Reconnaissance (1:20,000) Fish and Fish Habitat Inventory
of
Security Creek Watershed
(WSC 950-901300)

Prepared for:

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_____

R.P. Bio.

February 28, 2001

Project Reference Information

FRBC Project Number	717396
FDIS Project Number	202
FRBC Region	Pacific Region
MELP Region	Skeena
MELP District	N/A
FW Management Unit	6-12
Fisheries Planning Unit	N/A
DFO Sub-District	2West
Forest Region	Vancouver
Forest District	Queen Charlotte
Forest Licensee and Tenure #	Weyerhaeuser Company Limited TFL #39
First Nations Claim Area	Council of the Haida Nation

Watershed Information

Watershed Group	Moresby Island (MORI)
Watershed Name	Security Creek
Watershed Code	950-901300-00000
UTM at Mouth	8.681852.5882614
Watershed Area	Approx. 3013ha
Total of All Stream Lengths	92.2 km
Stream Order	4th
NTS Map	103F/1
TRIM Maps	103F.009, 103F.019.
BEC Zone	CWH, MH
Air Photos	MB94003: 306-310, 315-318, 332-334

Sampling Design Summary

Total Number of Reaches	210
Random Sampling Sites	25
Discretionary Sample Sites	9
Total Stream Sample Sites	34
Lakes Sampled	1
Field Sampling Dates	September 8 - October 31, 2000

Contractor Information

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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 classifications, is subject to review by a statutory decision - maker for the purposes of determining whether or not to approve an operational plan.

Acknowledgments

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For technical assistance:

- Staff at the Haida Fisheries Program, Skidegate, including:
  Robert Russ, Christine Bentley, Peter Katinic, Pat Fairweather, Leandre Vigneault and Russ Jones
- Paul Giroux (Fisheries Inventory Specialist, Skeena Region, MoELP, Smithers).
- Lynn Miers, (Data Administrator, Ministry of Agriculture, Food and Fisheries Victoria)
- Sean Cheesman (Spatial Data Technician, Ministry of Agriculture, Food and Fisheries Victoria)
- Gord Oliphant (Data Compilation Biologist, Ministry of Agriculture, Food and Fisheries Victoria)

For providing background information, documents, air photos and maps:

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For quality assurance:

- Lynn Lee (MTE Inc., Tlell BC)

For anecdotal information:

- Jeremy Hyatt (DFO Patrolman, Queen Charlotte City, BC)
- Victor Fradette (DFO Fisheries Manager for Queen Charlotte Islands, Queen Charlotte City, BC)
- Kiku Dhanwant (Wildlife Biologist, Tlell, BC)
- Gord McMahon (Angler and Teacher, Tlell, BC)
- Keith Rowsell (former DFO Patrolman and Charter Boat Operator, Queen Charlotte City, BC)
- Dan Bate (MoELP - Watershed Restoration Program, Queen Charlotte City, BC)

For Funding:

Funding for this inventory project was provided by Forest Renewal BC to Weyerhaeuser Company Limited, Juskatla, BC.

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Attachments from 1999 and 2001 for The Security Creek Watershed Inventory Available at MoELP Office, Smithers

Attachment I- Planning Documents and Reports

Prepared for Phases I, II, and III, the planning document includes the following:

i) A Phase Completion Report (one report for Phases I-III)
ii) Project budget break-down by phase
iii) Project sampling design plan including a brief explanation of the process of site selection used in the planning process
iv) Hardcopy and digital Reach table for all reaches ID'd in project area
v) Hardcopy and digital Lake table for all lakes ID'd in project area
vi) Hardcopy and digital copy of the random sample table.
vii) 1:20,000 Interim maps with sub-basin boundaries, Interim Locator Points (ILPs) reach breaks, sample reaches, known features and known fish distributions.
viii) Reference search and contact list
ix) Digital copy of the reach spreadsheet and sampling design exercise.

The following additional report was prepared for Phase VI:

i) Lake report entitled "Secondary Lake Survey of Unnamed Lake (Security Lake). WSC 950-901300-27190. WBID 00019MORI. (2001).

Attachment II - Hardcopy FISS Update Data Forms and maps, including:

i) Hardcopy FISS update data forms that include new FISS information gathered in Phases I-VI of this project.
ii) Copies of original reference report material that is being updated onto FISS.
iii) Annotated 1:50,000 NTS map (103F/01) and a 1:20,000 TRIM-based map of Security Creek watershed containing portions of TRIM mapsheets 103F.009 and 103F.019. Maps show ID numbers relating to FISS update forms showing historical data updates and data gathered from this inventory project.
iv) E-mail letter from Gord Oliphant verifying the need for 1:20,000 coverage for the FISS update map.

Attachment III - Field Data

i) Field lake, stream, fish cards
ii) Field notes
iii) Field working maps
iv) Paper sounding traces from e-line bathymetric transects from Security Lake.

Attachment IV - Photodocumentation binder that includes:

i) Photo Survey Form 1
ii) A Photo Summary Report printout from the FDIS Database including the CD# and CD image# for each roll and frame.
iii) copies of the photo CD's.
iv) A color photocopy of each thumbnail reference in each CD jacket.
v) All negatives contained in 8½" X 11" plastic sleeves and uniquely labeled.

Attachment V - Digital Data

i) Reports text and all tables and figures in Microsoft Word97 or Excel97 format.
ii) **FDISdat.mdb** data file for FDIS program.
iii) GIS data files from Security Creek GIS mapping.

Meta data delivered	
Project Location	Security Creek Watershed (950-901300)
Map types	Project Overview Map, Fisheries Project Map, Fisheries Interpretive Map
FDIS #	202
Fiscal year delivered	2000-01
Ministry Representative	Paul Giroux
Basemap	TRIM
Accuracy	~20m
Datum	NAD83
Projection Stored	UTM Zone 8
Software format	Arc export
GIS contractor	Nadele Flynn Applied Ecosystem Management Ltd., Suite 100-211 Hawkins St. Whitehorse, YT. Y1A 1X3 Ph. (867) 393-3793
Platform	PC
Delivery medium & reference #	CD # F6200101

Attachment VI - Phase Completion Reports and Quality Assurance Reports

Binders containing hardcopies of:

i) Phase Completion reports for Phases IV, V, VI
ii) Quality Assurance reports from Phases IV, V, and VI.

1.0 INTRODUCTION

In the 2000-2001 fiscal period, the Haida Fisheries Program was retained by Weyerhaeuser Company Limited to carry out Phases IV - VI of a 1:20,000 Fish and Fish Habitat Inventory project for Security Creek watershed on northwest Moresby Island. The work was funded under the inventory program of Forest Renewal BC. Haida Fisheries Program subsequently retained Wildside Biological Consulting to provide a biologist to plan, supervise and carry out the work.

This report is divided into seven main sections:

1) **Section 1.0 (Introduction)** describes the study area and the scope of the study.

2) **Section 2.0 (Resource Information)** describes past and present development and land use in the study area.

3) **Section 3.0 (Methods)** discusses the procedures used in sample site selection and the field inventory.

4) **Section 4.0 (Results and Discussion)** summarizes and describes the data collected during this survey.

5) **Section 5.0 (Major Findings and Recommendations)** outlines some of the main findings from the study and recommends areas requiring further studies to better understand the fish and fish habitat of the study area.

6) **References** contains a list of reference materials used for this project and literature cited in this report.

7) **The Appendices** provide greater detail about specific aspects of the inventory.

1.1 Project scope/objectives

A Reconnaissance 1: 20,000 Fish and Fish Habitat Inventory was undertaken for the BC Ministry of Environment, Lands and Parks (MoELP). Security Creek watershed was selected in 1998 by MacMillan Bloedel Ltd. as a priority areas for the inventory reconnaissance because it represented an area of significant timber value in TFL #39.

Phases I-III of the 1:20,000 Reconnaissance Fish and Fish Habitat Inventory for Security Creek was conducted in the 1998 – 99 fiscal year. MacMillan Bloedel Ltd. was bought by

Weyerhaeuser Company Limited in 1999 and, due to shifting priorities, no work was conducted on the Security Creek inventory in the 1999 – 2000 fiscal year. Phases IV – VI of this inventory project were then completed in the 2000 - 2001 fiscal year.

1.1.1. Pre-field Work

Random sample reach selection was conducted in 1998 using the FDIS 6.5 data entry tool. Data for all reaches found on 1:20,000 TRIM maps and 1:20,000 Forest Cover maps of Security Creek watershed were combined for entry into FDIS 6.5.

Twenty-five out of 210 reaches were selected for random sampling by the FDIS 6.5 program for a total of 12.1%. This low percentage of random sample reaches is a result of two main factors. Firstly, it is partially an artifact of the large percentage of steep reaches in the watershed. Ninety-seven of the 210 (or 46.2%) reaches in the watershed are over 30% gradient and are therefore not considered for sampling by the FDIS 6.5 program. Secondly, the random sampling feature of the FDIS 6.5 program only considers those reaches which are found on the TRIM map base and ignores the unmapped reaches that were added from the Forest Cover maps. This effectively eliminated another 63 reaches (or 30%) of the potential sample pool. This resulted in a random sample size of 25 of 50 eligible reaches or 50%. It was also anticipated that numerous bias sites may be required to help describe the fish distribution in the study area.

1.1.2. Field Work

A total of 34 stream sites were sampled between September 8 and October 31, 2000. Twenty-four of the twenty-five randomly selected reaches were sampled. One random site (reach NID 4716) was not sampled due to difficult access and was replaced by a nearby comparable reach (NID 4704) approximately 500m downstream. Nine discretionary (bias) sites were sampled, one as part of a lake survey and eight others to help describe the fish distribution and fish habitat in the watershed.

A secondary lake survey was conducted on one unnamed primary lake, locally known as Security Lake. Due to its remote location and low likelihood of a future recreational fishery, and after consultation with the Ministry Representative, it was agreed that a secondary lake survey was appropriate for this primary lake. The results of this lake survey are covered in a separate report (Haida Fisheries Program, 2001).

1.1.3. Post - field Work

An updated version of FDIS (version 7.3) was available for the 2000 filed season. Since data was initially entered into a previous version of FDIS (version 6.5), a computer

technician (Lynn Miers) with the Ministry of Fisheries in Victoria performed the necessary upgrade to the database to allow post-field data entry in FDIS version 7.3.

1.1.4. Objectives

The two main objectives were:

1) to describe the species composition and distribution of fishes in the study area; and

2) to document and photograph the physical characteristics of the fish habitat in the study area.

