	Y	Barrier to all fish
Larson	900-357900-59100	92K/10	3	Rock Falls	3	N	Part of cascade system in same macroreach. May be char and/or trout above this obstruction.
Larson	900-357900-59100	92K/10	3	Cascade		Y	May be char and/or trout above this obstruction.
Larson	900-357900-59100	92K/10	4	Cascade		N	No fish caught above this obstruction.

All the lakes in the Brem River watershed are high elevation headwater systems that offer little or no potential fish habitat. Furthermore, the majority of these lakes are upstream of confirmed fish migration barriers.

4.3.2 Quatam River

4.3.2.1 Fish Distribution

Historical information available for Quatam River watershed identifies several species of salmon as well as char and trout species as using the watershed at various stages of their life cycle. Chinook, coho, pink and chum salmon spawn in the watershed while juvenile chinook and coho also use the watershed for rearing. Additionally, anadromous and resident forms of coastal cutthroat trout, rainbow trout/steelhead and Dolly Varden spawn and rear in the Quatam River drainage (FISS). During the inventory, fish were captured in two of the four sites sampled. Of the salmon species present in the watershed, only coho was captured. Other species captured include char, rainbow trout/steelhead and sculpin. Specific fish capture locations for the Quatam River watershed are listed below in Table 15.

Table 15 **Summary of fish capture results for Quatam River watershed.**

Stream Name	Watershed Code / ILP	NTS Map	Macro-Reach	Site	Species Captured
Quatam River	900-368900	92K/7	13	1	sculpin and coho
Unnamed	900-368900-69900-64000	92K/7	1	3	suspected Dolly Varden and rainbow/steelhead

The inventory sampling results confirmed the presence of char and rainbow/steelhead, above the uppermost obstruction previously noted in FISS data. These fish were captured in Site 3 located in a tributary to the mainstem. Fishing efforts were unsuccessful in the second macroreach of another tributary located further upstream. However, despite unsuccessful fishing efforts in this location, presence of these species is presumed to occur throughout the watershed to the cascades present near the headwaters in macroreach 40 of the mainstem. These cascades, discovered during the inventory field sampling program, are considered a barrier to fish passage and no fish were captured during sampling efforts above this feature.

Coho were the only salmon species captured during the inventory, however, it is assumed that other salmon species use the watershed as indicated in the FISS database. Historical information indicates that lower reaches of the mainstem are used by pink salmon for spawning and by chinook for spawning and rearing, below the series of falls and cascades at 4.8 km. Previous reports listed in FISS also found chum spawning as far upstream as macroreach 21 and steelhead present below the falls at 13.3 km.

Hardcopy project maps of the inventory area showing detailed site and reach information are provided in Appendix A2.

Two tissue samples from trout identified as rainbow/steelhead in the field were submitted to the University of British Columbia for DNA testing to determine if hybridization was occurring. Results of the testing showed that no hybrids or crosses were present, and all fish were confirmed as rainbow/steelhead. The only char captured in the watershed could not be sampled for DNA since its length (65mm) was below the required minimum of 100mm. Therefore the char, identified in the field and by voucher specimen identification as a Dolly Varden, could not be confirmed with DNA analysis.

Voucher specimens were collected of various species captured in the watersheds. The resulting identifications made and are provided as Attachment 4. Only one conflicting result arose. One trout specimen caught at Site 3 was originally identified as a rainbow trout. However, voucher identification then determined the specimen to be a cutthroat. This was then nullified by DNA analysis that provided confirmation of its original identification as rainbow trout. The voucher specimen was noted by the identifier as damaged, which may have led to the misidentification. Corrected specimen identifications have been incorporated into the FDIS database.

4.3.2.2 Habitat

Specific habitat characteristics recorded for the four sampling sites are shown in the FDIS printouts provided in Appendix 1. Overall, Quatam River has been noted as a stable system containing good spawning habitat throughout especially in upper portions of the watershed. Upper sections have also been noted as under utilized and possessing greater potential (MELP files from FISS). General habitat features are as follows:

- ❑ Approximately 4.8 km upstream from the mouth of the Quatam River there is a canyon section containing a series of cascades and low rock falls. This feature may act as a barrier to pink and chinook salmon. Downstream of this obstruction is a large section of river that acts as the main spawning ground for chum, chinook and pink salmon.
- ❑ Between the canyon and a rock falls present at 11 km (macroreach 26), there are several additional areas of chum and coho salmon spawning habitat, as well as rearing areas for other salmonid species.
- ❑ Upstream of the waterfall at 11 km mainstem reaches contain additional coho spawning and rearing habitat, as well as rearing habitat for char and trout species. A number of lower reaches in Quatam tributaries also offer good rearing and spawning habitat to salmonids.
- ❑ In macroreach 40, cascades were discovered which act as a barrier to upstream fish passage.

A summary of historic and new barriers to fish migration in the Quatam River watershed is provided below in Table 16. While most of these features were noted from FISS and RAB data, two obstructions were verified in the field during a helicopter overflight.

Table 16 Summary of historic and new barriers to fish migration found in Quatam River watershed.

Stream Name	Watershed Code	NTS Map #	Macro-Reach	Barrier Type	Height (m)	Field Verified	Description
Quatam	900-368900	92K/7	10	Falls	-----	N	May be barrier to species including pink, and chinook salmon. Chum, coho, steelhead, char and trout species present above barrier.
Quatam	900-368900	92K/7	10	Cascade	2.5	N	500m in length. May be barrier to species including pink, and chinook salmon. Chum, coho, steelhead, char and trout species present above barrier.
Quatam	900-368900	92K/7	10	Falls	-----	N	May be barrier to species including pink, and chinook salmon. Chum, coho, steelhead, char and trout species present above barrier.
Quatam	900-368900	92K/7	26	Falls	-----	N	May be a barrier to steelhead and chum salmon. Coho, char and trout species present upstream.

Quatam	900-368900	92K/7	29	Falls	-----	N	Rainbow, cutthroat, char and coho confirmed upstream
Quatam	900-368900	92K/7	29	Falls	-----	N	Rainbow, cutthroat, char and coho confirmed upstream
Quatam	900-368900	92K/7	40	Cascade	20	Y	Barrier to fish migration
Quatam	900-368900	92K/7	40	Cascade	30	Y	Barrier to fish migration

Lakes present in the Quatam River watershed are all located near the headwaters of tributaries to the mainstem. Few, if any of these lakes are suspected to offer potential fish habitat.

4.3.3 Toba River

4.3.3.1 Fish Distribution

A wide variety of fish species have been previously recorded in the Toba River watershed. Historical information present in the FISS database accounts for ten fish species that have, at some point during their life cycle used the Toba River system. Salmon species recorded include chinook, chum, coho, pink and steelhead. Other sport fish noted include char, coastal cutthroat trout and rainbow trout. Other non-game fish present include stickleback and sculpin species. Fish were captured at 8 of the 15 sites sampled during the inventory and include chinook, coho, rainbow/steelhead, Dolly Varden and sculpin. The locations of fish captured in the Toba River watershed are listed below in Table 17.

Table 17 Summary of fish capture results for Toba River watershed.

Stream Name	Watershed Code / ILP	NTS Map	Macro-Reach	Site	Species Captured
Toba River	900-349300	92K/9	41	1	chinook, coho and suspected Dolly Varden
Klite River	900-349300-03300	92K/9	1	3	sculpin, coho and rainbow/steelhead
Klite River	900-349300-03300	92K/9	15	4	Dolly Varden and rainbow/steelhead
Boyle Creek	900-349300-17500	92K/9	1	5	coho
Filer Creek	900-349300-42200	92K/9	29	6	Dolly Varden, sculpin, coho and chinook
Filer Creek	900-349300-42200	92K/9	68	7	Dolly Varden
Filer Creek	900-349300-42200	92K/9	74	8	Dolly Varden
Headwall Creek	900-349300-42200-60500	92K/9	1	9	Dolly Varden

Of the species present in the Toba River watershed, Dolly Varden and rainbow/steelhead have the most extensive distribution and have been noted in the mainstem and smaller tributaries as far upstream as the rock falls present at km 62 (de Hrussochy-Wirth *et al.* 1977; MELP files in FISS). Consistent with FISS information, inventory sampling was unsuccessful in capturing fish

above this barrier. Downstream however, Dolly Varden were found in both mainstem reaches and tributaries of the Toba River. Distribution of Dolly Varden extends to the headwaters of Klite River and Filer Creek and into Headwall Creek (a headwater tributary to Filer Creek). Rainbow/steelhead were also captured near the headwaters of Klite Creek however none were captured or have been documented in Filer Creek. Coho and chinook salmon distribution in the watershed extends to the falls present at 62 km on the mainstem, and were captured in the mainstem below this point during the current sampling effort. Historically, chinook presence is noted as far upstream as macroreach 41 in Filer Creek, to the falls at km 7.3 of the Klite River as well as in the lower reaches of Jimmie Creek. Sampling efforts only confirmed chinook presence in Filer Creek. Coho salmon were only captured within the range previously noted in FISS data that extends into Filer Creek to the rock falls present at km 20.9 and in lower reaches of Klite River.

Major tributaries further upstream of Klite River and Filer Creek but downstream of the rock falls at 62 km include Racoon Creek, Jimmie Creek, East Toba River and Dalglish Creek. Sampling efforts were unsuccessful and historical information indicates only limited use of Racoon Creek and Jimmie Creek by coho, chinook and Dolly Varden. Possible barriers to fish passage were also discovered within the lower reaches in each of these tributaries during inventory sampling. Pink and chum salmon were not captured or observed during the survey, but it is assumed from historical information available, that they spawn in the mainstem habitat as far upstream as macroreach 37. Also assumed from historical information is the presence of cutthroat trout in mainstem reaches and smaller tributaries of the Toba River to the falls at km 62. Although not sampled during this study, previous sampling of Little Toba River notes the presence of coho, chum, chinook and pink salmon as well as steelhead/rainbow trout in lower reaches and its tributaries to the falls present at the end of reach 3 (HCL 2000a). Dolly Varden were also found to be as far upstream as reach 7.

