Reconnaissance (1:20,000) Fish and Fish Habitat Inventory of Four Sub-Basins in the Nadina River Watershed, downstream of Nadina Falls

Watershed Code: 180-374000-95200-99500

Prepared for

Houston Forest Products Co.
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Prepared by

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_____

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March 31, 2002

PROJECT SUMMARY SHEET

PROJECT REFERENCE INFORMATION

MSR Project #:	HFP-SKR-001-2002
FRBC MYA #	CON0001398
FRBC Activity #:	721096
FDIS Project #:	940
MSR Region:	Skeena Region (06)
MSR District:	Not applicable
FW Management Unit:	06-04, 06-09
Fisheries Planning Unit:	Not applicable
DFO Subdistrict:	Prince George (1)
Forest Region:	Prince Rupert
Forest District:	Morice Forest District
Forest Licensee & Tenure #:	Houston Forest Products, FLA – 16827
First Nations Claim Area:	Wet'suwet'en Nation

WATERSHED INFORMATION

Watershed Group	FRAN
Watershed Name	Nadina River
Watershed Code	180-374000-95200-99500
UTM at Mouth	9.663787.5983999
Watershed Area	225.45 km^2 (study areas only)
Total of all stream lengths	577.60 km
Stream Order	5
NTS Maps (1:50,000)	93E/14, 93E/15, 93L/2, 93L/3 (study areas only)
TRIM Maps	093L.005, 093L.006, 093L.007, 093E.095, 093E.096, 093E.097
BEC Zone	SBSmc, SBSdk, ESSFmc
Air Photos	30BCB91108 No. 192-213 (study area only) 30BCB91108 No. 266-273 (study area only) 30BCB91109 No. 37-45 (study area only) 30BCB91109 No. 98-112 (study area only) 30BCB91110 No. 79-89 (study area only) 30BCB91110 No. 216-244 (study area only) 30BCB91113 No. 29-30 (study area only) 30BCC97161 No. 60-74 (study area only

SAMPLING DESIGN

Total # of Reaches	943
Random Sampling Sites	40 (40 proposed)
Discretionary Sample Sites	58 (58 proposed)
Added Value Sites	11
Total Sample Sites	109 (98 proposed)
Field Sampling Dates	July 23rd – 27th, July 30th, August 7th-10th, August 13th – 17th, August 21st – 22nd, 2001
Fish Species in Watershed	DV, RB, KO, LKC, MW, SK, LSU, CSU, CAS, LNC, CH, BT, NSC, RSC, BB, PCC

CONTRACTOR INFORMATION

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DISCLAIMER

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

ACKNOWLEDGEMENTS

Funding for this project was provided by Forest Renewal B.C. and Houston Forest Products Co. (HFP), Houston, B.C. The contract was administered and monitored by Karen Balkwill for HFP. Melissa Todd and Karen Balkwill (HFP) were invaluable in their support throughout this project. Helicopter services were provided by Highland Helicopters, and the help and effort of Pat Rooney, Ryan Buchanan and Tanya Booth are greatly appreciated. Editorial comments on drafts of this report were provided by Karen Balkwill and Melissa Todd (Houston Forest Products Co.), Ron Saimoto (SKR Consultants Ltd.), Chris Schell (QA/QC Monitor), and Matthew Jessop (Ministry of Sustainable Resources). Matthew Jessop (Ministry of Sustainable Resources) reviewed the non-fish bearing tables for this project.

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Digital reports
Digital FDIS database

1.0 INTRODUCTION

Portions of the Nadina River Watershed were inventoried in July and August 2001 to assess fish habitat characteristics and to investigate the diversity, population characteristics, and distribution of fish in the study area. SKR Consultants Ltd. was retained by Houston Forest Products Co. (Houston, B.C.) to conduct these surveys. The project was jointly funded by Forest Renewal B.C. (FRBC) and Houston Forest Products Co. (HFP).

The Nadina River watersheds was divided into 10 sub-basins according to boundaries obtained from B.C. Environment (1999). These sub-basins are:

- Sub-basin I (Glacier Creek – WSC: 180-374000-95200-99500-7340)
- Sub-basin II (Larkin Creek – WSC: 180-374000-95200-99500-7930)
- *Sub-basin III (Upper Nadina Face Units – WSC: 180-374000-95200-99500)*
- *Sub-basin IV (Lower Nadina Face Units – WSC: 180-374000-95200-99500)*
- *Sub-basin V (Gates Creek – WSC: 180-374000-95200-99500-2000)*
- *Sub-basin VI (Shelford Creek – WSC: 180-374000-95200-99500-5720)*
- **Sub-basin VII (Hay Meadow – WSC: 180-374000-95200-99500-3890)**
- **Sub-basin VIII (Hill Tout Creek – WSC: 180-374000-95200-99500-4980-2480)**
- **Sub-basin IX (Tagetochlain Creek – WSC: 180-374000-95200-99500-4980)**
- **Sub-basin X (Cliff – WSC: 180-37400-95200-99500-5150)**