1.2 Location and Access

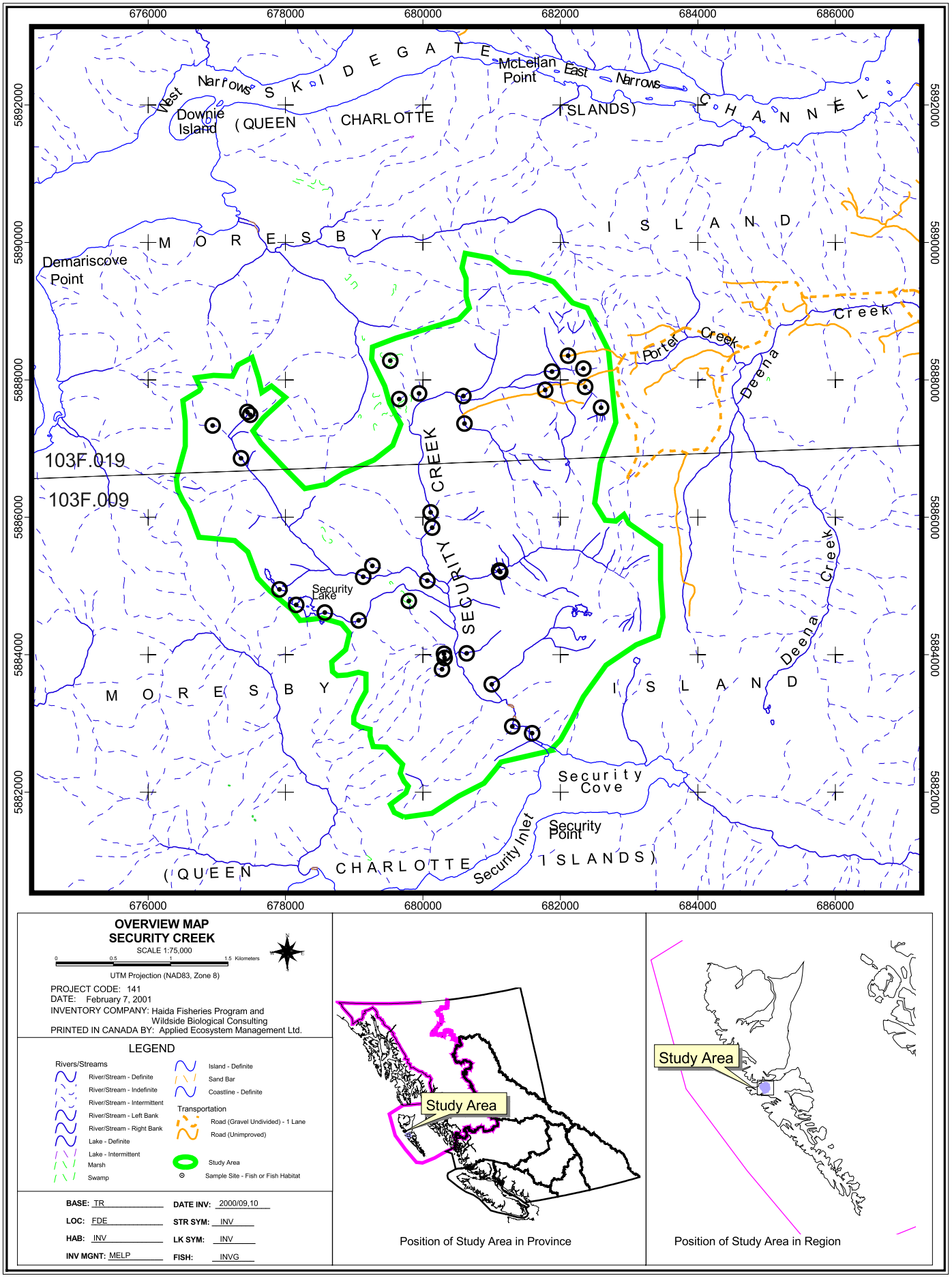
1.2.1. Location

Security Creek watershed covers approximately 3050 hectares of northwestern Moresby Island. Moresby Island is the second largest island in the Queen Charlotte/Haida Gwaii archipelago. Figure 1 shows the location of the study area on northwest Moresby Island. Fisheries and Oceans Canada BC 16 documents refer to the stream as "Security Left-hand Creek" as it flows into the left-hand side of the inlet relative to a vessel moving toward the head of Security Cove.

Based on TRIM map coverage, the mainstem of Security Creek is a fourth order stream. The upper 2.5km of the mainstem of Security Creek flows in a more or less westerly direction. The main channel then turns southward and flows southerly for approximately 5km where it empties into the north shore of Security Cove at the head of Security Inlet.

1.2.2. Access

There is presently no vehicle access to Security Creek watershed. All sites were accessed by helicopter then hiking. The helicopter flight from Queen Charlotte City to Security Creek takes approximately 15 minutes.



OVERVIEW MAP
SECURITY CREEK

SCALE 1:75,000

0 0.5 1 1.5 Kilometers

UTM Projection (NAD83, Zone 8)

PROJECT CODE: 141
DATE: February 7, 2001
INVENTORY COMPANY: Haida Fisheries Program and Wildside Biological Consulting
PRINTED IN CANADA BY: Applied Ecosystem Management Ltd.

LEGEND

Rivers/Streams
- River/Stream - Definite
- River/Stream - Indefinite
- River/Stream - Intermittent
- River/Stream - Left Bank
- River/Stream - Right Bank
- Lake - Definite
- Lake - Intermittent
- Marsh
- Swamp

- Island - Definite
- Sand Bar
- Coastline - Definite

Transportation
- Road (Gravel Undivided) - 1 Lane
- Road (Unimproved)

- Study Area
- Sample Site - Fish or Fish Habitat

BASE:	TR	DATE INV:	2000/09,10
LOC:	FDE	STR SYM:	INV
HAB:	INV	LK SYM:	INV
INV MGNT:	MELP	FISH:	INVG

Position of Study Area in Province

Position of Study Area in Region

2.0 RESOURCE INFORMATION: Development and Land Use

2.1. Logging

The Security Creek watershed study area is significant as it contains one of the largest unlogged areas on northern Moresby Island. One cutblock of less than 40 hectares was logged in the upper Security Creek watershed adjacent to Porter Creek sub-basin of the Deena Creek watershed in 1979. Some shoreline logging may have occurred near the estuary in earlier years, but no significant evidence of this was found. Other than a few crude log helicopter landing pads, probably constructed by mineral exploration crews, the remainder of Security Creek watershed seems to be essentially undisturbed by man.

Security Creek watershed lies within Tree Farm Licence (TFL) #39, currently held by Weyerhaeuser Company Limited (formerly MacMillan Bloedel Ltd.) (Paterson, pers.comm.). In 1979 approximately 34ha (just over 1%) of the watershed was logged near the headwaters, adjacent to Deena Creek watershed. No logging has occurred in the remainder of the watershed (Doucette, pers.comm.). Weyerhaeuser has included four potential cutblocks for logging in the watershed in their 2000-2004 Forest Development Plan.

Approximately 3.8 km of road has been built in the watershed in areas adjacent to the logged section. These roads are currently inaccessible to vehicles due to deactivation and bridge removal of adjacent roads in Deena Creek watershed.

Numerous landslides are present in the watershed and signs of terrain instability are obvious. Three large slides have originated from the slopes immediately above the logged area. Other areas of significant landslide activity are in Colleen Creek sub-basin where extensive natural landslides are present. Heavy rainfall and steep terrain undoubtedly contribute to terrain instability.

2.2. Mining

Mining exploration has been a major activity in the Security Creek watershed at different times since the early 1970's (BC Mines Branch, 2001). Anomalous copper was found in the area in by Efram Specogona in 1971. Prospecting and staking of mineral claims has occurred, mostly in the late 1980's and 1990's.

In 1989, the following activity was reported to BC Mines:

- Doromin Resources conducts geological mapping and sampling early in the year.

- Several mining companies examine the property and in June, it is optioned to Teck Corp.
- Teck conducts an initial program of stream silt sampling in August.
- In the fall, a program of geological mapping, geophysics (magnetometer and VLF-EM) and soil geochemistry [144 samples] is conducted over 27 km of grid line.
- Logging road access (Spur 121?) is partially repaired to allow closer access of drill equipment. In November, Teck Corp. drills 6 diamond drill holes from 2 sites. Both sites are only accessible by foot or helicopter long line (i.e. no helicopter landing pad).

All of the land base in the watershed has been under different mineral claims in the past. Mineral rights claims to most of the area are presently expired. Current mineral titles maps (2001) obtained from B.C. Ministry of Energy and Mines showed the only active mineral claims in the study area are in upper Colleen Creek sub-basin.

Maps and more details about mining activity in the watershed were provided by BC Mines and are included in Appendix 3.

2.3. First Nations Issues

While there is little information available on traditional and present Haida use of the area, the Haida Nation designated the Security Creek watershed as one of their 14 protected areas. The Haida Nation is in stage two of the B.C. Treaty Process and the Security Creek watershed lies within their traditional territory.

2.4. Recreation

No major fisheries are known to occur in the freshwater portion of the Security Creek watershed. Occasionally sport fishermen may travel by boat and hike up the river to fish for coho salmon or steelhead, but no data are available to determine how frequently this occurs. Other than via helicopter, the only other access for sport fishermen is hiking in from Deena West Mainline along deactivated logging roads.

Due to its remote location, Security Creek watershed probably does not receive many other recreational visitors each year. Some boaters may hike upstream from the estuary to camp in the old growth forest and fish for coho salmon, steelhead and/or Dolly Varden char. Wildlife viewing and hunting are also potential recreational activities in the area.

Other than by boat or helicopter, the only other access for recreational users to the watershed, is via the roads from the adjacent Deena Creek watershed. Driving on Deena West Mainline allows a 4X4 vehicle to within 2.5 km of Security Creek headwaters. The

hike into Security Creek from the last de-activated creek crossing would then be over de-activated logging roads.

2.5. Commercial Fishing

Security Creek watershed contains stocks of wild steelhead, coho, pink and chum salmon and Dolly Varden char. No records were found to indicate any stock enhancement or watershed restoration work have ever been performed in the watershed. In some even-numbered years, Fisheries and Oceans Canada (DFO) conducts commercial seine or gillnet fisheries for pink salmon in Security Inlet. Up to 40% of the approximately 350,000 pinks taken in the commercial fishery in 2000 may have been stock from Security Creek as it is one of the largest streams in the area and a major contributor to the catch (Fradette, pers.comm.). Some by-catch of chum salmon is common in the pink salmon fishery.

2.6. Wildlife

Wildlife species are abundant throughout the Security Creek watershed and wildlife sightings were a daily occurrence during the field season.

2.6.1. Furbearers

Indigenous furbearer species on Moresby Island include black bear *(Ursus americanus)*, pine marten *(Martes americana)*, river otter *(Lutra canadensis*) and the Queen Charlotte ermine *(Mustela erminea)*. Black bear, river otter and marten are commonly seen, but the BC Conservation Data Center has "red-listed" the Queen Charlotte ermine. No records of ermine sightings have been confirmed in Security Creek watershed.

Other species of furbearers introduced to the islands by man in the early 1900's that may be found in the area include red squirrel *(Tamiasciurus hudsonicus*), raccoon *(Procyon lotor)* and beaver *(Castor canadensis)*. Beavers are present in the adjacent watershed (Deena Creek) and are expanding their range throughout the islands.

BC Ministry of Environment, Lands and Parks' (2001) trapline map shows Security Creek watershed is divided into two traplines. One trapline covers the southern half of the watershed (0612T021) and another encompasses the northern half of the watershed (0612T009). Both traplines seem to be inactive and show no trapper returns for the 1992 to 1998 trapping seasons.

2.6.2. Cervids

The only cervid known to inhabit the area is the introduced Sitka Black-tailed deer *(Odocoileus hemionus sitka*). Deer sign was observed throughout the watershed during this survey.