Hardcopy project maps of the inventory area showing detailed site and reach information are provided in Appendix A2.

Fish tissue samples were collected from the Toba River watershed for DNA analysis at the University of British Columbia. A total of nine samples were submitted including eight char and one trout. Results generated from the Toba samples showed that all char were Dolly Varden which is consistent with previous DNA analysis conducted as part of a 1:20,000 Reconnaissance Fish and Fish Habitat Inventory of Little Toba River (HCL 2000a). DNA analysis of tissue collected from trout also confirmed original field identifications as rainbow trout/steelhead (see Attachment 4).

Voucher specimens were collected for chinook, coho, Dolly Varden and rainbow trout/steelhead captured in the Toba River watershed. The resulting identifications confirmed field identifications made and are provided as Attachment 4. Two field misidentifications were made of chinook juveniles that were originally identified as coho. The voucher specimen identifications have been incorporated into the FDIS database.

4.3.3.2 Habitat

Specific habitat characteristics recorded for the fifteen sampling sites are shown in the FDIS printouts provided in Appendix 1. General habitat features are as follows:

- ❑ Mainstem reaches possess excellent spawning habitat for many different fish species and almost all fish present in the system can be found as far upstream as the falls at km 62.
- ❑ Excellent rearing habitat is present in side channels and first reaches of smaller tributaries to the Toba River.
- ❑ Lower reaches of major tributaries such as the Klite River, Filer Creek, Jimmie Creek and Racoon Creek provide excellent spawning grounds for many salmon present in the watershed. Headwater areas of Klite River and Filer Creek also provide good spawning and rearing for salmonids.
- ❑ Excellent rearing habitat can be found in the side channels and backwater areas of Filer Creek.

A summary of historic and new barriers to fish migration in the Toba River watershed is provided below in Table 18. Most of these features were noted from FISS and RAB data and a number were verified in the field during a helicopter overflight.

Table 18 Summary of historic and new barriers to fish migration found in Toba River watershed.

Stream Name	Watershed Code	NTS Map #	Macro-Reach	Barrier Type	Height (m)	Field Verified	Description
Toba	900-349300	92J/12	54	Cascade	-----	N	May act as barrier to upstream fish migration.
Toba	900-349300	92J/12	54	Rock Falls	100	Y	Impassable to all fish.
Toba	900-349300	92J/12	57	Rock Falls	30	N	Impassable to all fish
Klite	900-349300-03300	92K/9	3	Rock Falls	3	N	Passable to coho, chinook and steelhead.
Klite	900-349300-03300	92K/9	6	Cascade	-----	N	Steelhead and char observed upstream. May be a barrier to coho and chinook.
Klite	900-349300-03300	92K/9	6	Falls	-----	N	Steelhead and char observed upstream. May be a barrier to coho and chinook.
Filer	900-349300-42200	92K/9	43	Cascade	-----	N	Passable to coho. Char caught upstream.
Filer	900-343900-42200	92K/9	66	Rock Falls	10	N	300m in length. Char caught upstream. Likely barrier to anadromous fish.
Filer	900-343900-42200	92K/9	69	Rock Falls	10	N	100m in length. Char caught upstream. Likely barrier to anadromous fish.
Filer	900-349300-42200	92K/9	72	Cascade	-----	N	Char caught upstream. Likely barrier to anadromous fish.

Stream Name	Watershed Code	NTS Map #	Macro-Reach	Barrier Type	Height (m)	Field Verified	Description
Montrose	900-349300-42200-29100	92K/9	1	Cascade	-----	N	May be char and/or trout above this obstruction
Unnamed	900-349300-42200-45000	92K/9	2	Rock Falls	300	Y	Impassable to all fish.
Headwall	900-349300-42200-60500	92K/9	7	Rock Falls	25	N	200m in length. Likely barrier to all fish.
Racoon	900-349300-52900	92J/12	4	Cascade	-----	N	Impassable to all fish.
Jimmie	900-349300-67200	92K/9	1	Rock Falls	50	Y	Impassable to all anadromous fish species.
Jimmie	900-349300-67200	92K/9	1	Cascade	-----	Y	Likely barrier to all anadromous fish.
Jimmie	900-349300-67200	92K/9	1	Falls	10	Y	Within cascade of the same macroreach. Likely barrier to all fish species.
Jimmie	900-349300-67200	92K/9	7	Cascade	-----	Y	Impassable to all fish species. Impassable barrier d/s
East Toba	900-349300-85000	92J/12	2	Cascade	-----	N	May be char and/or trout above this obstruction
East Toba	900-349300-85000	92J/12	5	Rock Falls	2	N	May be char and/or trout above this obstruction
East Toba	900-349300-85000	92J/12	5	Rock Falls	3	N	May be char and/or trout above this obstruction
Dalglish	900-349300-88000	92J/12	3	Cascade	-----	N	May be char and/or trout above this obstruction

Very few lakes exist in the Toba River watershed. Many of the lakes that are present are located near the headwaters of tributaries to the mainstem and are glacier fed. None of these lakes are suspected to offer potential fish habitat. A few small lakes/wetlands can also be found on the valley floor of the Toba River. These lakes or wetland areas may offer good potential rearing habitat to juvenile salmonids if connected to mainstem reaches at high water.

4.3.4 Southgate River

4.3.4.1 Fish Distribution

An examination of historical information present in the FISS database notes the presence of seven fish species in the Southgate River watershed during at least one stage of their life cycle. Species noted include chinook, chum, pink, coho, steelhead/rainbow, coastal cutthroat trout and both anadromous and resident Dolly Varden. Fish were captured at all six sites sampled in the Southgate watershed during the present study. Fish species captured include coho, chinook, Dolly Varden, bull trout, Dolly Varden/bull trout hybrids, cutthroat, rainbow/steelhead and sculpin. The location of fish captured is presented below in Table 19.

Table 19 Summary of fish capture results for Southgate River watershed.

Stream Name	Watershed Code / ILP	NTS Map	Macro-Reach	Site	Species Captured
Southgate River	900-404100	92K/16	137	5	Dolly Varden, chinook and coho
Unnamed	900-404100-07000	92K/15	1	1	suspected Dolly Varden and bull trout
Unnamed	900-404100-12100	92K/15	2	2	coho, bull trout, Dolly Varden/bull trout hybrid and suspected Dolly Varden
Elliott Creek	900-404100-16200	92K/15	1	3	sculpin, Dolly Varden, Dolly Varden/bull trout hybrid and suspected Dolly Varden
Unnamed	900-404100-28700	92K/15	1	4	chinook, coho and suspected Dolly Varden
Unnamed	900-404100-66700-15500	92K/16	1	6	coho, coastal cutthroat, Dolly Varden and rainbow/steelhead

Results of the present overview inventory confirm those obtained from a previous reconnaissance (1:20,000) fish and fish habitat inventory (ARL 1998). The distribution of fish in the Southgate River watershed is limited by the falls present at km 51.5 (macroreach 182) of the mainstem, approximately two kilometres upstream from the confluence with the Bishop River. Steep valley walls in the Southgate drainage form high gradient stream reaches and obstructions, which generally limit fish distribution to first reaches of smaller tributaries. Even fish distribution in a larger tributary, Bishop River, is limited to the lower reaches by the presence of a cascade 12 km upstream from the confluence (macroreach 11). Many species have an extensive range within this area of accessible habitat. Coho, coastal cutthroat, rainbow/steelhead and Dolly Varden were all captured in a tributary of Bishop River (Site 6) below the cascade barrier indicating the extent of the upstream distribution of these species in the watershed. Chinook has also been documented equally as far upstream (FISS database).

Although not captured during inventory sampling, it is assumed that pink and chum spawn throughout the Southgate mainstem and lower reaches of its tributaries based on FISS database information. Chum may spawn as far upstream as the Bishop River while pink salmon remain in lower reaches and have not been noted as far upstream.

Hardcopy project maps of the inventory area showing detailed site and reach information are provided in Appendix A2.

Twenty-three char tissue samples from the Southgate River watershed were submitted to the University of British Columbia for analysis to determine whether specimens collected were either Dolly Varden, bull trout or hybrids. As with prior char samples, each individual was assessed at 2 nuclear loci. Results generated from the Southgate watershed determined there to be 15 Dolly Varden, 5 bull trout and 3 hybrids present in the samples collected (see Attachment 4). These

findings confirm results of a previous study that also determined bull trout presence and hybridization in the Southgate watershed (ARL 1998). An additional 5 tissue samples from trout identified as rainbow/steelhead in the field, were also submitted for DNA testing. Results of the testing showed that no hybrids or crosses with cutthroat trout were present and confirmed field identifications.

Voucher specimens were collected of various species captured in the watersheds. The resulting identifications are provided as Attachment 4. Generally, voucher identifications corresponded to field identifications. One exception was at Site 6, where fish originally identified in the field as rainbow trout/steelhead were later identified as cutthroat trout upon examination of voucher specimens. Additionally, two juvenile bull trout, not sampled for DNA, were identified from vouchers collected at Site 2 that were originally identified as Dolly Varden. Voucher identifications also noted bull trout and hybrids in the char specimens collected and corresponded to results of DNA analysis. Corrected identifications have been incorporated into the FDIS database.