Sub-basins I and II were inventoried in 1999 (SKR 2000a, 2000b) (indicated in plain text above). Sub-basins III, IV, V, and VI were inventoried in 2001 (indicated in italic text above) (SKR 2001e) , and sub-basins VII, VIII, IX, and X were inventoried in 2001. Two lakes were sampled in the 2001 field season as part of this project (WBID 01168FRAN and 00672FRAN (SKR 2002 a, b). This report summarizes the results of the reconnaissance level stream inventory project that was conducted in the Hay Meadow (sub-basin VII), Hill Trout (sub-basin VIII), Tagetochlain (sub-basin IX) and Cliff (sub-basin X) portions of the Nadina River watershed. The report is divided into two volumes. Volume 1 contains the report, Appendix 2, Appendix 3, Appendix 4 and Appendix 5. Volume 2 contains Appendix 1 with site cards, fish collection forms and site photographs for all sample sites.

1.1 OBJECTIVES

The main objectives of the 1:20,000 fish and fish habitat reconnaissance level stream inventory project in the four sub-basins Nadina River watershed were:

- to review and summarize historical fisheries information for the study area,
- to describe fish distribution and diversity by conducting a 1:20,000 fish inventory,
- to document barriers to fish passage,
- to document fish habitat characteristics,
- to conduct secondary lake inventories at lakes where fish presence is unknown,
- to identify further sampling requirements, and
- to classify reaches sampled according to the B.C. Forest Practices Code Fish – Stream Identification guidebook (FPC 1998).

1.2 LOCATION

The Nadina River Watershed is located in the Morice Forest District, Prince Rupert Ministry of Forests and Ministry of Sustainable Resources Region. The Nadina watershed is the largest watershed contained entirely within the Morice Forest District, and drains into Francois Lake approximately 47 km south-southeast of Houston, B.C. Four of the ten sub-basins in the Nadina Landscape Unit were inventoried from July to August 2001, all of which form major tributaries (fourth or fifth order) to the Nadina River downstream of Nadina Falls.

1.2.1 Access

The study area was accessed by vehicle and helicopter. To access the area by vehicle proceed west from the Houston town center along Highway 16 for approximately 5 km. Turn left onto the Morice River Forest Service Road (FSR), and proceed past Canfor Ltd. and Houston Forest Products Co. At km 27 the Morice River FSR veers to the right, and the Morice – Owen FSR continues straight. Take the Morice – Owen FSR past Owen Lake and the Owen Lake resort. At km 56.5, turn right onto the Morice – Nadina FSR. Most of the access to the study area in the Hay Meadow and Cliff sub-basins (sub-basins VII and X) was obtained from this road and adjoining network of main and spur roads. Access to the Tagetochlain and Hill Tout sub-basins (sub-basins VIII and IX) was possible via the Morice-Tahtsa FSR which branches to the west off the Morice-Owen FSR at 48 km. Some of the reaches sampled in this study could only be accessed by a helicopter, which was based out of Houston, B.C..

See Attached file: Nadina Overview Map.cdr (COREL DRAW 7.0).

Figure 1. Overview map of the Nadina River watershed located in central British Columbia.

1.3 HISTORICAL INFORMATION

A series of cascades located at the outlet of Nadina Lake (locally known as Nadina Falls) impede fish passage to the lake and its inlet streams. However, sockeye have been reported upstream of the falls (Fielden 1995, SKR 2001e), which indicates that the cascades are passable, at least at some flows. Rainbow trout (*Oncorhynchus mykiss*), kokanee (*O. nerka*), mountain whitefish (*Prosopium williamsoni*), burbot (*Lota lota*) and longnose suckers (*Catostomus catostomus*) are known to utilize Nadina Lake (FISS). Redside shiners (*Richardsonius balteatus*), lake chub (*Couesius plumbeus*), longnose dace (*Rhinichthys cataractae*), largescale suckers (*Catostomus macrocheilus*) and Dolly Varden (*Salvelinus malma*) have also been reported present in the Nadina Lake drainage basin (DeGisi and Schell 1997, SKR 1996, 1997, 1998a,b, 1999a,b,c,d,e). In addition to species documented upstream of Nadina Falls, bull trout (*Salvelinus confluentus*), chinook (*Oncorhynchus tshawytscha*), prickly sculpin (*Cottus asper*), peamouth chub (*Mylocheilus caurinus*) and northern pikeminnow (*Ptychocheilus oregonsis*) have been documented in the Nadina River and/or associated streams and lakes below the falls (FISS, Fielden 1995, SKR 2001e).