2.6.3. Birds

Bird life is abundant in the Security Creek watershed. A variety of passerine and non-passerine land birds as well as waterfowl and raptors also use the area. Although in-depth, comprehensive bird inventories have not yet been conducted, Security Creek watershed contains habitats similar to much of the landscape on the Queen Charlotte Islands/Haida Gwaii and is probably home to dozens of species of birds.

Two "red-listed" species of birds, the Northern Goshawk and the marbled murrelet are known to inhabit the watershed. A wildlife study on Northern Goshawks was conducted in the area in 1998 (Chytyk et al, 1998). One Northern Goshawk was sited in the Security Creek watershed and additional surveys may be forthcoming (Dhanwant, pers. comm.). The forest near middle and lower reaches of Security Creek was identified as a nesting area for marbled murrelets in 1995, 1996 and 1997 (Mc Laughlin, 1997).

2.6.4. Herpetofauna

The only herpetofauna likely to be found in the study area are the Western toad (*Bufo boreas*), an indigenous species and the Pacific treefrog (*Hyla regilla*), an introduced species. Treefrogs were seen or heard regularly, but no toads were observed in this study.

2.7. Other Fisheries Related Work in the Watershed

Most of the existing fisheries information about Security Creek comes from the Fisheries and Oceans Canada (DFO) BC16 files. These annual records go back to 1953 with few gaps. These documents outline the escapement estimates for each year and include comments the DFO patrolman made pertaining to fish habitat, predation and other significant observations.

Prior to initiating logging in the area, MacMillan Bloedel Ltd. conducted a fisheries survey for Security Creek watershed (Pollard, pers.comm.). The results of that survey are presented in a written report (Bruce and Pollard, 1978) and a series of three folio maps, each map showing a different "layer" of information. The folio map layers are: 1) Physical Inventory, 2) Fish Inventory and 3) Sensitive Areas. Their report outlines some of the fish use, and channel characteristics of portions of the watershed. Electrofishing results at three sites are provided and much of the other fish distribution information they provided was based on interpreted fish habitat characteristics. Although their study was in

some ways less thorough than a 1:20,000 Reconnaissance Fish and Fish Habitat Inventory, their results were considered wherever appropriate. Bruce and Pollard (1978) also provided information about the physical parameters of the channel and stream bank stability issues and identified several sensitive areas. They also commented on the potential impacts of logging on fish production in the Security Creek watershed and made some general timber harvesting recommendations.

In 1995 and 1996 Tripp (1996a, 1996b, 1996c) electrofished several streams crossed by the existing and proposed road layout in the upper watershed. Although several of the streams he sampled do not appear on TRIM maps, his data helped to determine fish distribution where appropriate.

Fry trapping data from Macmillan Bloedel's block files is limited to one short section of the North Fork sub-basin (Macmillan Bloedel, 1997; Johnson, pers. comm.). No fish were caught, but the traps were left soaking for 5 days and this is not considered to be a reliable sample.

A report was written detailing the potential impacts of building a proposed logging road along Security and Jason Creeks and boat/barge ramp near the estuary of Security Creek at the head of Security Cove (White, 1997). The report describes the estuarine substrate, flora and fauna at the mouth of Security Creek and provides a brief review of the fisheries values of the watershed.

No Watershed Restoration Program works have been done in the watershed and none are presently planned as it is mostly unlogged (Bate, pers. comm.).

2.8. Existing Water Quality Data

No existing water quality data was found for Security Creek.

3.0 METHODS

This inventory project was undertaken according to British Columbia's Ministry of Environment, Lands and Parks (MoELP) standards and practices described in the Resource Inventory Committee (RIC) manual "Reconnaissance 1:20,000 Fish and Fish Habitat Inventory Standards and Procedures" (Anonymous, 1998). The Reconnaissance 1:20,000 Fish and Fish Habitat Inventory consists of six phases. Phases I, II and III are pre-fieldwork office work, Phase IV is the fieldwork, Phase V is data compilation and Phase VI is reporting and mapping. Photodocumentation starts in Phase II and continues through Phases IV – VI.

3.1 Pre – fieldwork (Phases I-III)

Before initiating any fieldwork, extensive research was undertaken to locate all existing information and documentation pertaining to the study areas (see References and List of Contacts, Attachment 1 viii). The Project Plan (Attachment 1) was written prior to initiation of field work in 1998 and outlines the intended field season and sampling strategy.

3.1.1 Mapping

Terrain Resource Information Management (TRIM) maps in 1:20,000 scale were used as the base maps for the inventory as prescribed in the 1:20,000 Reconnaissance Lake and Stream Inventory Standards and Procedures (Anonymous, 1998) manual. The study area watershed boundaries were outlined based on heights of land and stream locations on the TRIM maps. These hardcopy maps were sent to the GIS contractor for reference. The GIS contractor also received digital TRIM maps on "loan" from MoELP's office in Smithers. Interim Locator Point (ILP) maps of the study area were produced from the digital TRIM base maps by the GIS contractor using a computer program called ArcView. The ILP maps had a 4-digit (ILP) number assigned to the confluence of each tributary according to the *User's Guide to the British Columbia Watershed/ Waterbody Identifier System Version 2.1, RIC 1997.* The ILP numbers were used as reference codes until a 45 – digit watershed code could later be assigned to each tributary in the system. The hard copy ILP maps produced were then used as base maps for the remainder of the project.

ILP Data Sheets that showed the UTM of each ILP were also created digitally by the GIS contractor using ArcView and Microsoft Excel. The ILP datasheets and ILP maps were later sent to Sean Cheesman at the Ministry of Fisheries, Programs and Operations Division, Planning and Information Branch in Victoria to be assigned 45-digit watershed codes.

Color aerial photographs (approximate scale 1:19,000 - flown in 1994 for MacMillan Bloedel Ltd., Ministry of Forests (MOF) Forest Cover Maps and MB (now Weyerhaeuser Company Ltd.) engineering department notes and maps were also studied to attempt to more accurately map the stream network. Changes, additions or deletions to the TRIM base maps were made as necessary. Where discrepancies existed between streams on the TRIM maps and streams on MOF or MacMillan Bloedel's Forest Cover maps, the latter were assumed to be the most accurate.

The watershed map was then divided into sub-basins according to the *Basin Classification Sheet* in the Standards and Procedures Manual (Anonymous, 1998).

3.1.2 FISS Updates

Existing FISS (Fisheries Information Summary System, 1998) data were acquired from the Data Management Section of the Ministry of Fisheries office in Victoria. The data included FISS data forms that showed known fisheries information about the watershed and a (1:50,000 NTS) map showing fish distributions and fisheries related features. Some of the data from FISS was derived from the Fish Habitat Inventory Information Program (1990). A clean NTS mapsheet (FISS update map) was annotated with newly obtained information from the pre-field data search. New FISS data compilation forms were updated according to the FISS Data Compilation and Mapping Procedures Draft 3 (Desrochers, 1997).

The FISS update procedure was continued in Phase V after fieldwork in was completed and new data obtained in this inventory project was added to the map and FISS update forms.

Stream channels shown for Security Creek watershed on the 1:50,000 NTS series maps are oversimplified. NTS maps show only the mainstem of Security Creek and its three major tributaries. TRIM maps plus Forest Cover maps show over 100 additional streams in the watershed. Subsequent discussions with Gord Oliphant (Data Compilation Biologist, Ministry of Agriculture, Food and Fisheries, Victoria) determined the best way to compensate for the additional streams not shown on NTS maps would be to present the FISS update information for the Survey Creek sub-basin on 1:20,000 TRIM - based mapsheets (Oliphant, pers.comm.).

Although TRIM maps more closely reflect the reality of the stream channels in the study area, they too have numerous areas that are mapped incorrectly.

3.1.3 Reach Break Analysis and Sample Reach Selection

Reach break analysis was performed for each sub-basin in the study area. Placement of reach breaks took into consideration numerous factors that are described below. Air

photo and map interpretation were the primary methods used but all additional information gathered, such as traverse notes or personal communication with persons with experience in the area, was considered.

Reconnaissance 1:20,000 Fish and Fish Habitat Inventory projects presently require sub-sampling of all stream reaches in the study area. Sample size (i.e. number of reaches of each type to be sampled) was determined by stratified random sampling using a computer data entry tool called the Field Data Information System version 6.5 (or FDIS 6.5). An instruction manual for FDIS 6.5 was provided by the Inventory Branch at BC Fisheries in Victoria (Field Data Information System, 1998).

FDIS 6.5 is an Oracle database program that uses Microsoft Access for data entry. FDIS 6.5 was provided by MoELP and is specially designed to manage the data generated from fish inventory projects in B.C. The random sample generated by FDIS 6.5 depended on four variables: 1) basin type 2) gradient 3) channel pattern and 4) stream order. All of basin types in the study area fell into the same category, so this criterion was effectively eliminated as a variable. Gradient was broken down into five classes: 1) <4%, 2) 4<8%, 3) 8<20%, 4) 20<30%, and 5) >30%. Stream order had three classes: 1) Small - 1^{st} order, 2) Medium - 2^{nd} and 3^{rd} order, and 3) Large - 4^{th} order or greater. Channel pattern had 3 categories: 1) Straight, sinuous or entrenched, 2) Meandering, and 3) Anastamosed or braided. For these reasons, the reach breaks were usually located at gradient breaks, major stream confluences resulting in a change in stream order, major changes in channel pattern or confinement or some combination of these factors. Other parameters such as known barriers to fish migrations or some other significant feature were also taken into consideration when assigning reach breaks.

Information about each reach was recorded on a "reach table" (Attachment 1-iv) and then entered into the "reach planning" section of FDIS. The FDIS "random sample" feature was used to summarize all the reach data and determine which stream reaches in the study area would be sampled based on the parameters mentioned in the previous paragraph (Attachment 1-vi).

The inventory is designed to establish one sample site in each sampled reach in an attempt to create generalities or make predictions about the fish and fish habitat in the un-sampled reaches, based on similarities in channel characteristics.

After the randomly assigned sample reaches had been mapped, a number of "discretionary" or "bias" reaches were added to the sampling plan to help define the fish distribution in each sub-basin

Reconnaissance helicopter flights were made over the study area in late 1998 to help verify the accuracy of the proposed reach breaks, identify features and to take a series of oblique aerial photographs of the watersheds. The photographs were taken to attempt to capture the general characteristics of the landscape in the watershed as well as some of the prominent features and channel characteristics of each sub-basin.

FDIS "reach cards" were completed for the reaches to be sampled. Reach cards are forms created by FDIS. They incorporated the data from the "reach planning" screen and also provided fields to expand the pre-field reach information about the reaches that were to be sampled.

A sampling strategy was prepared for each sub-basin (Attachment 1). The project plan prepared took into consideration all the information gathered in Phases I, II and III.

3.2. Field Work (Phase IV)

3.2.1. Field Equipment

A list of field equipment used in the fieldwork is provided in Table 1.

Table 1. List of field equipment used in the 1:20,000 Reconnaissance Fish and Fish Habitat Inventory at the Security Creek watershed, Moresby Island, September 8 – October 31, 2001.