4.3.4.2 *Habitat*

Sites surveyed during the inventory of the Southgate River watershed were primarily direct tributaries to the mainstem below the falls at 51.5 km. Specific habitat characteristics recorded for the six sampling sites in this area are shown in the FDIS printouts provided in Appendix 1. A brief summary of habitat conditions and features based primarily on references in the FISS database is provided below:

- ❑ Good spawning and rearing habitat for salmon, char and trout species is noted throughout much of the mainstem and some side channel areas. In particular, good habitat conditions are found in the braided, meandering channel of the lower mainstem reaches.
- ❑ Many of the unnamed smaller tributaries to Southgate River possess good rearing habitat and have a moderate amount of spawning habitat in their lower reaches as found in Sites 1 to 4. However, many of the tributaries are glacially fed and as a result have generally low water temperatures throughout the year. This feature may limit fish growth and reproduction in these streams.
- ❑ A large falls present at 51.5 km of the mainstem is an impassable barrier to upstream fish passage in the watershed.
- ❑ High gradient reaches, falls and cascades limit fish distribution to lower reaches of tributaries to the Southgate River. Obstructions were present in FISS data or discovered during sampling for all tributaries sampled with one exception (Site 2).

A summary of historic and new barriers to fish migration in the Southgate River watershed is provided below in Table 20. Most of these features were noted from FISS and RAB data and several were verified in the field during helicopter flights to the sampling sites.

Table 20 Summary of historic and new barriers to fish migration found in Southgate River watershed.

Stream Name	Watershed Code	NTS Map #	Macro-Reach	Barrier Type	Height (m)	Field Verified	Description
Southgate	900-404100	92N/1	190	Falls	4	N	Barrier to fish movement. Impassable falls d/s.
Southgate	900-404100	92N/1	190	Cascade	-----	N	300m long. Barrier to fish movement. Impassable falls d/s.
Southgate	900-404100	92N/1	190	Cascade	-----	N	50m long. Barrier to fish movement. Impassable falls d/s.
Southgate	900-404100	92N/1	190	Cascade	-----	N	50m long. Barrier to fish movement. Impassable falls d/s.
Southgate	900-404100	92N/1	190	Cascade	-----	N	50m long. Barrier to fish movement. Impassable falls d/s.
Southgate	900-404100	92N/1	192	Falls	15	N	Impassable barrier to all fish.
Southgate	900-404100	92K/16	192	Falls	15	N	Impassable to all fish.
Southgate	900-404100	92N/1	194	Falls	5	N	Barrier to fish movement. Impassable falls d/s.
Southgate	900-404100	92N/1	194	Falls	5	N	Impassable falls d/s.
Southgate	900-404100	92N/1	196	Cascade	-----	N	900m long. Impassable barrier to all fish. Impassable falls d/s.
Southgate	900-404100	92N/1	196	Falls	80	N	Impassable falls d/s.
Southgate	900-404100	92N/1	197	Cascade	-----	N	20m long. Barrier to fish movement. Impassable falls d/s.
Southgate	900-404100	92N/1	197	Velocity Barrier	30	N	20m long. Barrier to fish movement. Impassable falls d/s.
Unnamed	900-404100-07000	92K/15	2	Cascade	-----	N	100m in length. Char and coho caught upstream
Unnamed	900-404100-07000	92K/15	2	Falls	5	N	Char and coho caught upstream.
Unnamed	900-404100-14999	92K/15	5	Cascade	-----	N	2km long. Probable barrier to anadromous fish.
Elliot	900-401000-16200	92K/15	2	Velocity Barrier	10	Y	30m long. Likely barrier to anadromous fish. May be char and/or trout above this obstruction.
Elliot	900-401000-16200	92K/15	2	Falls	4	Y	May be char and/or trout above this obstruction
Unnamed	900-404100-16200-22700	92K/15	2	Cascade	-----	N	20m long. May be a barrier to anadromous fish.
Unnamed	900-404100-27900	92K/15	2	Falls	20	Y	Impassable to all fish.
Unnamed	900-404100-27900	92K/15	2	Cascade	-----	Y	10m long. May be a barrier. Impassable falls d/s within same macroreach.
Unnamed	900-404100-34600	92K/15	2	Falls	20	N	Impassable to all fish

Stream Name	Watershed Code	NTS Map #	Macro-Reach	Barrier Type	Height (m)	Field Verified	Description
Unnamed	900-404100-37500	92K/15	2	Falls	8	N	Impassable to all fish
Unnamed	900-404100-37500	92K/15	2	Cascade	-----	N	100m long. Probable barrier to anadromous fish. Impassable falls d/s.
Icewall	900-404100-38900	92K/16	3	Velocity Barrier	2	N	Possible barrier to anadromous fish.
Unnamed	900-404100-38900-30100	92K/16	1	Cascade	120	N	290m long. Likely barrier to all fish.
Unnamed	900-404100-43700-06000	92K/16	1	Falls	30	N	Impassable to all fish.
Raleigh	900-404100-50400	92K/16	2	Falls	10	Y	Impassable to all fish.
Raleigh	900-404100-50400	92K/16	4	Velocity Barrier	60	N	10m long. Likely barrier to anadromous fish. Impassable falls d/s on Raleigh.
Unnamed	900-404100-50400-56500	92K/16	1	Cascade	320	Y	500m long. Impassable to all fish. Impassable falls d/s on Raleigh.
Unnamed	900-404100-57700	92K/16	2	Falls	30	N	Impassable to all fish
Unnamed	900-404100-58500	92K/16	2	Cascade	20	N	40m long. Likely barrier to anadromous fish.
Unnamed	900-404100-65100	92K/16	2	Falls	20	N	Impassable to all fish.
Unnamed	900-404100-65100	92K/16	2	Cascade	340	N	795m long. Barrier to all fish. Impassable falls d/s.
Unnamed	900-404100-65100	92K/16	2	Cascade	40	N	150m long. Probable barrier to all fish. Impassable falls d/s.
Bishop	900-404100-66700	92K/16	10-12	Cascade	-----	Y	3km long. Likely barrier to fish passage.
Bishop	900-404100-66700	92K/16	20	Cascade	10	N	Likely barrier to all fish. Cascade barrier d/s.
Bishop	900-404100-66700	92K/16	19	Velocity Barrier	10	N	50m in length. Likely barrier to anadromous fish. Cascade barrier d/s.
Bishop	900-404100-66700	92J/13	52	Cascade	-----	N	300m long. May be a barrier to upstream migration. Cascade barrier d/s.
Unnamed	900-4041000-66700-03900	92K/16	2	Falls	-----	N	Probable barrier to fish passage.
Charon	900-404100-66700-17500	92K/16	1	Cascade	320	N	757m long. Impassable to all fish.
Durham	900-404100-66700-24600	92K/16	1	Falls	10	Y	Impassable to all fish.
Durham	900-404100-66700-24600	92K/16	1	Cascade	50	Y	100m long. Impassable falls d/s.
Sytx	900-404100-66700-34200	92K/16	1	Cascade	30	N	50m long. Barrier to all fish. Cascade barrier d/s on Bishop.
Unnamed	900-404100-66700-37500	92K/16	1	Falls	-----	N	Probable barrier to fish passage. Cascade barrier d/s on Bishop.
Unnamed	900-404100-66700-40200	92K/16	1	Falls	20	N	Impassable to all fish.

Stream Name	Watershed Code	NTS Map #	Macro-Reach	Barrier Type	Height (m)	Field Verified	Description
Unnamed	900-404100-66700-40600	92K/16	1	Cascade	20	N	30m long. Impassable barrier to all fish.
Unnamed	900-404100-66700-50900-42300	92K/16	2	Cascade	20	N	300m long. May be a barrier to upstream migration. Cascade barrier d/s on Bishop.
Falcon	900-404100-66700-50900	92K/16	12	Cascade	60	N	300m long. May be a barrier to upstream migration. Cascade barrier d/s on Bishop.
Unnamed	900-404100-73300	92N/1	1	Falls	40	N	Impassable to all fish. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	2	Cascade	-----	N	Barrier to fish passage. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	3	Falls	5	N	Barrier to fish passage. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	3	Falls	5	N	Barrier to fish passage. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	4	Cascade	-----	N	Barrier to fish passage. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	4	Falls	-----	N	Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	4	Falls	-----	N	Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	4	Falls	-----	N	Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	4	Cascade	-----	N	Barrier to fish passage. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	7	Cascade	-----	N	350m long. Likely barrier to fish. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	8	Cascade	120	N	820m long. Barrier to all fish. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	8	Falls	-----	N	Part of cascade in same macroreach. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	8	Falls	-----	N	Part of cascade in same macroreach. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	8	Falls	-----	N	Part of cascade in same macroreach. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	16	Cascade	40	N	90m. Fish Barrier. Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	18	Falls	8	N	Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	18	Falls	10	N	Impassable falls d/s on Southgate.

Stream Name	Watershed Code	NTS Map #	Macro-Reach	Barrier Type	Height (m)	Field Verified	Description
Allaire	900-404100-81600	92N/1	19	Falls	7	N	Impassable falls d/s on Southgate.
Allaire	900-404100-81600	92N/1	19	Cascade	-----	N	Likely barrier to fish movement. Impassable falls d/s on Southgate.
Unnamed	900-404100-81600-02400	92N/1	1	Cascade	20	N	60m long. Likely barrier to fish passage. Impassable falls d/s on Southgate.
Unnamed	900-404100-81600-02400	92N/1	1	Cascade	480	N	900m long. Barrier to fish passage. Impassable falls d/s on Southgate.
Boulanger	900-404100-91900	92N/1	1	Cascade	20	N	75m long. Likely barrier to fish movement. Impassable falls d/s on Southgate.

Very few lakes are present in the Southgate River watershed. Lakes that are present appear to be glacially fed headwater systems that offer little or no potential fish habitat. These lakes are located above documented obstructions that act as barriers to fish passage.