Some historical fisheries information exists for the sub-basins inventoried in 2000. Dolly Varden and rainbow trout were captured in the Hay Meadow and Cliff sub-basins, and the presence of chinook and bull trout are suspected to utilize excellent fish habitat found in reach 1 of Unnamed Creek (180-374000-95200-99500-3890) within the Hay Meadow sub-basin (SKR 1998a, SKR and Oikos 1999). Refuge habitat in the lower reach of Unnamed Creek (180-374000-95200-99500-5150) is speculated to be utilized by several species known to exist in the Nadina River mainstem (SKR and Oikos 1999). A cascade was identified as a barrier to fish passage on a 3rd order system within the Hay Meadow sub-basin (180-374000-95200-99500-3890-0500), but no natural barriers were identified in the Cliff sub-basin during previous surveys. A variety of species have been documented present in the Tagetochlain and Hill Tout sub-basins, including rainbow trout, lake trout, rocky mountain whitefish, lake whitefish, burbot, redside shiner, peamouth chub, lake chub, sculpins, largescale sucker, and longnose sucker (FISS, B.C. Environment no date, Burns and Tredger 1974b, SKR and Oikos 1999)

2.0 RESOURCE USE

The Nadina River watershed is public land, and as such is utilized by several resource sectors.

1. First Nations issues and interests in the study area:
   - The Wet'suwet'en Nation have claimed a portion of the Nadina watershed as part of their traditional territories. The Wet'suwet'en Nation is in Stage 4 of the treaty process (B.C. Treaty Commission 2000).
2. Development and land use: forestry, mining, recreation:
   - The study area falls into forest license FLA-16827 (HFP), and harvesting and road building is in varying stages of planning and or development. Harvesting in the area is proposed to 2003 (HFP 1999).
   - Relatively high recreational and landscape values, due to the presence of the Sibola Mountains, have been identified in the Nadina River Watershed LRUP (MoF, Morice District 1993). A Forest Recreation Site (Poplar Lake Recreation Site) exists on the east shore of Tagotochlain Lake (MoF 1997).
   - A number of mineral tenures are clustered to along the northeast shore of Tagetochlain Lake, and in the southwest portion of the Hill Tout sub-basin (Ministry of Employment and Investment 2000).
   - The guide outfitter territories in the study area are 609G006 and 604G007 and the trapline territories are 604T039 and 604T046. The Poplar Lake Range unit encompasses the north east portion of the Tagetochlain sub-basin (HFP 1999).
3. Other developments, concerns or points of interest:
   - No Protected Area Strategy (PAS) study sites are known to exist within the Nadina Landscape Unit. However, Nadina Mountain, located at the northern border of the Nadina Landscape Unit has been identified as a potential protected area (Goal 1) (MoF, Morice District 1993)
   - A local-level land use plan known as the Nadina River Watershed LRUP has been developed for the Nadina River watershed. Management objectives for the units and subunits identified in the Nadina River watershed are outlined in the LRUP document (MoF Morice District 1993).
   - Three water licenses have been identified in the Nadina Landscape unit: two on Nadina Lake (C03018 and C03019) and one on the Nadina River (C107189). No community watersheds are located in the study area (B.C. Environment 1999).
4. Impacts and uses by wildlife:
   - A comprehensive inventory of wildlife species does not exist for the Morice Forest District. However, several rare and endangered wildlife species are known or suspected to utilize habitat in the Nadina River watershed, including Grizzly bear (*Ursus arctos*), wolverine (*Gulu gulu luscus*), fisher (*Martes pennanti*), and American Bittern (on the west side of Nadina Lake) (Horn and Tamblyn 2000). Other wildlife species of interest include mountain goats, moose, and deer.
5. Existing water quality data:
   - Water quality data was collected on the mainstem Nadina River by Fielden (1995) between Francois Lake and Nadina Lake. Cursory water quality data, including TDS and Secchi depth has been collected for five lakes in the Nadina River watershed during various surveys. These lakes include Nadina Lake (Burns & Tredger 1974a, Tagetochlain Lake (Burns and Tredger 1974b), Hill Tout Lake (B.C. Environment no

date), Jewell Lake (Walsh & Hughes 1976b) and Stanton Lake (Walsh and Hughes 1976a).

6. Previous presence of fish in systems of interest:
   - Fish presence previously documented in the study area is summarized in Table 1.

Table 1. Summary of fish species in the Nadina River Watershed.