Equipment	Make /Model /Style
Electrofisher	Smith-Root/ Model 12A / 10" anode ring
Global Positioning System (GPS)	Garmin / 12XL
Fry Traps	Standard 16.5"x9" Gee traps; .25" and .125" mesh.
pH meter	Oakton / pH Testr2, model WD36524-22
Conductivity meter	Oakton / TDS Testr3 with ATC, model WD356661-30
Compasses	Silva/ Ranger
Hipchain	Hipchain / scaled in meters
Clinometer	Suunto
Thermometer	Pocket cased metal / alcohol -filled / hand-held
Camera	Pentax / Espio 105WR, 38-105mm zoom

3.2.2. Sample Site Location and Size

Sample sites were located a measured distance upstream or downstream of a known point, usually the most practical access point. Air photos, a hipchain and a Silva Ranger compass were used to assist in mapping the locations of the sites onto the TRIM base maps. Whenever possible Global Positioning System (GPS) points were collected to

assist in navigation and in determining the location of sample sites and features. The GPS unit used was a hand-held unit called the Garmin GPS 12XL (Taiwan). GPS locations were entered into FDIS as appropriate.

A minimum of 100 lineal meters of stream length or ten times the average channel width (whichever was greater) was sampled in each sample reach unless the field conditions made this impractical. This included wetland sites with flooded areas or large channel reaches with deep, dark water with mucky organic substrate that made obtaining accurate measurements impractical or dangerous. In those situations, the channel width was estimated.

All site data collected were entered onto an FDIS site card at the site and later entered into the FDIS computer program.

3.2.3. Fish Sampling

Those sites that had a wetted, defined channel were sampled for both fish and physical parameters. Fish sampling was done with an electrofisher and/or minnow traps.

The electrofisher used was a Smith-Root Model XII-A, backpack unit with a 10 - inch diameter anode ring and a "rat-tail" cathode. Voltage settings were typically 300-500 volts with a frequency of 80 hertz and pulse width of 6 milliseconds. Electrofishing sessions began prior to taking physical measurements and started at the downstream end of the sample site and progressed upstream. All available habitat types were sampled while avoiding those areas where spawning salmon or redds could be seen. Fish captured were identified to species, measured to the nearest mm fork– length, and released in relatively quiet water. Fish stunned by the electrofisher but not captured were identified if possible, but those that escaped and could not be identified were tallied as "SP" on the FDIS Fish Card.

Some sites were not electrofished due to improper field conditions. These included proximity to spawning salmon or poor visibility and/or wading conditions (e.g. deep or fast water). In these cases, minnow traps were used for fish sampling. All traps used were standard 16.5" x 9" metal Gee traps. Approximately 80% of the traps had 0.25" mesh and 20% had 0.125" mesh. Usually five traps were set out in prime habitat, baited with salt-cured salmon roe. Soak times ranged from 2.75 to 44 hours depending on logistics and access to the site. Each fish captured was measured and tallied appropriately on the corresponding Fish Card.

An FDIS Fish Collection Form was filled out for each site where sampling took place. Data recorded on the card included geo-referencing information, fish capture methods employed, gear specifications, catch and effort data, water temperature and conductivity. These data were subsequently entered in the FDIS database.

3.2.4. Water Quality

Water temperature was measured to the nearest half degree Celsius at each site using a handheld, alcohol-filled pocket thermometer. Turbidity was estimated visually as either clear, lightly turbid, moderately turbid or turbid.

A clean plastic bottle was rinsed with sample water prior to use and used to collect an undisturbed water sample from each site. The samples were kept cool and analyzed for pH and conductivity within 24 hours. The pH was measured using a hand – held meter called an Oakton pH Testr2, model WD36524-22 (made in Singapore). A hand - held conductivity meter was also used. It was an Oakton TDS Testr3 with ATC, model WD356661-30 (made in Singapore).

3.2.5. Physical Parameters

Physical parameters measured directly in the field were as follows. Channel width and wetted width in each site were the average of at least six measurements, each measurement taken at a riffle-pool crest if possible. Widths were measured to the nearest 0.1m using a logger's tape, hipchain or a graduated pole where appropriate. Residual pool depth was recorded as the difference in depth between the deepest part of the riffle pool crest and the deepest part of the pool immediately upstream. Channel depth was measured to the nearest 0.1m using a graduated pole at three of the six places width measurements were taken. Channel depth was measured at the deepest spot in the channel under a string or tape spanned from rooted edge to rooted edge. If measuring channel widths or depths was too dangerous, a ground estimate was used. Gradient was the average of 2 to 3 measurements per site over the longest visible distances using a Suunto Clinometer. Substrate D95 and D (largest moveable particle) were measured using a ruler or a graduated pole where appropriate. If wading a channel was too dangerous to take measurements of physical parameters, ground estimates were made.

Site Card User Notes (Anonymous, 1998) were used to assist estimates for parameters requiring visual interpretations at the site. These parameters included crown closure, fish cover, large woody debris abundance and distribution, riparian and instream vegetation composition, flood signs, bed materials, bank shape and texture, channel confinement, coupling, channel pattern, islands, bars and the presence of disturbance indicators. In most sites the habitat quality was rated according to the requirements of those species present (or suspected) in the site.

Channel morphology was classified as large channel, riffle–pool, cascade–pool or step–pool according to the guidelines set forth in the Channel Assessment Procedures Field Guidebook (Anonymous, 1995b).

Features such as waterfalls, cascades, logjams and beaver dams which were known or suspected to be barriers to fish migration were photographed if possible and measured for

height and length using a logger's tape, graduated pole or hipchain whenever appropriate. If measuring the feature was too dangerous to attempt, a visual estimate of its size was made.

3.3 Post – fieldwork (Phases V and VI)

Data compilation (Phase V) occurred throughout the field season and continued after fieldwork ended. Prior to entering any field data, our FDIS was upgraded from FDIS 6.5 to FDIS 7.2 by Lynn Miers at the Data Management Branch of BC Fisheries in Victoria. Data from completed site cards and fish cards were entered into the FDIS computer program and exported into Excel97 for analysis. Charts, tables and figures were created for use in the reports written for Phase VI. The field information entered into FDIS was also used to make FISS update forms and create FISS update maps (see section 3.1.2).

The data from the FDIS program was transferred to the TRIM maps using a GIS (Geographic Information System) computer program. The program used was ArcView version 3.2. The digital files containing point feature location information were then sent electronically to a GIS contractor to complete the project mapping requirements. The GIS contractor linked the FDIS database to ArcView to create the final digital and hardcopy GIS maps of the information gathered in the study. When GPS-derived sample site and feature NID locations differed from the stream linework provided on TRIM map coverage, the NID point was placed on TRIM stream linework as near as possible to the GPS-derived point.

In addition to this report, a separate report was written for the secondary lake survey conducted on an unnamed lake, locally called Security Lake (Haida Fisheries Program, 2001). Two Phase Completion Reports were also written, one for Phase IV the other for Phases V and VI. All reports were written in Word97.

3.4 Photodocumentation

Oblique photographs were taken from the helicopter during the reconnaissance flights over the study area in 1998. These photographs were intended to capture the general characteristics of the stream courses and the landscape of the sub-basins. Photographs were also taken of some prominent features.

During the field work, photographs were taken at most sample sites usually upstream from the bottom of the site and downstream from the top of the site. A photograph of the substrate in a typical part of the site was also taken. Other important features such as waterfalls, cascades and logjams were photographed as they were encountered. Representative fish specimens from each sub-basin were photographed. Selected photos

from each site are included in Appendix 1. All photos taken for the 2000 field season are stored digitally on CD #1.

The camera used for this project was a Pentax Espio 105WR with a 38-105mm zoom lens (made in Japan).

3.5. Variations from the Project Plan and/or RIC Standards

See section 4.1. Logistics for discussion of details pertaining to how logistics resulted in variations to the Project Plan.

4.0 RESULTS AND DISCUSSION

4.1 Logistics

The Project Plan proposed in Phase III indicated that two sampling session were planned, one at summer low flows for the larger mainstem reaches to avoid spawning salmon, the other after fall rains had swollen the smaller tributaries. Contractor scheduling delayed the summer sampling session until late August , by which time migrating pink and chum salmon had arrived in the system. This limited electrofishing opportunities in some reaches and some species present may not have been captured at some sites. Furthermore, fry trapping was less effective in some reaches than expected, possibly due to the abundance of loose pink salmon eggs in the system, giving fish more choices of "easy" food.

One random sample reach (NID 4716) was not sampled due to poor access and was replaced by a reach (NID 4704) of similar characteristics flowing into the same tributary and located approximately 500m downstream. Both streams are small first order tributaries to Colleen Creek and have less than 150m of habitat with gradient less than 30%.

One pre-selected bias site was not sampled (Reach NID 4411) due to poor access. This reach was chosen as a bias site because it is potentially fish-bearing (gradient 12%), it is located near the estuary and it is upstream of a steep section (23% reach) that likely contains a barrier. No other stream in the area has similar characteristics and reasonable access. Consequently, this bias site was dropped from the sampling regime.

During sampling of Reach 6 of Security Creek mainstem (Site NID 84005) the channel was found to contain two significantly different habitat types and was therefore split into two sub-reaches. Sub-reach 6.0 is a confined, bedrock-controlled section where bedrock and boulders dominate the substrate and gradient is 2 to 3%. Several cascades located in Reach 6.0 are obstacles to upstream fish movements and seem to be the upstream limit of pink and chum salmon migration. Sub-reach 6.1 is upstream of 6.0 and is a less confined, lower gradient (1%) section where gravels and cobbles dominate the substrate. A bias site was established upstream of the cascades and fish captures confirmed that coho and steelhead are able to navigate past these obstructions and access the upper half of the watershed (Site NID 94005).

Soak times for minnow traps varied depending upon access to the site. Traps set at difficult to access sites, that would have required the extra expense of an additional helicopter trip to retrieve, were checked the same day they were set rather than being left overnight. Soak time for all traps ranged from 2.75 hours to almost 44 hours. Even in sites where traps were soaked a short time, species diversity was usually high and nearly all expected species were captured.

Due to budget limitations, sample sites were sampled only once, even if no fish were captured. A second sampling session to confirm fish absence was usually not possible.

The FDIS database version 6.5 was used for Phases I-III of this project because that was the most up-to-date version when the project began in 1998. The database was upgraded to FDIS 7.3 for Phases IV-VI.

Most GPS readings gathered at features in stream channels in the field did not fall on stream channels on the TRIM maps. The GPS showed UTM readings that, when located on the TRIM base maps in ArcView, were up to 75m from the nearest mapped stream channels. When these features were mapped using ArcView, they were placed on the portion of the stream channel located closest to the UTM derived from the GPS unit in the field as per the recommendation of Tony Cheong (Fisheries Inventory Branch, Ministry of Fisheries, Victoria, BC). Given the abundance of known inaccuracies on TRIM maps for QCI, it is suspected that most of the GPS - derived UTMs logged for certain features may more closely reflect their actual whereabouts than their positions indicated on the TRIM – based Project Map and Fisheries Interpretive Map. Field tests with the Garmin 12XL found it to be accurate within 10m over 70% of the time and within 20m over 90% of the time (Reindl, 2001).