4.3.5 Homathko River

4.3.5.1 Fish Distribution

Fish species diversity in the Homathko River watershed is comparatively high. Historical FISS records show the presence of chinook, coho, chum, sockeye and pink salmon, anadromous and resident coastal cutthroat trout and Dolly Varden, rainbow trout/steelhead, longnose dace (*Rhinichthys cataractae*), longnose sucker (*Catostomus catostomus*), redbside shiner (*Richardsonius balteus*), eulachon (*Thaleichthys pacificus*), threespine stickleback (*Gasterosteus aculeatus*), river lamprey (*Lampetra ayresi*) and sculpin. Nine species of fish were captured at 11 of the 15 sites sampled in the Homathko watershed during the inventory. Species captured include chinook, coho, coastal cutthroat trout, bull trout, Dolly Varden, rainbow/steelhead, longnose sucker, lamprey and sculpin. Reaches where fish were caught during the inventory are listed below in Table 21.

Table 21 Summary of fish capture results for lower Homathko River watershed.

Stream Name	Watershed Code / ILP	NTS Map	Macro-Reach	Site	Species Captured
Unnamed	1	92N/2	1	5	coastal cutthroat
Unnamed	2	92N/2	1	3	coho
Unnamed	3	92N/2	1	4	coho and lamprey
Homathko River	900-406900	92N/3	135	10	sculpin, chinook, Dolly Varden, longnose sucker

Stream Name	Watershed Code / ILP	NTS Map	Macro-Reach	Site	Species Captured
Smith Creek	900-406900-08700	92N/2	1	2	Dolly Varden, bull trout, coho, coastal cutthroat, rainbow/steelhead
Brew Creek	900-406900-16700	92N/3	1	6	chinook and Dolly Varden
Whitemantle Creek	900-406900-21700	92N/3	1	9	chinook, coho and sculpin
Unnamed	900-406900-22700	92N/3	1	8	supected Dolly Varden, sculpin, chinook and coho
Scar Creek	900-406900-24900	92N/3	1	11	chinook and suspected Dolly Varden
Unnamed	900-406900-30300	92N/2	1	14	coho and Dolly Varden
Klattasine Creek	900-406900-31500	92N/2	1	15	Dolly Varden

A major limiting factor to fish distribution in the Homathko watershed is the cascade found in Waddington Canyon. This barrier is impassable to most fish during high flow conditions, however chinook, coho and steelhead fry have been observed upstream of the canyon. Fish presence in the watershed above this barrier is generally limited to resident rainbow trout and char, which can be found into headwater areas. Downstream of this barrier, access to all mainstem reaches is not limited by obstructions and noted fish species in the drainage are spread throughout these reaches.

Another limiting factor is the steep valley walls in the Homathko drainage forming high gradient stream reaches and obstructions that generally limit fish distribution to first reaches of smaller tributaries. Even fish distribution in larger tributaries is limited to the lower reaches by the presence of obstructions (FISS database records). Chinook, coho, chum salmon and coastal cutthroat trout are present in Brew Creek to the rock falls and cascades starting in macroreach 1. Fish sampling efforts were unsuccessful above these obstructions during the present inventory. Although no barriers were discovered in the lower reaches of Coola Creek, no fish were captured in macroreach 3 and no record of fish presence is listed in FISS database. Site survey information indicates very little fish habitat and cover is present in this location, which may act as a limiting factor to fish distribution in Coola Creek as well as in other larger tributaries. A tributary to Heakamie River was also sampled without success. This location is downstream of a rock falls on Heakamie River, which may be an impassable fish barrier. Although coho, chum, coastal cutthroat and Dolly Varden are noted in FISS to use the Heakamie River below these falls, a cascade was discovered near the mouth of the tributary that is also thought to impede fish passage.

Hardcopy project maps of the inventory area showing detailed site and reach information are provided in Appendix A2.

A total of 9 char tissue samples from the Homathko River watershed were submitted to the University of British Columbia for DNA analysis. Tissue samples submitted were from fish captured in Smith Creek, Brew Creek, Klattasine Creek and 900-406900-30300. Results generated from the Homathko samples indicated all were Dolly Varden as originally identified in the field (see Attachment 4). However, DNA analysis recently confirmed other char samples from the Homathko River mainstem near Scar Creek to be bull trout (Duanne Jesson, *pers. comm.*). An additional 5 tissue samples from trout identified as rainbow/steelhead as well as one tissue sample from a salmon identified as coho in the field were also submitted for DNA testing. Results of the testing showed that no hybrids or crosses were present and confirmed field identifications as correct.

Voucher specimens were collected of various species captured in the watersheds. The resulting identifications confirmed field identifications made and are provided as Attachment 4. One exception to this was the identification of a juvenile bull trout in macroreach 1 of Smith Creek, originally identified as a Dolly Varden. The voucher specimen identifications have been incorporated into the FDIS database.

4.3.5.2 *Habitat*

The current inventory was restricted to the Homathko River watershed below Waddington Canyon. Specific habitat characteristics recorded for the fifteen sampling sites in this area are shown in the FDIS printouts provided in Appendix 1. A brief summary of habitat conditions and features is provided below:

- ❑ Excellent spawning gravel and rearing habitat for salmon, char and trout species is present throughout the lower mainstem reaches and a number of side channels.
- ❑ A large cascade is present in Waddington Canyon often preventing passage of anadromous fish but is occasionally passable in low flow periods. Generally however, only resident char and rainbow trout are present above this cascade.
- ❑ Good to fair spawning habitat is present in lower reaches of tributaries to the Homathko River including Smith Creek, Brew Creek, Scar Creek and Coola Creek. Good salmonid rearing habitat was also found in many of these tributaries including Cumsack Creek, Smith Creek, Whitemantle Creek and Scar Creek.
- ❑ High gradient reaches, falls and cascades generally limit fish distribution to lower reaches of tributaries including Heakamie River and Brew Creek.

A summary of historic and new barriers to fish migration in the Homathko River watershed is provided below in Table 22. Most of these features were noted from FISS and RAB data and several were verified in the field during the field sampling program.

Table 22 Summary of historic and new barriers to fish migration found in Homathko River watershed.

Stream Name	Watershed Code	NTS Map #	Macro-Reach	Barrier Type	Height (m)	Field Verified	Description
Homathko	900-406900	92N/2	184	Cascade	20	N	250m long. Barrier to anadromous fish.
Unnamed	900-406900-00600-33100	92K/15	1	Velocity Barrier			Likely impassable to anadromous fish
Unnamed	900-406900-00600-52500	92K/15	1	Velocity Barrier			Likely impassable to anadromous fish
Unnamed	900-406900-00600-86000-2500	92K/15	1	Velocity Barrier			Likely impassable to anadromous fish
Heakamie	900-406900-10500	92N/2	19	Falls			Probable barrier to fish.
Heakamie	900-406900-10500	92N/2	26	Cascade		Y	Probable barrier to fish.
Heakamie	900-406900-10500	92N/2	27	Cascade	-----	Y	Probable barrier to fish.
Heakamie	900-406900-10500	92N/2	28	Cascade	-----	Y	Probable barrier to fish.
Unnamed	900-406900-10500-39600	92N/2	1	Cascade	2	Y	Probable barrier to fish.
Jewakawa	900-406900-11600	92N/2	13	Cascade	3	N	Passable to many species
Jewakawa	900-406900-11600	92N/2	18	Cascade	-----	N	May be char and/or trout above this obstruction. Likely impassable to anadromous species.
Jewakawa	900-406900-11600	92N/2	23	Cascade	-----	N	May be char and/or trout above this obstruction. Likely impassable to anadromous species.
Jewakawa	900-406900-11600	92N/2	25	Rock	1	N	10m long. May be char and/or trout above this obstruction. Likely impassable to anadromous species.
Jewakawa	900-406900-11600	92N/2	28	Cascade	-----	N	May be char and/or trout above this obstruction. Likely impassable to anadromous species.
Brew	900-406900-16700	92N/2	3	Cascade	-----	Y	Probable barrier to fish passage.
Brew	900-406900-16700	92N/2	4	Cascade	-----	Y	Probable barrier to fish passage.
Brew	900-406900-16700	92N/2	6	Cascade	-----	Y	Probable barrier to fish passage.
Brew	900-406900-16700	92N/2	7	Rock	1		Probable barrier to fish passage.
Brew	900-406900-16700	92N/2	10	Cascade	-----	Y	Probable barrier to fish passage.
Brew	900-406900-16700	92N/3	11	Cascade	-----	Y	Probable barrier to fish passage.

Very few lakes are present in the lower portions of the Homathko drainage where the inventory was conducted. Some of these lakes are headwater systems that offer little or no potential fish habitat and furthermore, are located upstream of fish migration barriers. A few small wetland areas are also located on the valley floor in the floodplain of the Homathko River. These may offer potential rearing habitat if not completely isolated from the mainstem.

4.4 FISH SIZE, AGE AND LIFE HISTORY

4.4.1 Brem River

The majority of fish captured in the Brem River watershed were measured and weighed. Ageing structures were collected from a total of 30 Dolly Varden (fin rays) and 18 rainbow steelhead (scales). Unfortunately problems associated with collection and the preservation process resulted in no Dolly Varden fin ray samples being aged for any of the project watersheds. However, ageing of all scale samples was carried out successfully with the materials collected in the field.

A broad range of lengths was recorded for Dolly Varden (49 – 170mm) and rainbow/steelhead (52 – 193 mm) captured in the Brem. It was not possible to differentiate between rainbow trout and steelhead captured.