Fish Species	**Location**	**Reference**[1]
Sockeye (*Oncorhynchus nerka)*	above & below Nadina Falls	1, 2, 14
Rainbow trout (*O. mykiss)*	above & below Nadina Falls, Cliff, Hay Meadow and Tagetochlain sub-basins	1, 10, 11, 12, 13
kokanee (*O. nerka)*	above & below Nadina Falls	1, 10
chinook (*O. tsawytscha*)	below Nadina Falls	1, 2, 13
bull trout (*Salvelinus confluentus)*	below Nadina Falls	2
mountain whitefish (*Prosopium williamsoni)*	above & below Nadina Falls	1, 10
burbot (*Lota lota)*	Nadina Lake	1
longnose suckers (*Catostomus catostomus)*	Nadina Lake	1, 13
redside shiners (*Richardsonius balteatus)*	above & below Nadina Falls	1, 3, 4, 5, 6, 7, 8, 9, 13
lake chub (*Couesius plumbeus*)	above & below Nadina Falls	1, 3, 4, 5, 6, 7, 8, 9, 10, 13
Peamouth chub (*Mylocheilus caurinus*)	Below Nadina Falls	13
longnose dace (*Rhinichthys cataractae*)	above & below Nadina Falls	1, 3, 4, 5, 6, 7, 8, 9, 13
largescale suckers (*C. macrocheilus*)	above & below Nadina Falls	1, 3, 4, 5, 6, 7, 8, 9, 13
Dolly Varden (*Salvelinus malma*)	above & below Nadina Falls, Cliff, Hay Meadow sub-basins	1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
prickly sculpin (*Cottus asper*)	above & below Nadina Falls, Hill Tout Lake	1, 13
northern pikeminnow (*Ptychocheilus oregonensis*)	above & below Nadina Falls	1, 13

[1]References are: 1 = FISS, 2 = Fielden (1995), 3 = DeGisi and Schell 1997, 4 = SKR 1997, 5 = SKR 1998a, 6 = SKR 1998b, 7 = SKR 1999a, 8 = SKR 1999b, 9 = SKR 1999c, 10 = SKR 2000a, 11 = SKR 2000b, 12 = SKR and Oikos 1999, 13 = SKR 2001e, 14 = SKR personal observations

3.0 METHODS

This project closely follows all applicable RIC Standards (1998a, 1999, 2000, 2001) and the Forest Practice Code fish - stream identification guidebook (1998). Details on methodologies and value added attributes of sampling site selection, field assessments, and digital mapping are provided in the following sub-sections.

3.1 SAMPLE SITE SELECTION

Sample sites were selected by conducting reach break analysis and random sampling queries using the Fish Data Information System (FDIS 7.0) ACCESS 2.0 data tool for each of the sub-basins in the study area. All streams on the 1:20,000 TRIM map scale were identified numerically by assigning an Interim Location Point (ILP) or watershed code, following 1:20,000 fish and fish habitat inventory standards (RIC 1998a, 1999). Streams were divided into reaches based on map and air photo interpretation. Necessary reach information was entered in the FDIS database, following Resource Inventory Committee standards (RIC 1998a, 1999). Version 7.0 of the FDIS ACCESS 2.0 data tool was used to randomly select sampling sites to determine the general distribution and total number of sites required in the study area for the Hill Tout sub-basin (sub-basin VIII) (SKR 1999f), and FDIS Version 7.2 was used to selected random sample sites for the Hay-Meadow, Cliff and Tagetochlain sub-basins (sub-basins VII, IX and X) (SKR 2001f). Some sites were deleted or moved based on previous fish sampling in the watershed and site accessibility. Random and biased sampling sites were mapped on 1:20,000 scale, along with existing fisheries information for presentation to the contract monitor and the ministry representative. The sampling plan was summarized in a project plan (SKR 1999f, SKR 2001f) for ministry and contract monitor approval.

3.2 STREAM ASSESSMENT

All stream assessments were conducted in July and August 2001. Stream sites were accessed by four wheel drive vehicle, helicopter and foot. Stream sections of interest were assessed to determine fish presence and habitat values. Fish Data Information System (FDIS) site cards and fish collection cards were completed at sample sites, following Resource Inventory Committee Standards (RIC 2001), and data were entered into the FDIS database using the FDIS data entry tool (version 7.2).

All fish that were captured during this study were identified to species in the field or small sub-samples were preserved for confirmation using a dissecting microscope (McPhail and Carveth, 1994). Fork lengths were recorded for all fish captured. Scale samples were collected for a sub-sample of salmonids captured in the watershed. Voucher specimens were retained for representative fish samples. Voucher specimens were preserved in 10% formalin for a minimum of 14 days after which they were rinsed in water and transferred to 50% isopropyl alcohol. Voucher samples were submitted to for species verification (Appendix 3).

A list of sampling equipment used during this 1:20,000 reconnaissance level fish and fish habitat inventory project is presented in Table 2.

Table 2. List of sampling equipment for stream reaches used during the 1:20,000 reconnaissance fish and fish habitat inventory project in the Nadina River watershed, July to September 2001.