The project plan had originally divided the watershed up into seven third order sub-basins, the 4th order mainstem of Security Creek and grouped all the first and second order tributaries to the mainstem. When the watershed codes were returned from Sean Cheesman (MOE, Victoria), it was concluded that the mainstem of upper Security Creek was different than the interim map and project plan had outlined. The result was that the boundaries of the four third order sub-basins in upper Security Creek were modified into five, totaling eight. Table 2 provides a breakdown of the actual sampling regime by the newly defined sub - basins.

Table 2. Reach totals - Security Creek separated by sub-basins. Random sites were generated by FDIS. Discretionary sites were used to assist in describing fish distribution and as lake inlet and outlet reaches.

Sub-basin	Order	# of reaches	# of random sites	+	discretionary sites	= total
Canyon Creek	3rd	14	3		1	4
Zim Line Creek	3rd	31	8		0	8
Colleen Creek	3rd	37	1		1	2
Upper Security Creek						
North Fork	3rd	17	1		0	1
Northeast Fork	3rd	11	1		0	1
Southeast Fork	3rd	8	2		0	2
South-central Fork	3rd	10	1		0	1
Southwest Fork	3rd	11	0		1	1
Mainstem Security Cr.	4th	12	2		3	5
1st & 2nd order mainstem tribs		59	6		3	9
TOTALS		**210**	**25**	**+**	**9**	**total 34 sites**

It should also be noted that the Watershed Codes provided by Mr. Cheesman do not always follow the expected numerical hierarchy. Mr. Cheesman explained the reason for this is that some of the streams in the project area had already been assigned WSCs prior to this project. Rather than re-assign new WSCs to the streams following the expected heirachy, the previously assigned WSCs were retained (Cheesman, pers. comm.).

4.2 Summary of Watershed Biophysical Information

Table 3 summarizes the biophysical information compiled for the Security Creek watershed study area. Note that only two small areas on top of the mountains on the east side of the watershed are in the Mountain Hemlock (MH) biogeoclimatic zone and the remainder is Coastal Western Hemlock (CWH).

Table 3. Summary of biophysical information for the Security Creek study area for 1:20,000 Reconnaissance Fish and Fish Habitat Inventory project, September 8 – October 31, 2000.

Gazetted Name	Watershed Code	UTM at mouth	Water-shed Area approx. (ha)	Stream length (km)	No. Of Reaches	Stream order	TRIM maps	BEC zone	Lake names	Wetlands
Unnamed Creek (alias Security Creek or Security Left-hand Creek)	950-901300-	8.681852.5 882614E	3013	92.2	210	4	103F.009, 103F.019	CWH, MH	8 lakes; all unnamed, approx. 10ha total	9 areas; approx. 15ha total

4.3 Habitat and Fish Distribution

4.3.1. Security Creek Mainstem Valley

The mainstem of Security Creek contains the majority of the most important fish habitat in the watershed. The stream flows through old growth forest and excellent spawning and rearing conditions exist for salmonid species throughout most of the valley flat. Cover is generally abundant and diverse. Off-channel areas provide fish refuge from

high flows. Average gradient of Security Creek mainstem from the estuary to the base of the mountains near the headwaters is less than 2 percent. Most of the mainstem of Security Creek has a substrate dominated by gravels with only short sections dominated by larger (Reach 6.0) or smaller (Reach 9) particle sizes. Reach 6.0 contains four cascades ranging from 0.5 to 1.5 m in height and these seem to be a barrier to upstream migration of pink and chum salmon. Coho salmon, steelhead and anadromous Dolly Varden char are able to pass these obstacles and access suitable habitat in the upper half of the watershed.

Older TRIM maps show a discontinuity of the stream channel at Reach 9 of the Security Creek mainstem, including part of upper Security Creek drainage as the headwaters of adjacent Porter Creek sub-basin of Deena Creek. Field observations showed the main channel of Security Creek continues through this area and it should therefore be considered as the mainstem of Security Creek. New Watershed Codes (WSCs) assigned to Security Creek watershed by Sean Cheesman's office (Ministry of Fisheries, Victoria, BC) concur with this finding. Further explanations follow in sections 4.3.7 and 4.3.9 below.

The first reach of almost every tributary to the mainstem visited had good fish habitat and was used by anadromous and possibly resident fish. Quality of fish habitat in tributary stream reaches was poorer as they progressed upstream away from the mainstem valley flat. The valley flat is mostly between 400m and 700m wide and the surrounding terrain is rugged. Gradient of most tributary streams increases rapidly upstream of the valley flat. More detail about each sub-basin is provided below.

4.3.2. First and Second Order Mainstem Tributaries

Several first and second order tributaries to Security Creek mainstem were sampled and, in most cases, only the first reach of the tributary seemed to possess good fish habitat. Even though suitable accessible habitat was usually found in the first reach, at some sites no fish were caught. However, these reaches are probably used by fish at certain times and may provide important overwintering habitat. This finding demonstrates the need for multiple sampling sessions to confirm fish absence in any stream.

In most cases the barrier to fish migration in tributary streams in the watershed is a steadily increasing gradient as the stream channel extends away from the valley flat and the valley walls steepen. Upstream of the first reach, as channel gradient increased, quality of habitat decreased accordingly. Barriers to anadromous fish appear to be located within 1km of the mainstem on almost all tributaries sampled, but the exact upstream limits of fish in most of these systems have not yet been defined.

4.3.3. "Canyon" Creek Sub-basin (WSC 950-901300-25541)

The first 3rd order tributary on the west bank upstream of the estuary of Security Creek was called "Canyon"Creek for the alleged canyon it was reputed to flow through. No canyon was observed in this study although one may exist further upstream than sampling crews traveled. The lower reaches provide very good rearing areas and spawning gravel. Several three to five meter high cascades prevent pink and chum salmon from using more than the lower few hundred meters of the sub-basin. Above the cascades the gradient increases and coho fry numbers diminished as the gradient increased to over 8%. Dolly Varden were found in the sites sampled in marginal habitat reaches as gradient increased to over 12%. Exact upstream limits of fish species presence in each tributary were not established, but the terrain becomes more rugged and it appears that habitat quality declines further upstream in each tributary. Further sampling is required to determine upstream limits in this sub-basin.

4.3.4. Zimline Creek Sub-basin (WSC 950-901300-30200)

Zimline Creek is the second west bank 3rd order sub-basin upstream of the estuary of Security Creek. Reach 1 of Zimline Creek is a major spawning area for pink salmon and to a lesser extent for chum salmon. One sockeye adult was observed mixed in with the pink salmon. Coho salmon, Dolly Varden char and trout fry (probably steelhead) were also present and those species may spawn in the area as well. Reach 2 contains cascades and three major waterfalls that prevent anadromous fishes from migrating upstream. Although suitable habitat exists for Dolly Varden char upstream of the falls, no fish were captured at any of the five sites sampled in the upper sub-basin. Re-sampling at a different time of year is required to verify fish absence above the falls on Zimline Creek sub-basin. Although Bruce and Pollard (1978) indicated that they suspected resident fish above the falls in this system, they did not sample the area and appear to have based their fish distribution on habitat characteristics only.

4.3.5. Colleen Creek Sub-basin (WSC 950-901300-28000)

Colleen Creek flows into Security Creek mainstem from the east, just upstream of Zimline Creek confluence. Historical records (FISS) indicate pink and coho spawn in the first reach. Numerous major landslides have occurred from the north slope above Colleen Creek in past decades. A series of major debris jams in upper reach one and the lower part of reach two plug the channel and prevent anadromous fish from accessing the upper reaches. Two adult coho were observed under the downstream-most jam, but none were seen above that point. DollyVarden char were the only fish species captured at sample sites upstream of the debris jams.

It is unknown if the streambed under the jams had barriers to fish migrations prior to formations of the jams. If the barriers are temporary, it appears that suitable habitat for Dolly Varden and possibly coho and steelhead may be present to the top of Reach 2. Additional sampling is required to find the present upstream limits of fish in the system.

4.3.6. North Fork (WSC 950-901300-62800)

The only site sampled in the North Fork was in Reach 1. The area contains excellent spawning and rearing habitat and coho, steelhead and Dolly Varden were present. Tripp (1996c) located a 7m falls in Reach 2 and caught no fish when he electrofished upstream of the falls. Additional sampling is required to verify fish absence above the falls.

4.3.7. Northeast Fork (WSC 950-901300)

The Project Plan from Phase III considered this stream to be a tributary of Security Creek. When assigning the watershed codes to the study area, Sean Cheesman (Ministry of Fisheries, Victoria, BC) concluded that this stream should be considered the mainstem of Security Creek. Upper Reach 8 was sampled and was found to have excellent rearing and very good spawning areas for coho and Dolly Varden. Reach 9 has a large channel morphology and is an excellent rearing area. Habitat quality diminishes upstream in the tributary reaches further from the valley flat throughout the logged area. Landslides in the area have affected stream flow patterns.

4.3.8. Southeast Fork (WSC 950-901300-67903)

The southeast fork flows into the upper mainstem of Security Creek from the southeast. The first reach crosses the mainstem valley flat and has good spawning and rearing areas for coho and Dolly Varden. Gradient increases and habitat quality decreases further upstream. The upstream limits of fish in this system have not yet been defined.

4.3.9. South-central Fork (WSC 950-901300-64357)

Originally this stream was classified as the mainstem of Security Creek. Discussions with Sean Cheesman (Ministry of Fisheries, Victoria, BC) indicated that this should be a tributary rather than the mainstem. The lower reaches contain good spawning and rearing habitat and the habitat quality decreases as the channel progresses upstream away from the valley flat and gradient increases. Coho and Dolly Varden were captured in the lower

part of the site (NID 84008) immediately upstream of the road crossing, but as the gradient increased and substrate shifted from cobble-gravel to cobble-boulder farther upstream, only Dolly Varden were captured. The upstream limits of fish in this system have not yet been defined.

4.3.10. Southwest Fork (WSC 950-901300-60046)

The Southwest Fork flows from the south into Security Creek mainstem near the same point that the North Fork enters on the opposite bank. Even using GPS, the field crew had a difficult time navigating in this area and it is suspected that there are errors on the TRIM maps of the area where the channels meet. The lower part of Reach 1 is good spawning and rearing habitat for coho and Dolly Varden and, again, habitat quality decreases further upstream. The upstream limits of fish in this system have not yet been defined.

4.3.11. Barriers to Fish Migration

Table 4 lists and describes barriers to upstream fish migration located in the Security Creek study area. Other barriers may exist in areas not visited in this survey.

Table 4. Summary of historic and new barriers to fish migration found in Security Creek watershed. All watershed codes start with 950-901300-.