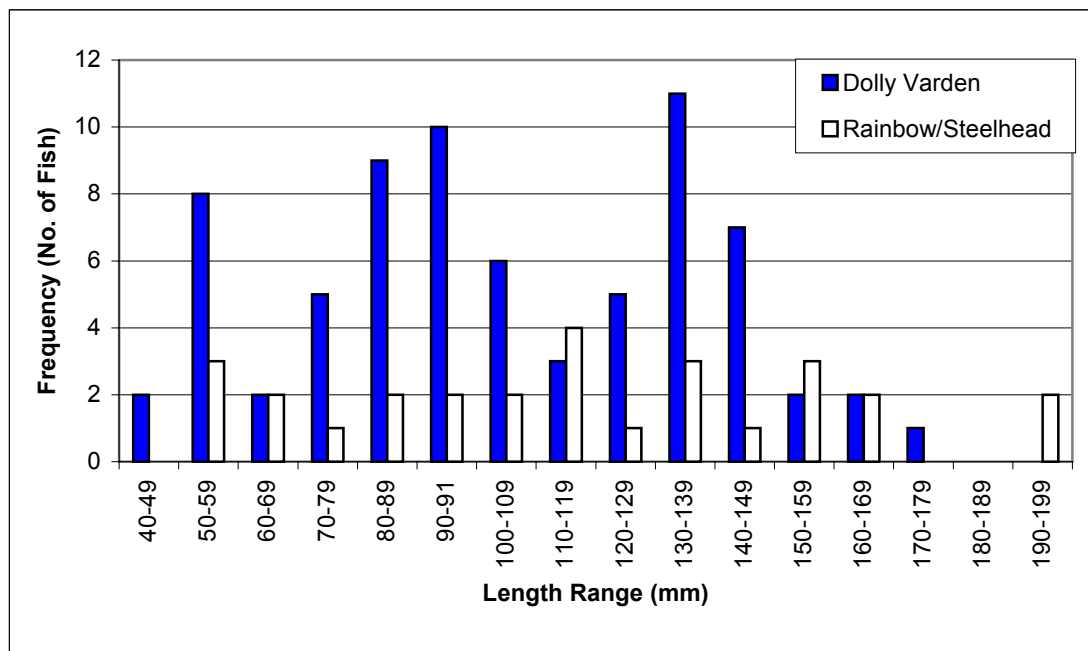


Figure 4 Length-frequency histogram for Dolly Varden and rainbow/steelhead collected in the Brem River watershed September 14-15, 2000.

A summary of length-at-age data for rainbow/steelhead from the Brem River watershed is provided below in Table 23. Three age classes were captured in the sampling effort, 2+, 3+ and 4+ fish. The majority of specimens aged were 2+ fish.

Table 23 Summary of length-at-age data from rainbow/steelhead sampled in the Brem River watershed, September 13-19, 2001.

Stream Name	Watershed Code	Age	Number of Fish	Mean Length (mm)	Range of Lengths (mm)
Brem River	900-357900	2+	6	115	103-139
		3+	2	174	156-191
		4+	2	160	155-164
Unnamed	900-357900-18600	2+	5	131	113-158
		3+	2	180	167-193
Hillis Creek	900-357900-33900	3+	1	140	-

4.4.2 Quatam River

Sampling within the Quatam River watershed resulted in very few fish captured. A total of eight fish were captured at two of the four sites sampled. All of these fish were measured for length and weighed. Ageing structures were collected from only two rainbow/steelhead captured from Site 3 measured to be 110 and 115mm in length. The scale samples collected were aged successfully and determined to be 2+ fish. It was not possible to differentiate between rainbow and steelhead. Due to the limited number of fish captured and aged, a meaningful analysis and representation of the population structure and size ranges cannot be carried out.

4.4.3 Toba River

Fish captured in the Toba River watershed were measured for length and weighed. Fin rays were collected from a total of eight Dolly Varden, two coho and one chinook while scales were collected from three rainbow/steelhead for ageing. None of the fin rays collected could be aged due to the problem previously mentioned however, the scale samples were successfully aged.

A narrow range of lengths (132-163 mm) was recorded for rainbow/steelhead captured in the Toba River watershed (see Figure 5) while the size range of Dolly Varden captured was much more extensive (44 – 210mm). Juvenile coho and chinook captured during the survey (Figure 6), also varied considerably in size (39 – 83mm). It was not possible to differentiate between rainbow and steelhead. Scale samples collected from the three rainbow/steelhead captured were aged and all found to be over two years of age.

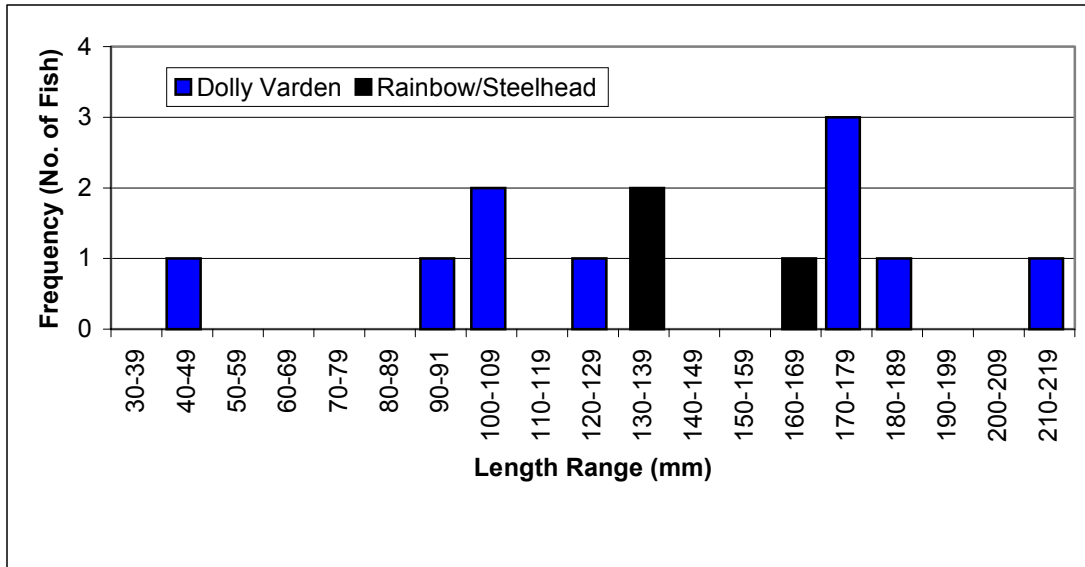


Figure 5 Length-frequency histogram for char Dolly Varden and rainbow/steelhead collected in the Toba River watershed September 12-13, 2000.

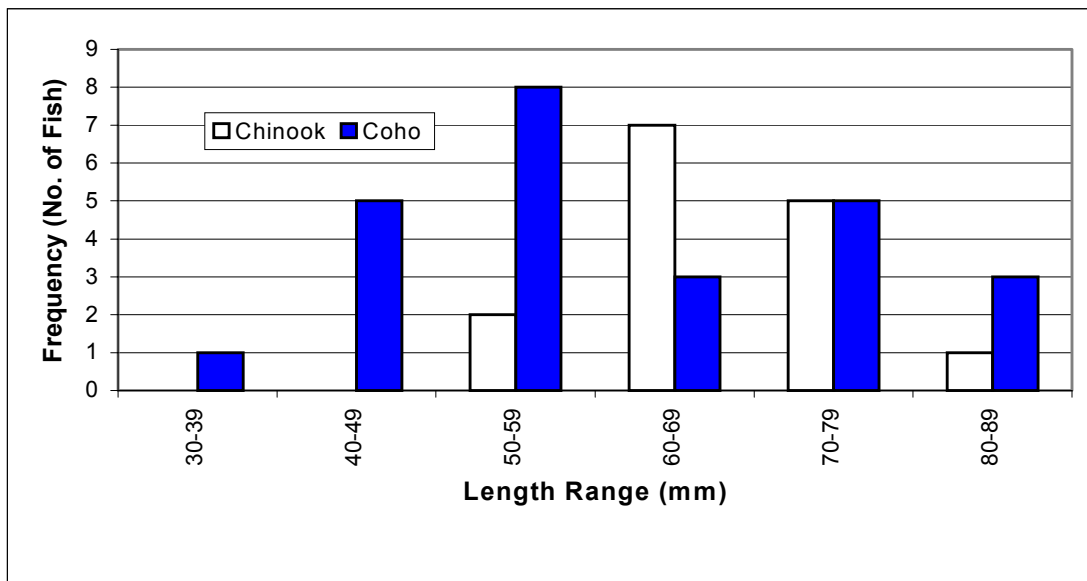


Figure 6 Length-frequency histogram for chinook and coho salmon collected in the Toba River watershed September 12-13, 2000.

4.4.4 Southgate River

Most fish captured in the Southgate River watershed were char (37%), chinook (16%) or coho juveniles (26%). All fish were weighed and measured. Ageing structures were collected from a total of 23 char (fin rays) and 5 rainbow trout/steelhead (scales). No char fin ray samples could be aged due to the preservation problem previously mentioned. However, ageing of the five scale samples was carried out successfully with the materials collected in the field.

Several char were captured of smaller size, ranging from 43 to 82mm in length. These char could not be sampled for DNA (less than 100mm in length) thereby confirming field identifications. Voucher identifications confirmed bull trout within this smaller size range. Dolly Varden captured in Southgate watershed and confirmed using DNA analysis, were found to range greatly in length from 132 to 273mm (Figure 7). Bull trout in the Southgate watershed, confirmed with DNA, ranged in length from 115 to 214mm. Confirmed Dolly Varden/bull trout hybrids similarly ranged in length from 106 to 240mm. Previous length at age data has been found to be quite similar for Dolly Varden, bull trout and their hybrids in the Southgate watershed (ARL 1998). Aged rainbow trout/steelhead ranged from 106 to 121mm in length and were all found to be 1+ fish. The range of lengths was recorded for juvenile coho captured in the Southgate watershed was 47 to 88mm, while juvenile chinook size was 52 to 77mm (Figure 9).