Parameter	Sampling Intensity	Method
date and time	each site	wrist watch
water temperature	each site	alcohol thermometer
PH	each site	Oaktron pHTestr2
Conductivity	each site	Hanna HI 9033, Oaktron TDSTestr 3
water clarity	each site	Visual
fish presence	as required to determine fish presence	Smith Root Model 15C, Smith Root Model 12B, GEE minnow traps,
Photography	each site	Canon Sureshot A1, Minolta Weathermatic Dual 35
GPS	where available	Garmen GPS 45
Gradient	each site	Abney Level or Suunto clinometer

3.3 MAPPING

Reach break analysis was conducted during phase II of this reconnaissance (1:20000) fish and fish habitat inventory project (RIC 1998a) by SKR Consultants Ltd. (SKR) and Western Geographic Information Systems Inc. (WGIS)(SKR 1999f). The majority of reach break information for the FDIS database was obtained from TRIM map and air photograph interpretations by SKR. WGIS provided lengths, gradients, and UTM coordinates for all reaches in the study area after linking new spatial data to TRIM map data that was obtained from the FTP//…TRIM library (MELP). All reach break mapping closely followed the RIC standards for reach analysis (1998a) and digital mapping (1998b).

Mapping during phase III of the project was completed by SKR Consultants Ltd. using the Fish Inventory Mapping System (Geosense Consulting Ltd. 2000). Data presented on the maps included sub-basin boundaries, sample site locations, significant features, and historical information within the study area. In addition, SKR identified reaches with known fish presence, suspected fish presence, suspected fish absence, and known fish absence for presentation of fish distribution on the interpretive maps. The criteria used by SKR for determining fish presence and absence are presented in Table 3.

Table 3. Criteria used to evaluate fish distribution for colour coded presentation on the Fisheries Project/Interpretive Hardcopy Maps (Appendix 5) of this study area.

Fish Present _____	• Stream reaches where fish have been captured or can be classified as fish bearing based on fish captured upstream. NOTE: fish distribution may not always extend to the upper limit of all reaches symbolized as fish bearing
Fish Suspected Present ----------	• Stream reaches with gradients less than 21% and with any potential for fish presence, excluding first order streams less than 1 km in length on 1:20000 TRIM map
Fish Suspected Absent ----------	• First order streams less than 1 km in total length on 1:20000 TRIM map • Streams visited with limited potential for fish presence, but no definable barriers to fish passage following RIC standards, thus still requiring resampling
Fish Absent _____	• Reaches with no fish captured in two seasons upstream of natural obstructions to fish migration • Reaches upstream of identified natural barriers to fish migration following intensive sampling in one season • 1st and small 2nd order streams flowing into non fish bearing reaches • Reaches with gradients exceeding 20% (Note: the location of lower reach break is not defined until field sampling is conducted)

4.0 RESULTS AND DISCUSSION

One-hundred and nine stream reaches (110 sample sites) of the 943 stream reaches in the Cliff, Hay Meadow, Hill Tout, and Tagetochlain sub-basins were sampled in July to August 2001. This includes 40 reaches randomly selected by FDIS and 69 discretionary reaches (including 11 value added reaches) were added to compliment fish distribution information obtained in previous studies (FISS, Fielden 1995, DeGisi and Schell 1997, SKR 1997, 1998a,b,c,d 1999 a,b,c,d,e, 2000 a,b, 2001 a,b,c,d,e,f). In addition to stream survey sites, secondary lake inventories were conducted for two lakes in the study area (SKR 2002 a, b). The following sections discuss findings from this field inventory project in context with historical information available for the Cliff, Hay Meadow, Hill Tout and Tagetochlain sub-basins, as outlined in the "Buba Creek Example Report" (MSR 2001).

4.1 LOGISTICS

Access to the majority of reaches sampled within the Nadina River watershed was by four wheel drive truck (44%) and foot (41.3% were more than 200 m distance from a road). Helicopter access was required for 16 of the 109 reaches sampled (14.7%). Helicopter landing sites were relatively abundant in wetlands along the mainstems, the lakes in the systems, and near the headwaters of some tributaries, but some sections of the drainage were difficult to access even by helicopter due to steep gradients and lack of available landing sites. Some discrepancies were noted between the drainage network shown on the TRIM map and that deduced from aerial and ground observations, which created some difficulties in locating sample sites. A grizzly bear encounter in the Tagetochlain sub-basin resulted in the loss of several scale samples for sites sampled in the Nadina and Peter-Aleck drainages.

Conductivity encountered in two of the reaches sampled (1.8%) was below 30 μS/cm and one site (0.9%) had slightly turbid water. Electroshocking efficiency may have been reduced at these sites as a consequence. Salmonids were captured in one of these reaches. Overall, water levels and weather conditions were conducive to sampling by electroshocking, although 11 of the reaches surveyed (10.1%) were dry at the time of sampling.