Stream name	Watershed Code	TRIM map #	Reach	Barrier Type (NID)	Height of barrier (m)	Verified in Field	Description of Barrier
Security Creek	-00000-	103F.009	6.0	Cascade (74005)	1.5	yes	Bedrock controlled chute. Barrier to pink and chum salmon. Coho, steelhead and Dolly Varden caught upstream.
Unnamed Trib. To Security Creek	-22987-	103F.009	1	Falls (64106)	6	yes	Bedrock controlled. Barrier to coho and probably all anadromous fishes. No fish caught upstream.
Unnamed Trib to Trib to Security Creek	-25541-14016-	103F.009	1	Falls (64204)	6	no	Gradient is 27% in reach upstream. Location of barrier needs to be confirmed.
Unnamed Trib. To Security Creek	-25541-	103F.009	1	Cascade (64200)	4	yes	Barrier to pink and chum salmon. Coho and Dolly Varden found upstream.
Unnamed Trib. To Security Creek (Zimline Creek)	-30200-	103F.009	2	Falls (64401, 74401)	8	yes	Bedrock controlled section with 2 sets of 8m falls. Barrier to all anadromous fishes. No fish caught upstream.
Unnamed Trib. to Security Creek (Colleen Creek)	-28000-	103F.009	2	Debris Jam (54701)	5	yes	Largest and upstream-most of 5 major debris jams in stream. Barrier to anadromous fish. One or all of the other 4 jams downstream may also be barriers. Dolly Varden caught upstream.
Unnamed Trib. to Security Creek (outlet to Security Lake)	-27190-	103F.009	6	Falls (64305)	25	yes	No fish caught upstream or in reach immediately below falls. Probably another barrier exists downstream, but its location must be confirmed.
Unnamed Trib. to Security Creek	-62800-	103F.019	2	Falls (64501)	7	no	From Tripp (1996). He caught no fish upstream. Probable barrier, but needs to be confirmed.

4.4 Fish Age, Size and Life History

A total of 34 stream reach sites were sampled for fish in the study area. Fish were captured at 18 of the 34 sites and almost all sites with fish had at least two species present. No fish were caught at 16 of the sites. Twenty-seven stream sites were electrofished and seven sampled with fry traps. The Ministry Representative indicated that DNA samples and fish aging were not required for this project.

A summary of all fish captured in the study is shown in Table 5. The numbers of fish captured for each species were not high enough to warrant presenting separate data for each of the 10 sub-basins.

Coho salmon (CO) and Dolly Varden char (DV) were the most abundant and widespread species captured in the study. Rainbow trout (RB) captured are presumed to be progeny of anadromous fish (i.e. steelhead). Thousands of pink salmon (PK) and dozens of chum (CM) salmon were visually observed migrating and spawning in the lower reaches of the watershed. A single sockeye (SK) was observed mixed in with the pink salmon spawners in reach one of Zimline Creek.

No cutthroat trout (CT) or sculpins were found in this study, although FISS data indicates their presence. Section 4.4.7 discusses cutthroat trout in more detail. No confirmed reports of cutthroat trout were found for Security Creek watershed, but Bruce and Pollard (1978) captured sculpins. The three small trout fry that could not be identified to species were labeled as TR.

Table 5. Summary of length data from fish species captured and observed in each sub-basin of the Security Creek watershed, September 8 – October 31, 2000.

Sub-basin name	**Watershed Code** (950-901300-	**No. of sites**	**No of sites with fish**	**Fish Species captured or (observed)**	**Number of Fish measured (observed)**	**Mean Length (mm)**	**Range of Lengths (mm)**
Security Creek Mainstem	-00000-	5	5	CO juveniles CO adults CM DV PK RB TR	78 (4) (dozens) 62 (hundreds) 8 2	62.6 (450) (600) 109 (450) 108.4 45.5	35 - 111 (300–900) (450–900) 56 - 300 (300-600) 77 – 175 45 - 46
1st and 2nd order mainstem tributaries	various	9	2	CO DV	33 3	57.4 67.3	40 – 85 58 - 78
Canyon Creek	-25541-	4	3	CO DV	10 17	73.2 91.8	46 – 135 50 - 124
Zim Line Creek	-30200-	8	2	CO (CM) DV (PK) SK TR	1 (dozens) 1 (hundreds) 1 1	64 (~600) 114 (~450) 800 54	64 (450-900) 114 (300-600) 800 54
Colleen Creek	-28000-	2	2	DV	19	82.9-	58 - 113
North Fork	62800-	1	1	CO (juv.) CO (adult) DV RB	35 2 14 3	55.9 325.0 75.1 98.0-	40 – 96 300 – 350 49 – 114 97 – 100
Northeast Fork	-00000-	1	0	NFC	-	-	-
Southeast Fork	-67903-	2	1	CO DV	5 6	74 – 96 49 - 94	85.5 64.5
South-central Fork	-64357-	1	1	CO DV	1 4	71 100	71 75 - 120
Southwest Fork	-60046-	1	1	CO DV	7 10	61.4 100.5	55 - 72 53 - 270

4.4.1. Coho Salmon

Coho salmon (*Oncorhynchus kisutch*) fry were captured throughout the low gradient reaches of the study area (Appendix 2c). A total of 170 juvenile coho were measured. The peak in abundance of fish in the 40-49mm size class in the histogram in Figure 2 probably represents the 0+ age class. It is likely that some of the larger coho juveniles (over 70mm long) represent older age classes, but no fish aging was conducted to confirm this. The two largest coho juveniles captured were 130 and 135mm long and were found upstream of the cascade in lower "Canyon" Creek. These two fish were bright silver and appeared to be ready to smolt (CD 1 Image 113). It is unusual to catch coho over 120mm long in stream on the islands at this time of year (October 3). Further study of the life history of these fish could provide some interesting information.

Data from DFO's BC 16 reports for Security Creek provide escapement estimates from 1953 to 2000. Numbers given show estimates of up to 3500 for coho in the 1960's, but escapement estimates for coho are less than 200 spawners for almost every year counted since 1984. This low number of returning fish indicates that the coho stock is potentially vulnerable to impacts form habitat alterations or overfishing. DFO's target escapement for coho in Security Creek is 2000 spawners.

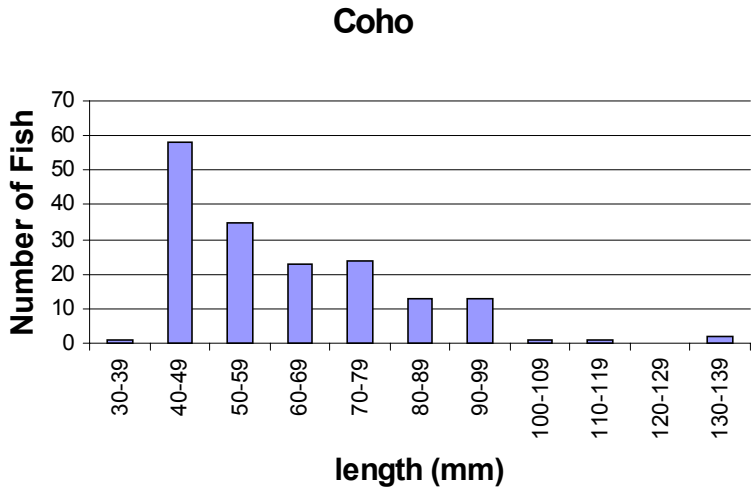


Figure 2. Length-frequency histogram of sampled coho salmon from Security Creek watershed, September 8 - October 31, 2000. n=170.

4.4.2. Rainbow Trout (steelhead)

Rainbow trout (*O. mykiss*) were identified only in the 4th order mainstem and the first reach of some of the larger third order tributaries in Security Creek watershed. Since no confirmed records of resident rainbow trout have been found for any stream on the Queen Charlotte Islands, it is assumed that these fish are progeny of anadromous fish, that is, steelhead. The upstream limit of steelhead in Security Creek watershed has not been accurately defined, but specimens were captured in reach one of the "North Fork" (WSC 950-901300-62800) near where it enters Reach 8 of the mainstem of Security Creek.

The low numbers of steelhead captured in the study (N=11) make it difficult to interpret possible age classes from the length - frequency histograms in Figure 3. It is not possible to determine if the lack of captured fish under 70mm in length is indicative of poor recruitment in 2000, rapid fry growth, insufficient sampling intensity or some other factor or combination of factors. It is probable that the three fry under 54mm long, identifiable only as trout, were steelhead, because there are no confirmed reports of cutthroat trout in the watershed.

Since relative numbers of steelhead captured is less than 10% of the number of coho captured, it is likely the steelhead population is also probably very low in the watershed and this species may also be vulnerable to impacts from habitat alteration or overfishing.

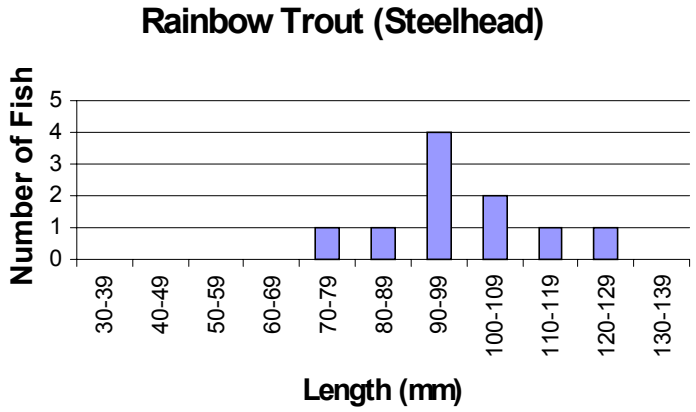


Figure 3. Length-frequency histogram of sampled rainbow trout (steelhead) from Security Creek watershed, September 8 - October 31, 2000. n=11.

4.4.3. Dolly Varden Char

Dolly Varden char *(Salvelinus malma)* were the most widely distributed fish in the watershed and were found at almost all of the fish-bearing sites. Dolly Varden were also

found in reaches a short distance upstream or downstream of the few sites where no Dolly Varden were captured and are very likely present in those reaches as well. Some Dolly Varden were inhabiting streams upstream of barriers to anadromous fish and must spend their entire lives in fresh water (e.g. in upper Colleen Creek).

The field crew were somewhat surprised to capture no fish in large areas of seemingly suitable Dolly Varden habitat. For example, no fish were captured at five sample sites above barriers in lower Zimline Creek sub-basin). Similar streams above bedrock barriers located at about the same elevation (approximately 100m above sea level) in adjacent Deena Creek watershed have healthy populations of Dolly Varden (Reindl, 1998).

Dolly Varden char present in water accessible to anadromous fish may represent separate populations of resident and anadromous fish, but more data collection (e.g. DNA sampling and analysis) is required to verify this.

A total of 136 Dolly Varden char were captured and measured in the study area. The histogram in Figure 4 shows a peak in the numbers of Dolly Varden between 70-90mm long and another peak in the 110-119mm size class. These peaks may represent the 0+ and the 1+ age classes respectfully, but no fish were aged to confirm this.

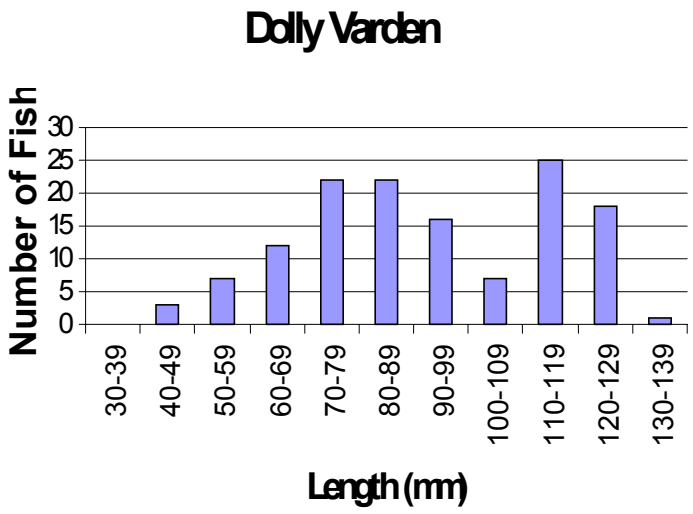


Figure 4. Length-frequency histogram of sampled Dolly Varden char from Security Creek watershed, September 8 - October 31, 2000. n=136.