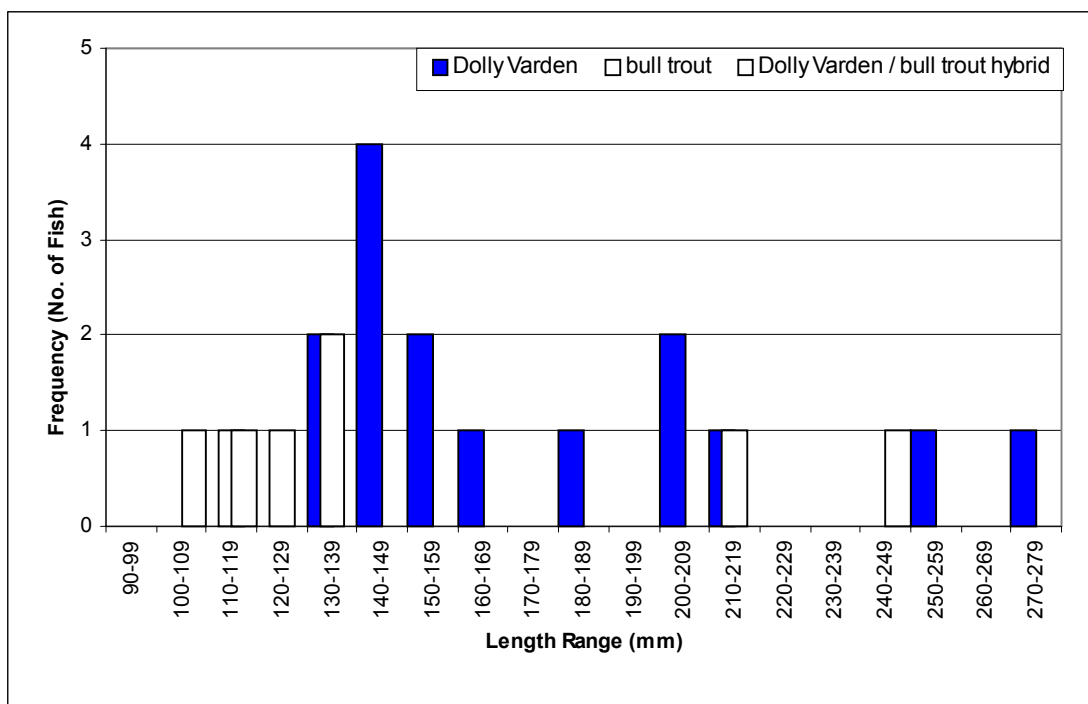


Figure 7 Length-frequency histogram for DNA confirmed Dolly Varden, bull trout and Dolly Varden/ bull trout hybrids collected in the Southgate River watershed September 16, 2000.

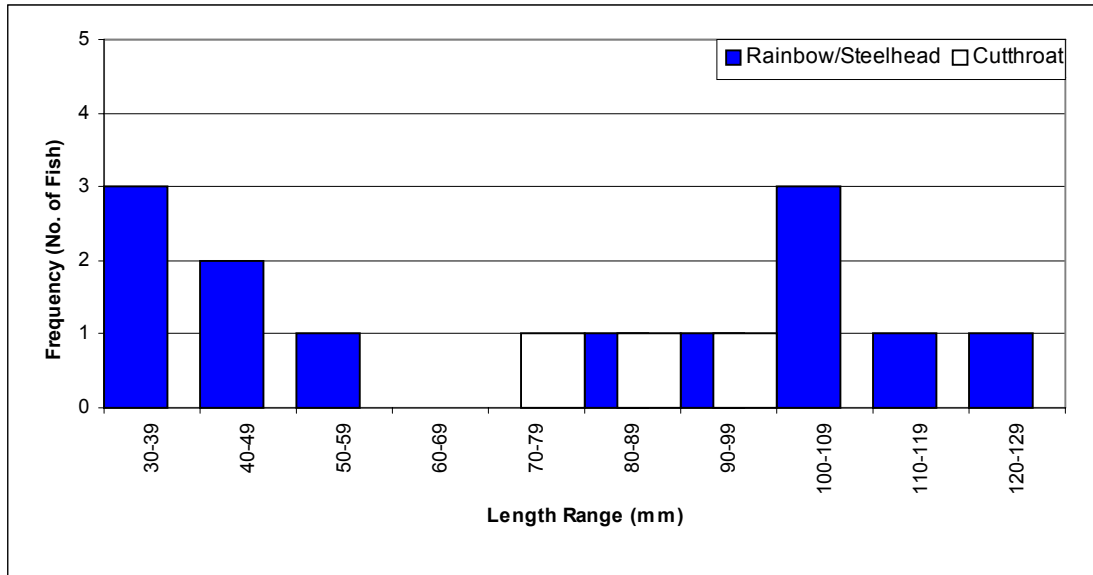


Figure 8 Length-frequency histogram for cutthroat and rainbow/steelhead collected in the Southgate River watershed September 16, 2000.

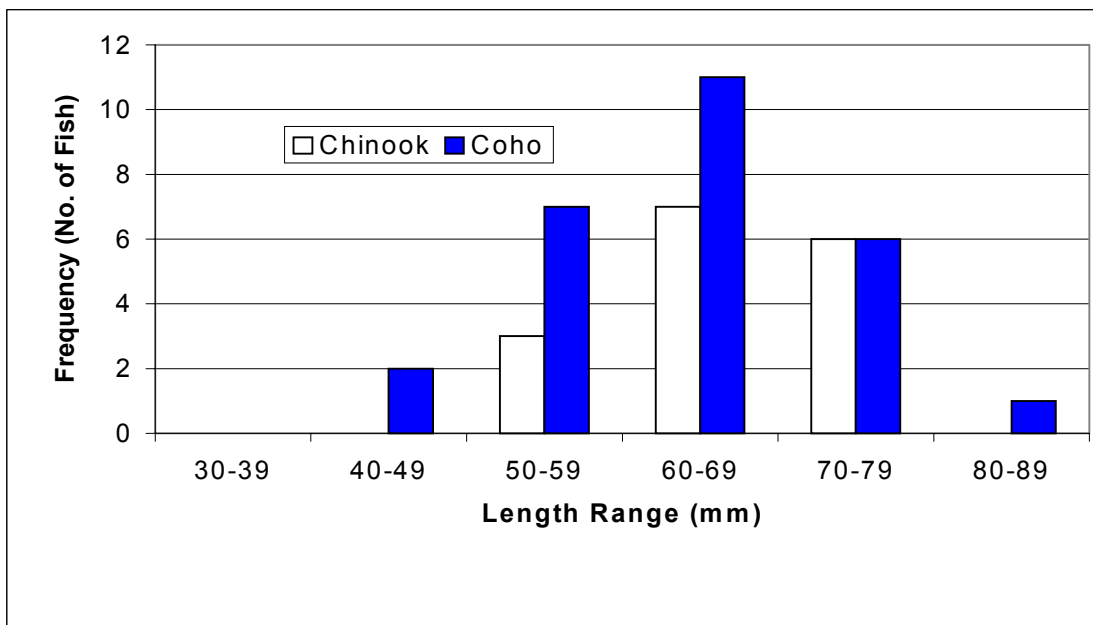


Figure 9 Length-frequency histogram for chinook and coho salmon collected in the Southgate River watershed September 16, 2000.

4.4.5 Homathko River

A total of 101 fish were captured during the field sampling program in the Homathko River watershed. Most fish were char (32%), and chinook (29%) or coho juveniles (29%). The majority of fish captured were weighed and measured. Ageing structures were collected from a total of 9 Dolly Varden (fin rays), 2 cutthroat trout (scales) and one adult coho (scale). No Dolly Varden fin ray samples could be aged due to the preservation problem previously mentioned. However, ageing of the three scale samples was carried out successfully with the materials collected in the field.

Dolly Varden captured in the Homathko River watershed were between 50 to 212mm in length with the exception of two fish measuring 240 mm and 410 mm (Figure 10). The only bull trout captured in the Homathko watershed measured 101 mm in length. Cutthroat trout size ranged from 69 to 148 mm in length. Scale samples taken from cutthroat trout 130 mm and 148 mm in length were both found to be 2+ fish. A range of lengths was recorded for juvenile coho (41 – 90 mm) and chinook (47 – 95 mm) captured in the Homathko (see Figure 11). Two adult coho were collected during the inventory, which were measured at 300 mm and 340 mm in length. Ageing results indicate that the 340 mm coho is a 2+ fish and probably an early returning male or “jack”.

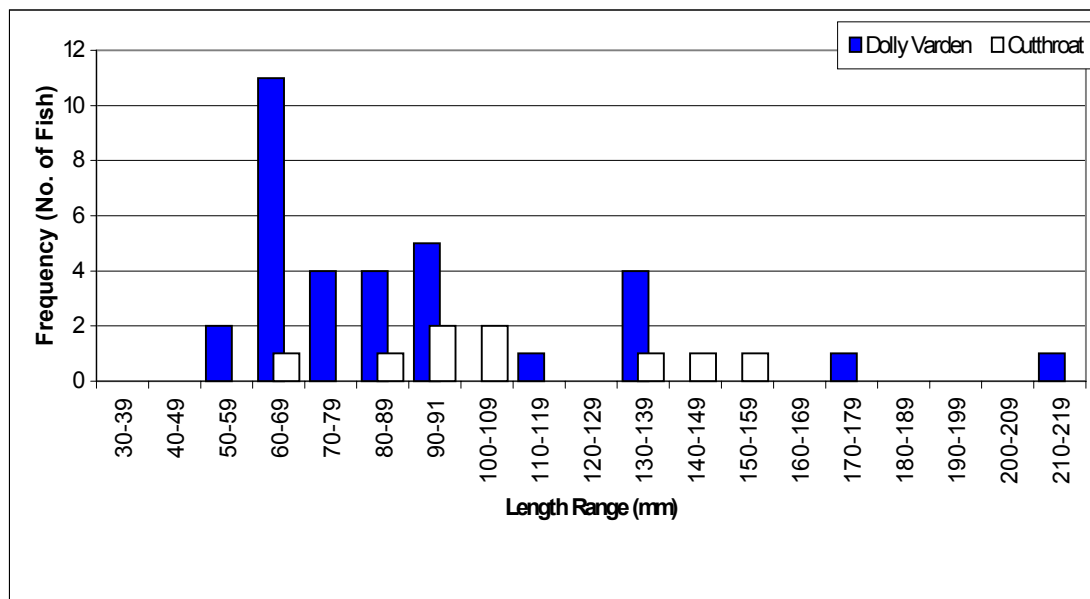


Figure 10 Length-frequency histogram for Dolly Varden and cutthroat trout collected in the Homathko River watershed September 15 – 18, 2000.