4.2 SUMMARY OF BIOPHYSICAL INFORMATION

The Nadina Landscape unit covers a relatively large geographic area, from streams draining the eastern slopes of the Sibola Mountains to the mouth of the Nadina River at Francois Lake. The topography varies from steep, mountainous terrain in the western sections to more gentle, rolling hills in the east. Although some of the streams in Sub-basin I (Glacier Creek) were influenced by glaciers, none of the sub-basins inventoried this year have glacial influence. The Nadina Landscape Unit falls within the Humid Continental Highlands Ecodivision of the Humid Temperate Ecodomain. Within the Central Interior Ecoprovince, the entire area is within the Fraser Plateau Ecoregion (Meidinger and Pojar 1991, MoF 2001). Table 4 provides a summary of watershed information for the 11 sub-basins within the Nadina River watershed, but only the Cliff, Hay Meadow, Hill Tout and Tagetochlain sub-basins were sampled in July and August 2001. Water quality parameters taken where available included temperature, pH, conductivity and turbidity. Of sites sampled, water quality measurements were taken at 74 stream reaches and at two lakes. For convenience, biophysical information for each sub-basin sampled this year is discussed separately.

Table 4. Summary of watershed information for the sub-basins distinguished between in the Nadina River watershed. Sub-basins inventoried in July and August 2001 are indicated in bold.

Sub-basin	Name	Watershed Code	Watershed Area (km^2)	Stream Length (km)	Stream Order[1]	NTS map	BEC Zone	Wetland areas (km^2)	Year of Inventory
Sub-basin I	Glacier UTM: 9.629658.5972148	180-374000-95200-99500-7340	124	418	5	93E/14	SBSmc, ESSFmc, AT	2.55	1999
Sub-basin II	Larkin UTM: 9.625166.5974147	180-374000-95200-99500-7930	50.4	164.22	4	93E/14	SBSmc SBSdk, ESSFmc	3.4	1999
Sub-basin III	Upper Nadina Face Units UTM: 9.633189.5974746	180-374000-95200-99500	180.1	426.22	4	93E/14 93E/15	SBSmc, ESSFmc	3.2	2000
Sub-basin IV	Lower Nadina Face Units UTM: 9.663787.5983999	180-374000-95200-99500	213.1	458.33	6	93E/15 93L/2	SBSmc ESSFmc	2.2	2000
Sub-basin V	Gates Creek UTM: 9.654044.5987594	180-374000-95200-99500-2000	83.6	239.54	5	93E/15 93L/2	SBSmc ESSFmc	2.3	2000
Sub-basin VI	Shelford Creek UTM: 9.638283.5978405	180-374000-95200-99500-5720	85.3	271.54	5	93E/15	SBSmc ESSFmc	3.2	2000
Sub-basin VII	**Hay Meadow UTM: 9.647527.5978678**	**180-374000-95200-99500-3890**	**32.6**	**118.52**	**4**	**93E/15**	**SBSmc**	**0.73**	**2001**
Sub-basin VIII	**Hill Tout Creek UTM: 9.637162.5982671**	**180-374000-95200-99500-4980-2480**	**62.6**	**189.78**	**4**	**93E/14 93E/15**	**SBSmc, ESSFmc**	**1.6**	**2001**
Sub-basin IX	**Tagetochlain Creek UTM: 9.637162.5982671**	**180-374000-95200-99500-4980**	**111.2**	**210.3**	**5**	**93E/14 93E/15 93L/2 93L/3**	**SBSmc, ESSFmc**	**0.9**	**2001**
Sub-basin XI	**Cliff UTM: 9.639464.5981249**	**180-374000-95200-99500-5150**	**19.1**	**59.00**	**4**	**93E/15**	**SBSmc**	**0.6**	**2001**

4.2.3 Sub-basin VII – Hay Meadow (180-374000-95200-99500-3890)

The Hay-Meadow sub-basin consists of an Unnamed tributary (WSC 180-374000-95200-3890) draining into the south shore of the Nadina River, just downstream of Tagetochlain (alias Poplar) Creek. There are a total of 11 small and moderate sized lakes in this sub-basin, all of which are unnamed. Lake surface areas range from 160 ha (ILP 50843) to less than 2 ha for some of the lower elevation lakes in the south half of the drainage. This system drains the north facing slopes of the Shelford Hills, and is generally characterized by moderate to high gradient reaches in the south portion of the drainage, along the slopes of the Shelford Hills, with gentler slopes near the Nadina River valley flat area. The majority of the watershed is characterized by rolling hills, since the Sibola Hills do not exceed elevations of 1370 meters. Water quality measurements were taken at nine of the 15 sample sites in this sub-basin. Temperature ranged between 4 ^{o}C and 14 ^{o}C. Only one of the 15 locations yielded temperatures greater than 10 ^{o}C (site 2 ILP 20800 reach 10). At the 15 sites where water quality measurements could be recorded, pH ranged between 6.9 and 8, with 14 of the sites having slightly basic pH values (7.4 to 8). Conductivity was relatively variable, ranging from 10 μS/cm to 140 μS/cm. Conductivity was generally lower in higher elevation reaches, except for the low conductivity recorded at site 1, in reach 7 of the mainstem, which had a conductivity of 40 μS/cm. Water was clear at all but one slightly turbid location (site 11, ILP 20855 reach 3).