4.4.4. Pink Salmon

Thousands of pink salmon (*O. gorbuscha*) were observed in Reach 2 of the mainstem and Reach 1 of Zimline Creek in the first week of October, 2000. BC 16 figures indicate most pink salmon spawners in Security Creek follow the usual pattern for pink salmon on the Islands, spawning in even-numbered years. The average escapement given for the even-numbered years from 1954 to 1996 is 18,911 adult spawners (range 1400-60,000). Odd – year escapements of pink salmon are usually less than 30 fish. Conversations with the DFO patrolman who regularly walks the stream revealed that most of the pinks spawn in the mainstem from Reaches 2 through 5 and that they are unable to pass the cascades in Reach 6.0 (Hyatt, pers.comm.). Main spawning areas in tributaries are in the lower parts of the first reaches of the larger tributaries (i.e. "Canyon" Creek, Zimline Creek and Collen Creek).

A commercial seine and/or gillnet net fishery in Security Inlet is usually held in mid to late August of even-numbered years. This fishery typically targets pink salmon destined for nearby streams including Security Creek, Jason Creek, MacKenzie Cove Creek and Kaisun Creek. The stocks are usually mixed at this point and it is difficult to determine accurate harvest statistics for individual streams that flow into Security Inlet (Fradette, pers.comm). DFO has an escapement target of 40,000 for pink salmon in Security Creek. According to BC16 data, 1998 and 2000 were the first two years since the early 1970's this target has been met or exceeded with a harvestable surplus.

4.4.5. Chum Salmon

Dozens of chum salmon (*O. keta*) were visually observed mixed in with the spawning pink salmon. According to the DFO patrolman, Security Creek chum usually spawn in more or less the same areas as pink salmon. BC 16 escapement records for chum for 1953 to 1999 averaged 2348 and ranged from 50 to 15,000 spawners. Some chum salmon are usually caught as by-catch in the pink salmon fishery, but they are not usually targeted unless escapement numbers are high. DFO's target escapement for chum salmon in Security Creek is 15,000 spawners.

4.4.6. Sockeye Salmon

One adult sockeye salmon (*O. nerka*) was observed mixed in with the pink salmon spawners in lower Zimline Creek. Although inconsistent, it is not uncommon to see a few adult sockeye in streams on the islands that are not lake-fed. It is unknown if these fish are a riverene stock of sockeye native to this stream or progeny of fish from a nearby lake-fed stream that have temporarily strayed into the watershed. It is well established that most sockeye tend to spawn in lake-fed systems. Security Creek is not considered to

be a lake-fed system as far as sockeye are concerned as all lakes in the watershed are upstream of barriers to anadromous fishes.

4.4.7. Cutthroat Trout

No cutthroat trout (*Salmo clarki*) were seen in this survey. FISS records indicate that cutthroat trout are present in the system and these records appear to refer to the report by Bruce and Pollard (1978). On reading this report, it appears that in their sampling efforts, no cutthroat trout were actually caught. Their reference to cutthroat trout in the report seems to be that they felt the habitat in portions of Security Creek is suitable for cutthroat trout, and that they suspected their presence, but no evidence of cutthroat trout presence was confirmed. Based on the extent of fish sampling conducted in the watershed in this study, (34 sites; over 11,000 seconds of electrofishing and over 1100 hours of fry trapping) the presence of cutthroat trout in Security Creek is questionable. It is possible, however, that cutthroat trout may use parts of the watershed occasionally or seasonally.

Further investigation has revealed that cutthroat trout are not common in streams that flow into the west coast of the Queen Charlotte Islands/Haida Gwaii. Anadromous coastal cutthroat trout are common in many streams that flow into Hecate Strait, Masset Inlet and Skidegate Channel. Although anadromous cutthroat trout are thought to spend the saltwater portion of their lives in the estuary, it is unknown how far they may travel. Although the upper reaches of Deena Creek (which has cutthroat trout) are less than 1km from upper Security Creek over land, a trout leaving the Deena Creek estuary would have to swim approximately 60km to reach the mouth of Security Creek. It is unknown how likely this would be. A few individuals are willing to say that they believe they have observed cutthroat trout swimming in west coast streams, but have not actually held one in their hands for positive identification. Visual observations of cutthroat in the lower reaches of Security Creek have been reported (Rowsell, pers.comm.) but no fish were actually captured to confirm the sightings. The only first-hand reports obtained from someone who has held cutthroat trout from west coast streams are from the head of Louscoone Inlet on southwestern Moresby Island (approximately 160km south of Security Creek) and from Otard Creek on northwestern Graham Island (approximately 110km north of Security Creek) (McMahon, pers.comm.).

4.4.8. Sculpins

Coastrange sculpins (*Cottus aleuticus*), and to a lesser extent prickly sculpins (*C. asper*), are common in the low gradient stream reaches accessible to anadromous fish on the Queen Charlotte Islands / Haida Gwaii. Although no sculpins were caught in this survey, Bruce and Pollard (1978) found sculpins in the lower mainstem of Security Creek and as far upstream as the first reaches of Colleen Creek and Zimline Creek. They were not identified to species.

4.5 Significant Features and Fisheries Observations

4.5.1. Spawning Habitat

Spawning gravel is abundant in the lower reaches of Security Creek mainstem and the first reach of most major tributaries in the watershed. Thousands of spawning pink salmon were observed in the vicinity of sites NID 84001, 84200 and 84400. Poorer quality spawning habitat is found in the bedrock and cascades section in reach 6.0. Good spawning habitat is also found upstream of Reach 6.0 in Reaches 6.1 to 8 of the mainstem, and in the lower reaches of upper mainstem tributaries in areas accessible only to coho, steelhead and Dolly Varden.

Much debris has entered the watershed from slides that have occurred in the Colleen Creek sub-basin. What effect these slides have had on spawning habitat in the watershed has not yet been determined. The original project plan for Phase IV had bias sites planned for the mainstem reaches of Security Creek upstream and downstream of the confluence of Colleen Creek to attempt to compare the habitat quality upstream and downstream of the effects of those natural slides. The Ministry Representative felt this level of sampling was beyond the scope of the 1:20,000 Reconnaissance Fish and Fish Habitat Inventory so those bias sites were dropped.

Most of the DFO patrolmen's walks (for BC 16's) of Security Creek over the years have concentrated on the lower 5km of the mainstem. Migration patterns of fish travelling to spawn in the upper reaches are not well documented, and it is unknown how much spawning activity each area receives at different times during the various runs.

4.5.2. Fisheries Sensitive Zones

Much of the mainstem of lower and upper Security Creek valley flat is susceptible to overbank flooding and some areas undoubtedly contain areas of off-channel habitat used by fish at certain times of the year.

Due to the sub-sampling nature of the 1:20,000 Reconnaissance Fish and Fish Habitat Inventory, it is not possible to walk all of the stream channels and map out each individual Fisheries Sensitive Zone. The Fisheries Sensitive Zones shown on the Project Map and Fisheries Interpretive Map are therefore general areas, and it is recommended that further studies be conducted to carefully map the individual Fisheries Sensitive Zones in Security Creek watershed.

Bruce and Pollard (1978) identified several sensitive areas in their report, including the entire mainstem downstream of the confluence with Colleen Creek and Reach 1 of Colleen Creek. They stated that the reaches have high fish production potential, yet have relatively low channel and bank stability and high potential for sediment production. They also expressed concern about the extensive side channel rearing areas. They

indicated that adding additional quantities of sediment and debris to the channel may accelerate erosion (by deflecting flow to unstable banks) and/or block fish access to side channel rearing areas. Bruce and Pollard (1978) also mention potentially sensitive areas in the valley flat upstream of the bedrock section (in Reach 6.1) all the way to the headwaters.

4.5.3. Fish above 20% Gradients

No fish were found at gradients over 20% in this survey. Three sites sampled had an average gradient over 20%. Reindl and Tripp (1997) captured Dolly Varden in reaches with gradients up to 23% and cutthroat trout in reaches with gradients of up to 26% in adjacent Deena Creek watershed. Several unsampled tributaries to Security Creek have gradients up to 26% and these have been defaulted to fish bearing status (dashed red-line) on the Fisheries Interpretive Map in Appendix 2c. If the 20 - 30% reaches flow intermittently or are upstream of impassable barriers they have been colored with a dashed blue line on the Fisheries Interpretive Map, indicating they are probably not fish bearing, but must be adequately sampled to confirm fish absence.

4.5.4. Rare Fish Stocks

Information obtained from the B.C. Conservation Data Center (1998) in Phase 1 of this project reported three rare plant species and one rare mammal species from the Security Creek watershed, but no records for rare fish species.

Dolly Varden char (*Salvelinus malma*) are widespread in the Security Creek watershed and are one of the species added to the BC Conservation Data Center's "blue list" of rare and endangered species in 2000 (Donovan, pers. comm., Ptlomey, pers.comm.). Dolly Varden were given a sub-national ranking of S3 – S4 in B.C., using the system developed over the past 25 years by The Nature Conservancy (U.S.). Definitions of S3 and S4 are:

S3 = Rare or uncommon (typically 21-100 occurrences); may be susceptible to large-scale disturbances; e.g. may have lost extensive peripheral populations

S4 = Frequent to common (greater than 100 occurrences); apparently secure but may have a restricted distribution; or there may be perceived future threats.

Anadromous stocks and small, isolated populations of resident fish, such as those found upstream of waterfalls or other barriers may need to be further evaluated to determine rare or endangered status.

4.5.5. Wild Fish Stocks

No records were found mentioning artificial enhancement of fish stocks in the Security Creek watershed. All fish in the study area are therefore presumed to be wild fish stocks.

4.5.6. Recreational Fishery

Little is known about the sportfishing activity in the study area but, due to Security Creek's remoteness, angling pressure is suspected to be low. Several kilometers of fish-bearing streams are accessible to anglers who hike up Security Creek from the estuary. The upper reaches are accessible only via helicopter or by hiking in along deactivated logging roads for approximately 3km. Coho salmon, steelhead and Dolly Varden are the most significant species for the recreational fishery.

4.5.7. Restoration and Rehabilitation Opportunities

Little of the watershed has been logged but several landslides have occurred in the logged area, indicating unstable slopes in the area. At least one tributary has torrented off the logged slopes and the resulting significant sediment aggradation in the downstream reach below site NID 84607 (Reach 1 of WSC 950-901300-67326). The sediment aggradation has led to de-watering of nearly 200m of potential fish-bearing habitat, (below the road) almost to the confluence of the tributary and the mainstem of Security Creek. Landslides have probably influenced fish habitat in the other streams in the area and it is recommended that all streams and road crossings in the logged area are assessed by trained Watershed Restoration Program personnel in the near future.