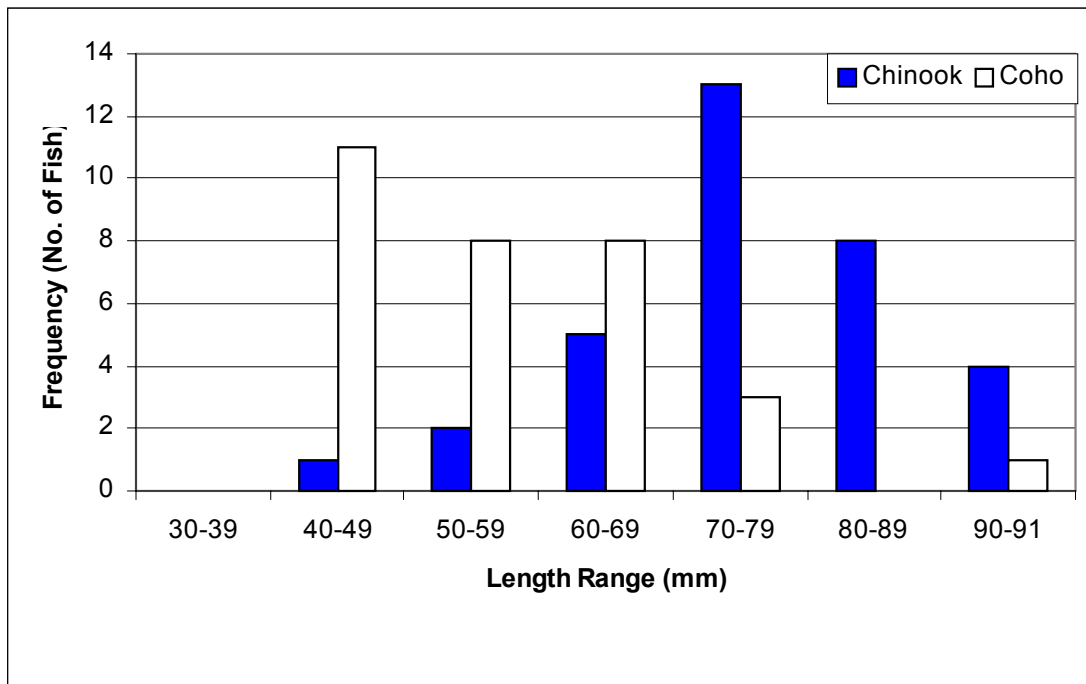


Figure 11 Length-frequency histogram for chinook and coho salmon collected in the Homathko River watershed September 15 – 18, 2000.

4.5 SIGNIFICANT FEATURES AND FISHERIES OBSERVATIONS

4.5.1 Fish and Fish Habitat

During the field data collection program no new critical habitats such as large spawning aggregations, staging areas, or other instances where special protection, enforcement, or management measures might be applicable were identified.

Based on historical fish and fish habitat information, many important populations of salmon, char and trout species use the river systems sampled to varying extents. Habitat of significant importance to almost all of these species is present within mainstem reaches below identified barriers. Major salmon spawning zones have been identified in all mainstem rivers of the watershed sampled especially in the Toba River, which is considered the largest producing salmon stream in DFO's Powell River Sub-District (FISS). Mainstem reaches in these watersheds also provide an abundance of side channels important for rearing and overwintering salmonids. First reaches of tributaries, including smaller ephemeral streams, are present in each watershed sampled and are important habitat for rearing salmonids escaping the high velocities of the mainstem.

4.5.2 Rare/Sensitive Species

During the inventory sampling, Dolly Varden were captured in all of the five watersheds sampled. Coastal cutthroat trout were captured in both the Southgate and Homathko River watersheds. Both of Dolly Varden and coastal cutthroat are blue listed species by the provincial government, giving these fish a status of rare or uncommon. Bull trout, also a blue listed species, has previously been captured in the Homathko River and Southgate River watersheds (ARL 1998; Duanne Jesson, *pers. comm.*, MELP, 2001). Interbreeding of bull trout with Dolly Varden is of particular interest to researchers studying these species and evidence of hybridization in these two watersheds may be of particular importance to fisheries managers with respect to conservation and the issues relating to biodiversity. Although bull trout / Dolly Varden hybrids were captured previously in the Southgate River watershed (ARL 1998), as well as during this study, none have been confirmed in the Homathko River watershed to date.

Previously noted sensitivities of fish stocks are noted in the FISS database. Summer steelhead runs in all project watersheds have not been rebounding despite management initiatives and is of particular concern. The winter steelhead returns, particularly in the Homathko River, continue to be poor. Another noted sensitivity in the Homathko is the spawning behavior of anadromous and resident Dolly Varden, which are believed to alternate spawning years (FISS).

Table 24 Known presence and distribution of freshwater fish species of special concern in project watersheds.

Species	Watershed Distribution and References				
	Toba River	Brem River	Quatam River	Southgate River	Lower Homathko River
Steelhead	Mainly winter run but may be low numbers of summer run. Observed in the Klite River. and lower Toba River (MELP files; observations by Fishery Officer). No confirmed captures during this study.	Winter and summer runs have been found in the mainstem to the confluence with Larson Creek, at approx. km 14. May use Reach 2 of Larson Creek for spawning (Scott 1980). No confirmed captures during this study.	Winter runs present with summer runs suspected. Observed above first falls to km 10.9 (Brown <i>et al.</i> 1977; observations by Fishery Officer). No confirmed captures during this study.	Winter run observed in low numbers at 30.2 km of the mainstem (Brown <i>et al.</i> 1977; observations by Fishery Officer). No confirmed captures during this study.	Winter run spawning mainly below Waddington Canyon but may move above under appropriate flow conditions – early spring low flows (Brown <i>et al.</i> 1977) No confirmed captures during this study.
Dolly Varden	Present to falls at km 62 of mainstem. Presence suspected throughout watershed downstream of these falls. Confirmed to headwaters of Klite R., Filer Ck. and Headwall Ck..	Present in mainstem to headwater areas and to the falls in macroreach 6 of Hillis Ck.. Presence suspected throughout watershed. May be anadromous forms present (Scott 1980).	Resident (fluvial) form most likely distributed throughout the system (MELP files), to cascades in macroreach 40 of the mainstem.	Confirmed presence throughout the watershed to the falls at km 51.5 on the mainstem and cascades at km 12 of Bishop R. (ARL 1999). Confirmed presence within this distribution during this study. Anadromous forms suspected but not confirmed.	Resident (fluvial) form distributed throughout the watershed. Anadromous form spawn up to Waddington Canyon (MELP files). Confirmed presence in lower reaches of several tributaries.
Bull Trout	No noted presence in watershed. None captured during this study	No noted presence in watershed. None captured during this study	No noted presence in watershed. None captured during this study	Confirmed presence throughout the watershed to the falls at km 51.5 on the mainstem and cascades at km 12 of Bishop R. (ARL 1999). Confirmed presence within this distribution during this study.	Confirmed present in Scar Creek ¹ . Voucher identification of bull trout in Smith Creek. Suspected presence throughout the watershed.
Dolly Varden / Bull Trout hybrid	No noted presence in watershed. None captured during this study	No noted presence in watershed. None captured during this study	No noted presence in watershed. None captured during this study	Confirmed presence in several tributaries to the mainstem (ARL 1999). Confirmed presence within this distribution during this study.	No noted presence in watershed. None captured during this study

Species	Watershed Distribution and References				
	Toba River	Brem River	Quatam River	Southgate River	Lower Homathko River
Coastal Cutthroat Trout	Presence noted in the lower reaches of the system (de Hrussochy-Wirth et al. 1977). Most likely anadromous form. None captured during this study.	Resident (fluvial) form most likely distributed throughout the system. May be anadromous forms present (Scott 1980). None captured during this study.	Resident (fluvial) form most likely distributed throughout the system. Observed at 10.9 km (MELP files). Anadromous form angled at mouth. None captured during this study	Present in a number of tributaries (MELP files). Confirmed presence in tributary watershed code - 66700-15500.	Both fluvial and anadromous forms found up to Waddington Canyon (MELP files). Confirmed presence in Coola Ck. and tributary to Heakamie Ck..

- ¹. DNA analysis of tissue sampled from char captured in the Homathko River mainstem, in the vicinity of Scar Creek, concluded that the fish captured were bull trout. Scar Creek is a tributary to the Homathko River entering the river at approximately 38 kilometres upstream of its mouth (Duanne Jesson, *pers. comm.*)

4.5.3 Habitat Protection Concerns

4.5.2.1 Fisheries Sensitive Zones

No specific fisheries sensitive zones were observed during the field data collection program in the Mainland Coast watersheds. However, as previously noted flow conditions in all of the project river systems were comparatively high throughout the period of the field program. As a result, numerous backwater areas and ephemeral streams were present, particularly in association with the first and second order tributaries flowing directly into the mainstems. These seasonal channels and backwaters often contained large numbers of coho fry and appeared to be serving as refuge from the high water/current conditions in the adjacent mainstem reaches.