4.2.2 Sub-basin X – Hill Tout (180-374000-95200-99500-4980-2480)

Hill Tout Creek drains the western portion of the Tagetochlain (*alias* Poplar) Creek watershed. This fourth order tributary drains into Tagetochlain Creek just downstream of Tagetochlain Lake. Ten small, and primarily moderate sized lakes are located in the Hill Tout sub-basin, including Hill Tout Lake, and the two Duel Lakes. The lakes range in size from 3 ha to 276 ha (Hill Trout Lake). The majority of the Hill Tout Sub-basin is characterized by gently sloped terrain, with lakes located in broad valleys, and an abundance of wetlands in the drainage (1.6 ha of the sub-basin consist of wetlands). Some steeper gradient areas are found in the north east portion of the sub-basin, where a height of land separates inlet streams to the east shore of Duell and Hill Tout lakes in the Hill Tout sub-basin from inlet streams to the southwest shore of Tagetochlain Lake in the Tagetochlain sub-basin. Similarly, steeper slopes along a height of land separating inlet streams to Gordeau Lake (upper Nadina Face Units) from the inlet streams to the west shore of Unnamed Lakes in the southwest portion of the Hill Tout sub-basin account for some steeper slopes along the western boundary of the Hill Tout sub-basin. Water quality data, including water temperature, pH, conductivity and water clarity were recorded at 27 of the 43 reaches sampled. Water temperature ranged between 5 ^{o}C and 17 ^{o}C, and pH ranged between 6.3 and 7.8. Only three of the 27 reaches where water quality data could be recorded had a pH lower than 7 (site 57 reach 3 ILP 21564, site 62 reach 1 ILP 21588, site 65 reach 1 ILP 21596), all of which are located upstream and to the southwest of Hill Tout Lake. Conductivity ranged from 40 μS/cm to 130 μS/cm. Conductivity was generally greater upstream of Hill Tout Lake. Turbidity was clear at all of the sites sampled.

4.2.3 Sub-basin IX – Tagetochlain Creek (180-374000-95200-99500-4980)

Tagetochlain Creek (*alias* Poplar Creek) is the largest inlet stream to the north shore of the Nadina River. This fifth order system is characterized by the presence of a large lake (Tagetochlain Lake), with a surface area of 8.6 km^2. In addition to Tagetochlain Lake, 19 small and moderate sized lakes are found in this sub-basin, ranging in size from 1 ha to 620 ha (Bittern Lake). This sub-basin is characterized by a predominance of gently sloped terrain with rolling hills. Some steeper slopes are present along the west border of the sub-basin where a height of land separates inlet streams to the west shore of Tagetochlain Lake (Tagetochlain sub-basin) from inlet streams to the east shore of Hill Tout and Duel Lakes (Hill Tout sub-basin), as well as along the east shore of the northern tip of Tagetochlain Lake and along the southwest facing slopes of Poplar Mountain located to the east of Tagetochlain Lake. Water quality data were obtained for twenty-six of the 37 reaches sampled in the Tagetochlain sub-basin. Water temperature ranged between 7 ^oC and 16 ^oC, with the highest temperature readings obtained at tributaries to the outlet of Tagetochlain Creek downstream of Tagetochlain Lake. At the sites sampled, pH readings were consistently neutral to slightly basic, ranging from 7.1 to 8.2. including temperatures between 6 ^oC and 20 ^oC. Conductivity values ranged between 30 μS/cm and 270 μS/cm. While conductivities fluctuated considerably among sample sites, higher conductivities tended to be observed in inlet streams to the northern portion of Tagetochlain Lake, and in tributaries to Tagetochlain Creek downstream of Tagetochlain Lake. Turbidity was clear at all sites sampled in the Tagetochlain sub-basin.

4.2.4 Sub-basin X – Cliff (180-374000-95200-99500-5150)

The Cliff sub-basin consists of the an area drained by Unnamed Creek (WSC 180-374000-95200-99500-5150), a fourth order tributary to the south shore of the Nadina River, just upstream of the confluence of the Nadina River and Tagetochlain Creek. This sub-basin is characterized by a lack of lakes, and a low predominance of wetlands. The lower (northern) half of the sub-basin consists of gently sloped terrain, and lies partly in the Nadina River valley flat area. Gradient increases in the southern half of the sub-basin, along the north facing slopes of the Shelford Hills. Some wetland are present on a plateau in the Shelford Hills in the southern portion of the sub-basin. Water quality data were obtained at 12 of the 14 reaches sampled in the Cliff sub-basin. Water temperature ranged from 6^oC to 10 ^oC. and pH ranged from 6.9 to 7.9. Most of the twelve sites where pH readings were taken had a slightly basic pH, and only two of the sites had a pH lower than 7 (site 99 reach 1 ILP 22076, site 109 reach 2 ILP 22023). Conductivities varied little, and ranged from 20 μS/cm to 40 μS/cm. Conductivities below 30 μS/cm were encountered at one of the 12 sites sampled in the Cliff sub-basin (site 107, reach 2 ILP 22079). While low conductivity may influence sampling efficiency at some locations, Dolly Varden were captured at site 107, indicating that sampling by electrofishing was effective at capturing fish in this location. Turbidity was clear at all sites sampled in the Cliff sub-basin.