The abundance of natural landslides in the watershed, in particular the Colleen Creek (WSC 950-901300-28000) sub-basin, indicates unstable terrain. Lower Colleen Creek has at least eight large persistent debris accumulations, likely a result of those landslides. The jams are comprised of large woody debris, small woody debris and a large amount of gravel, cobble and boulders in large wedges. These debris jams prevent anadromous fishes from accessing approximately three kilometers of potential habitat. It is unknown if other natural barriers such as waterfalls have been buried by some of the massive logjams. Resident Dolly Varden were the only fish species captured upstream of the logjams on Colleen Creek. It is also unknown what habitat rehabilitation opportunities exist in this area, if any.

4.6 Fish Bearing Status

4.6.1 Fish Bearing Reaches

Eighteen of the 34 sites sampled in this survey had fish present (Table 6). Dolly Varden char were the most widespread species in the study area and were captured in 16 of the 18 fish-bearing reaches. Dolly Varden were found in sites upstream and downstream of the other two sites and are presumed to be present in those sites as well.

Coho salmon were found in 13 sites and are well distributed throughout the low gradient, accessible reaches of the watershed. The only fish-bearing sites where coho were not captured were either over 7% gradient or upstream of barriers to anadromous fishes or both.

The widest channel measured with fish present was Reach 2 of Security Creek. The narrowest channel sampled with fish present was a 1.2m wide first order tributary to Security Creek. Nearly two - thirds of the fish bearing reaches were low gradient (<4%) and the steepest site sampled that had fish present had a gradient of 15%.

As mentioned in Section 4.5.4, fish have been found on the Queen Charlotte Islands/Haida Gwaii in reaches with gradients up to 26%, but no records have been located of fish captured in streams on the islands at gradients over 30%. All reaches under 26% gradient that are downstream of barriers to fish migration have been defaulted to fish-bearing status on the Fisheries Interpretive Map (Appendix 2c). Confirmed fish-bearing reaches are designated by a solid red line on the Fisheries Interpretive Map and reaches suspected to be fish bearing are shown on the map with a dashed red line.

Almost half of the 210 reaches in the watershed are under 26% gradient and 42 reaches are under 8% gradient. Twenty - eight reaches are confirmed fish bearing reaches and another 41 reaches were defaulted to fish-bearing based on gradient.

Table 6. Summary of data from surveyed fish bearing reaches in the Security Creek watershed, September 9 – October 31, 2000.

				Channel			
Stream Name	**ILP/Watershed Code**	**Reach**	**Species**	**Width (m)**	**Site Gradient (%)**	**Follow up sampling? (Y or N)**	**Comments**
Security Creek	950-901300-	2	CO,PK,CM,(CC, DV, RB/ST)	44.4	1	Y	Confirm sculpin species presence. Determine CCT presence.
Security Creek	950-901300-	6.0	CO,DV,PK,RB/ST	12.5	2.5	Y	Confirm sculpin species presence.
Security Creek	950-901300-	6.1	CO,DV,RB/ST, TR	14.9	1	N	
Security Creek	950-901300-	8	CO,DV,(ST)	7.8	1	Y	Confirm steelhead presence.
Security Creek	950-901300-	9	CO,DV	8.1	0	N	
Unnamed tributary to Security Creek (Southcentral Fork)	950-901300-64357	2	CO,DV	2.9	8.7	N	
Unnamed tributary to Security Creek	950-901300-51601	1	CO,DV	1.2	3.5	N	
Unnamed tributary to Security Creek	950-901300-54183	1	CO,DV	2.5	2.5	N	
Unnamed tributary to Security Creek ("Canyon" Creek)	950-901300-25541	1	CO,DV	3.4	4.5	N	
Unnamed tributary to tributary to Security Creek	950-901300-25541-24869	1	DV	2.4	12.5	N	
Unnamed tributary to tributary to Security Creek	950-901300-25541-14016	1	DV	2.0	7.5	N	
Unnamed tributary to Security Creek (Zimline Creek)	950-901300-30200	1	CO,CM,(DV),PK, SK,TR	14.5	1.5	Y	Confirm trout species.
Unnamed tributary to tributary to Security Creek	950-901300-30200-16934	1	DV	3.4	13	N	
Unnamed tributary to Security Creek (North Fork)	950-901300-62800	1	CO,DV,RB/ST	6.6	1	N	
Unnamed tributary to Security Creek	950-901300-67903	1	CO,DV	5.3	4.5	Y	Determine upper limit of fish.
Unnamed tributary to Security Creek	950-901300-60046	2	CO,DV	5.9	6	N	
Unnamed tributary to Security Creek (Colleen Creek)	950-901300-28000	2	DV	12.0	3	N	
Unnamed tributary to tributary to Security Creek	950-901300-28000-28694	1	DV	7.3	15	N	

4.6.2 Non-Fish Bearing Reaches

Non fish - bearing status could not be assigned to any of the reaches in the study area, except those defaulted by gradient over 30%. The BC Forest Practices Code requires at least two sampling sessions at different times of the year to confirm fish absence and this was not possible in the duration of this project. As mentioned in section 4.5.4, fish have been found on the islands in reaches with gradients up to 26%, but no records have been located of fish captured in streams on the islands at gradients over 30%.

Most of the streams that are classified as non fish-bearing in the watershed are steep (over 26% gradient) upper reaches of tributaries to the mainstem of Security Creek. These streams drain the slopes of mountains and some are ephemeral. Many of these tributaries have suitable fish habitat in their lower reaches, but become too steep for fish use a short distance upstream of the Security Creek mainstem valley flat. Some ephemeral streams may only have enough flow to support fish in their lower reaches during peak flow periods. Proper fish sampling is required to verify non fish-bearing status of all streams.

4.6.3 Follow-up Sampling Required to Confirm Fish Absence

No fish were captured at 16 of the 34 sites sampled in the study area. However, one sampling session in which no fish were caught is not considered sufficient to confirm fish absence according to the BC Forest Practices Code (Anonymous, 1995a, 1995c). Follow – up sampling is required to confirm fish absence in the sampled reaches containing potential fish habitat listed in Table 7.

The streams listed in Table 7 appeared to contain enough potentially fish-bearing water to support small populations of Dolly Varden char. Other unsampled streams may also be fishless, but any reaches that were under 26% gradient were defaulted to fish-bearing on the Fisheries Interpretive Map (Appendix 2c).

Although it is strongly suspected that Zimline Creek is fishless above the top of its second reach (no fish were caught in five well-spaced sites), the Forest Practices Code requires at least two sampling sessions to confirm fish absence in potentially fish - bearing habitat. The requirement for a second sampling session, preferably at a different time of the year, to verify fish absence in sites where no fish were caught could not be achieved within the limitations of this project. It is recommended that Reaches 3 – 7 of Zimline Creek and its tributaries are re-sampled at low flow when any fish present in the system may be concentrated in the deep pools.

Table 7. Follow-up sampling required for classification of non fish-bearing reaches sampled in the Security Creek watershed.

Stream Name	Watershed Code (Site NIDs)	Reach	Timing	Methods	Comments
Unnamed trib. to Security Creek	950-901300-22987 (84107)	2	Low flow	MT and/or EF	No fish caught upstream of falls, little habitat available.
Unnamed trib. to Security Creek	950-901300-27190 (84303, 84305, 84307)	3 - 9	Low flow	MT and/or EF	Locate barrier, probably in reach 2. No fish caught in lake or in 3 stream sites above reach 2.
Unnamed trib. to Security Creek (Zimline Creek)	950-901300-30200 and its tributaries upstream of reach 3. (84402, 84404, 84406, 84419, 84422)	3 - 7	Low flow	MT and/or EF	Two 8m falls in reach 2 are a barrier to upstream migration. No fish caught at 3 mainstem and two tributary sites upstream in reasonable DV habitat. Locate pools that would concentrate fish at low flows and sample them.
Unnamed trib. to Security Creek (North Fork)	950-901300-62800	2 - 3	Low flow	EF and/or MT	Fish abundant in reach 1. Tripp (1996) caught no fish above 7m falls in reach 2. Sample above and below falls during low flow to confirm barrier.

4.7 Wildlife observations

A list of vertebrate wildlife observations at the sample sites in this study area is provided in Table 8. Observations included visual and auditory observations of animals and fresh signs such as tracks, beds, buck rubs, droppings and nest sites that were encountered in the process of conducting the fish and fish habitat inventory.

Table 8. Wildlife observations in a Reconnaissance 1:20,000 Fish and Fish Habitat Inventory in Security Creek watershed, September 8 – October 31, 2000. Vertebrates only listed.

Group	Common Name	Scientific Name	Site NIDs observed
Mammals:			
	Sitka Black-tailed Deer	*Odicoileus hemionus sitkensis*	84001, 84213, 84404, 84419, 84600, 84617, 88034
	Black Bear	*Ursus americanus*	84001, 84102, 84400
	River Otter	*Lutra canadensis*	84601
	Red Squirrel	*Tamiasciurus hudsonicus*	84005, 84204, 84303, 84402, 84404
Birds:			
	Dark-eyed Junco	*Junco hyemalis*	84001, 84102, 84125, 84404, 84419, 84500, 84600, 84601, 84617, 88034, 94005
	Winter Wren	*Trolodytes troglodytes*	84001, 84404, 84601, 88034
	Bald Eagle	*Haliaetus leucocephalus*	84001, 84122, 88034
	Stellar's Jay	*Cyanocitta stelleri*	84600
	Belted Kingfisher	*Ceryle alcyon*	84001
	Common Raven	*Corvus corax*	84001, 84102, 84122, 84400, 84601, 84701, 88034
	Red - breasted Sapsucker	*Saphrapicus ruber*	84122
	Northern Flicker	*Coleaptes auratus*	84600, 84601
	Canada Goose	*Branta canadensis*	84410
	Green-winged Teal	*Anas crecca*	84410
	American Dipper	*Cinclus mexicanus*	84005, 84701
Amphibians:			
	Pacific Treefrog	*Hyla regilla*	84213, 84305, 84410

5.0 MAJOR FINDINGS AND RECOMMENDATIONS

1. Dolly Varden char were the most widespread fish species captured in the study area. Coho salmon were found throughout the accessible, low gradient reaches of the watershed. Steelhead were found only in 3rd order and larger reaches in Security Creek watershed.
2. Excellent spawning and rearing habitats are abundant throughout the stream reaches in and adjacent to the Security Creek mainstem valley flat.
3. Pink and chum salmon spawn in the accessible reaches in the southern half of the watershed, downstream of the cascade section in Reach 6.0. Coho, steelhead and Dolly Varden are able to navigate past the cascades and access all suitable streams in the valley flat up to the headwater reaches.
4. No fish were caught in five sample sites above the waterfalls in Reach 2 of Zimline Creek. Follow-up sampling is required to confirm fish absence in the upper sub-basin.
5. Major landslides have occurred in the sub-basin indicating terrain instability. Slides are evident in the logged area near the headwaters of Security Creek and in the unlogged Colleen Creek sub-basin. At least one stream has torrented and become de-watered and further study is required to determine the impact on fish use in the area. Several major debris jams have formed in lower Colleen Creek and are barriers to upstream fish migration.
6. Follow-up sampling is required to verify fish species distributions and to locate barriers to fish species migrations in several tributaries. Section 4.6 outlines specific areas of concern.

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