4.5.2.2 Fish Above 20% Gradients

None of the sites sampled during the inventory were found to have gradients exceeding 20%. Only four sites were found to have gradients of more than 10%. Most sites selected were first reaches of tributaries to mainstems and were located in or near the valley floor of the watershed and therefore had comparatively lower gradients.

4.5.2.3 Restoration and Rehabilitation Opportunities

No specific restoration or rehabilitation options are recommended based on the results and observations generated during the inventory. The Klahoose and Homalco First Nations have been investigating watershed restoration options in the Toba, Quatam and Brem systems with support from FRBC and DFO. Furthermore, the Watershed Restoration Program (WRP) has funded preliminary overview assessment studies prepared by EBA (1998) that analyze potential opportunities for restoration in the Homathko River valley.

4.6 FISH BEARING STATUS

4.6.1 Fish Bearing Reaches

Fish bearing reaches identified during the inventory site surveys are listed in the tables below by watershed. Although not verified in the field, fish bearing status is assumed for a number of reaches based on the presence of fish immediately downstream and the absence of significant obstructions to upstream movement. A number of reaches have also been tentatively categorized as fish bearing since the upstream extent of Dolly Varden, rainbow/steelhead and cutthroat trout distribution remains uncertain pending follow-up sampling.

Table 25 **Summary of data from surveyed fish bearing reaches in the Quatam Watershed.**

Stream name	Watershed Code	Macro-Reach	Species	Channel Width (m)	Site Gradient (%)	Follow-up Sampling	Comments
Quatam River	900-368900	13	CO CC	24	4	N	
Unnamed tributary to Quatam River	900-368900-69900-64000	1	RB DV	11	10	N	
Unnamed tributary to Quatam River	900-368900-73900	2	NFC	10	11	Y	Possible cascade obstruction downstream on tributary or Quatam mainstem

Table 26 **Summary of data from surveyed fish bearing reaches in the Toba Watershed.**

Stream name	Watershed Code	Macro-Reach	Species	Channel Width (m)	Site Gradient (%)	Follow-up Sampling	Comments
Toba River	900-349300	41	CO CH DV	70	1	N	
Toba River	900-349300	54	NFC	31	9	Y	Cascades all throughout reach, located in steep canyon
Klite River	900-349300-03300	1	CC CO RB	41	6	N	
Klite River	900-349300-03300	15	RB DV	32	9	N	
Boyle Creek	900-349300-17500	1	CO	11	4	N	
Filer Creek	900-349300-42200	29	CC CH CO DV	224	1	N	
Filer Creek	900-349300-42200	68	DV	25	6	N	
Filer Creek	900-349300-42200	74	DV	70	2	N	
Headwall Creek	900-349300-42200-60500	1	DV	41	3	N	

Table 27 **Summary of data from surveyed fish bearing reaches in the Brem Watershed.**

Stream name	Watershed Code	Macro-Reach	Species	Channel Width (m)	Site Gradient (%)	Follow-up Sampling	Comments
Brem River	900-357900	20	RB DV	102	2	N	
Brem River	900-357900	27	RB DV	63	2	N	
Brem River	900-357900	29	DV RB	25	2	N	
Brem River	900-357900	36	RB DV	33	6	N	

Stream name	Watershed Code	Macro-Reach	Species	Channel Width (m)	Site Gradient (%)	Follow-up Sampling	Comments
Unnamed tributary to Brem River	900-357900-18600	1	RB DV	15	8	N	
Unnamed tributary to Brem River	900-357900-28300	1	NFC	11	8	Y	Channel present but no water at time of survey
Hillis Creek	900-357900-33900	5	RB DV	15	1	N	
Larson Creek	900-357900-59100	9	NFC	15	3	Y	Cascade and 3m falls in reach 3. FISS map reports probable DV in the area
Unnamed tributary to Brem River	900-357900-71400	4	DV	17	4	N	

Table 28 Summary of data from surveyed fish bearing reaches in the Southgate Watershed.

Stream name	Watershed Code	Macro-Reach	Species	Channel Width (m)	Site Gradient (%)	Follow-up Sampling	Comments
Southgate River	900-404100	137	CH CO DV	104	2	N	
Unnamed tributary to Southgate River	900-404100-07000	1	BT DV	17	7	N	
Unnamed tributary to Southgate River	900-404100-12100	2	DV/BT CO BT DVXBT	96	4	N	
Elliot Creek	900-404100-16200	1	DV CC BT	32	4	N	
Unnamed tributary to Southgate River	900-404100-28700	1	CO CH DV SP	16	2	N	
Unnamed tributary to Southgate River	900-404100-66700-15500	1	RB DV CO TR DV CCT	8	3	N	

Table 29 Summary of data from surveyed fish bearing reaches in the Homathko Watershed.

Stream name	Watershed Code	Macro-Reach	Species	Channel Width (m)	Site Gradient (%)	Follow-up Sampling	Comments
Unnamed tributary to Homathko River	ILP 2	1	CO	6	2	N	
Unnamed tributary to Homathko River	ILP 3	1	CO RL	6	2	N	
Unnamed tributary to Homathko River	ILP 1	1	CT TR	3	13	N	
Homathko River	900-406900	135	CC CH DV LSU	285	3	N	

Stream name	Watershed Code	Macro-Reach	Species	Channel Width (m)	Site Gradient (%)	Follow-up Sampling	Comments
Cumsack Creek	900-406900-00600	1	NFC	25	1	Y	Fish use assumed in this reach due to presence in adjacent Homathko River mainstem
Smith Creek	900-406900-08700	1	CO RB CT DV BT DV/BT	22	3	N	
Unnamed tributary to Homathko River	900-406900-10500-39600	1	NFC	3	13	Y	Cascade at mouth of tributary, flows directly into Heakamie River
Brew Creek	900-406900-16700	1	DV CH	72	5	N	
Brew Creek	900-406900-16700	13	NFC	124	3	Y	Series of cascades on tributary below site
Whitemantle Creek	900-406900-21700	1	CH CC CO	44	4	N	
Unnamed tributary to Homathko River	900-406900-22700	1	CO TR DV CH	10	1	N	
Scar Creek	900-406900-24900	1	DV CH	32	2	N	
Coola Creek	900-406900-28400	2	NFC	32	2	Y	Two fry observed but not captured
Unnamed tributary to Homathko River	900-406900-30300	1	DV TR CO	19	4	N	
Klattasine Creek	900-406900-31500	1	DV	143	6	N	

4.6.2 Non-Fish Bearing Reaches

Information on non-fish bearing reaches surveyed during the Mainland Coast inventory is summarized in the table below by watershed.

Table 30 Summary of data from surveyed non-fish bearing reaches in the Quatam Watershed.

Stream Name	Watershed Code	Macro-Reach	Site Gradient (%)	Electrofishing Specifications				Other Methods		Comments
				Dist. (m)	Time (s)	Cond. (µs/cm)	Temp (C)	Type	Method	
Quatam River	900-368900	40	6	100	305	<10	8			20m Cascade below site on mainstem

Table 31 Summary of data from surveyed non-fish bearing reaches in the Toba Watershed.

Stream Name	Watershed Code	Macro-Reach	Site Gradient (%)	Electrofishing Specifications				Other Methods		Comments
				Dist. (m)	Time (s)	Cond. (µs/cm)	Temp (C)	Type	Method	
Raccoon Creek	900-349300-52900	4	7	200	602	10	8			Cascades located in reach 4
Raccoon Creek	900-349300-52900	6	5	200	611	10	9			Cascades located in reach 4
Raccoon Creek	900-349300-52900	11	6	200	601	<10	8			Cascades located in reach 4
Jimmie Creek	900-349300-67200	5	4	200	469	<10	5			Cascades and 10m falls located in reach 1
East Toba River	900-349300-85000	3	2	200	431	10	5			3km long cascade in reach 1 and 2
Zoltan Creek	900-349300-85000-29300	1	3	150	426	20	4			3km long cascade in reach 1 and 2 of East Toba River

Table 32 Summary of data from surveyed non-fish bearing reaches in the Brem Watershed.

Stream Name	Watershed Code	Macro-Reach	Site Gradient (%)	Electrofishing Specifications				Other Methods		Comments
				Dist. (m)	Time (s)	Cond. (µs/cm)	Temp (C)	Type	Method	
Unnamed tributary to Brem River	900-357900-18600	4	16	202	537	0	12	MT	2 traps, 6 hrs.	10m falls located downstream in reach 3.

4.6.3 Follow-up Sampling Required

Follow-up sampling requirements for non-fish bearing reaches in the Mainland Coast watersheds are listed below in Table 32.

Table 33 Follow-up sampling required for classification of non-fish bearing reaches for Mainland Coast.

Stream Name	Watershed Code	Reach	Timing	Methods	Comments
Unnamed tributary to Quatam River	900-368900-73900	2	Medium flow: Aug. – Sept.	EF, MT	Possible cascade obstruction downstream on tributary or Quatam mainstem
Toba River	900-349300	54	Low flow: July - August	EF, MT	Cascades all throughout reach, located in steep canyon
Unnamed tributary to Brem River	900-357900-28300	1	Medium flow: Aug. – Sept.	EF, MT	Channel present but no water at time of survey
Larson Creek	900-357900-59100	9	Low flow: July - August	EF, MT	Cascade and 3m falls downstream in reach 3. FISS map reports probable DV in reach
Cumsack Creek	900-406900-00600	1	Low Flow: July - August	EF, MT	Fish use assumed in this reach due to presence in adjacent Homathko River mainstem
Brew Creek	900-406900-16700	13	Medium flow: Aug. – Sept.	EF, MT	Series of cascades on tributary below site
Unnamed tributary to Homathko River	900-406900-10500-39600	1	Medium flow: Aug. – Sept.	EF, MT	Cascade at mouth of tributary, flows directly in Heakamie River
Coola Creek	900-406900-28400	2	Low Flow: July - August	EF, MT	Two fry observed but not captured

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