4.3 HABITAT AND FISH DISTRIBUTION

Fish were confirmed to be present in approximately 76.77 kilometres of stream in the study area, which has approximately 565.93 kilometres of first, second, third and fourth order streams shown on the 1:20,000 TRIM maps. Of the 25 first order reaches sampled, one (4%) was dry and 13 (52%) were NCD. No fish were captured in the remaining 11 first order reaches (44%). Habitat quality in most of the first order reaches sampled was poor or absent (Tables 5 to 7, Figures 3 to 5). Habitat quality tended to improve in higher order reaches, and most third and fourth order reaches were identified to be fish bearing. Fish distribution in higher order reaches, particularly in the Hay Meadow sub-basin was limited by the natural topographic barriers (i.e. falls, cascades, etc.) or anthropogenic causes that were identified in the study area (Table 8), rather than limited habitat quality which tended to be the case in first order reaches. The biophysical features of the four sub-basins inventoried in July and August 2002 indicated that the Tagetochlain and Hill Tout sub-basins were relatively similar, while the Hay Meadow and Cliff sub-basin appeared to differ in the extent of fish distribution. Due to biological and biophysical similarities between the Hill Tout and Tagetochlain sub-basins, fish distribution data for these two sub-basins has been grouped for this section, while fish distribution data for the Cliff and Hay Meadow sub-basins is summarized separately.

Within the Nadina watershed, anadromous fish species distribution may be limited to some degree by Nadina Falls at the outlet of Nadina Lake (SKR 2000, FISS). However, Nadina Falls are passable at some flows, since Fielden 1995 reports the cascade to be passable, and since SKR (personal observations) noted the presence of spawning sockeye salmon in a tributary to Glacier Creek upstream of Nadina Falls. The four sub-basins sampled in July and August 2001 drain into the Nadina River downstream of Nadina falls, and are thus accessible to anadromous species found in the watershed. Fish distribution in the Tagetochlain and Hill Tout sub-basins extended from lower elevation reaches to mid elevation reaches and encompassed most of the lakes found in these two sub-basins. Fish were generally absent in steeper reaches draining into the south shore of Tagetochlain Lake, but in the remainder of these four sub-basins, few topographic barriers to fish distribution appear to be present. Fish distribution in the Hay Meadow sub-basin is limited by waterfalls in the mainstem, and in a large, fourth order drainage (ILP 20479), which render much of the sub-basin inaccessible to fish. The majority of the mainstem in the Cliff sub-basin is accessible to fish, and Dolly Varden were captured in reach 5 of the mainstem (near the headwaters of the system). Similarly, lower and mid elevation reaches in third and some second order tributaries are accessible, but steeper gradients in the upper elevation of some of the first and second order tributaries decrease fish habitat quality and accessibility in this sub-basin. The relatively low proportion of fish bearing reaches and confinement of fish distribution to lower and mid portions of tributaries to the Nadina River, particularly in the Hay Meadow sub-basin, was also found in Glacier and Larkin Creeks, that were sampled in 1999 (SKR 2000 a,b).

Overall the Tagetochlain, Hill Tout and Cliff sub-basins appear to contain a higher proportion of accessible reaches than the Hay Meadow sub-basin. Of the 118.7 km of stream reaches in the Hay Meadow sub-basin, 10.46 km (8.8%) were found to be fish bearing, and an additional 9.96 km (8.4%) are suspected to be fish bearing (Table 5, Figure 2). In contrast, 49.61km (12.8%) of the 387.8 km in the Hill Tout and Tagetochlain sub-basins were confirmed to be fish bearing, and another 65.06 km (16.8%) are suspected to be fish bearing (Table 6, Figure 3). In addition, 16.68 km (28%) of streams in the Cliff sub-basin, which has 59.41 km of streams, were

confirmed to be fish bearing, and another 7.41 km (12.5%) are suspected to be fish bearing (Table 7, Figure 4). Of the four sub-basins sampled, the Cliff sub-basin appears to have the highest proportion of suspected or known fish bearing reaches, while the Hay Meadow sub-basin contains the least amount of accessible fish habitat.

Table 5. Fish presence and absence in the Hay Meadow sub-basin

	% Gradient Range	Fish Confirmed Present	Fish Suspected Present	Fish Absent/ Suspected Absent	Totals
1st order reaches	0-2	0.00	0.80	2.94	3.73 (5.8%)
	2-10	0.00	2.00	20.97	22.97 (35.7%)
	10-20	0.00	0.00	25.51	25.51 (39.6%)
	>20	0.00	0.00	12.17	12.17 (18.9%)
	Totals	**0.00 (0%)**	**2.80 (4.3%)**	**61.58 (95.7%)**	**64.38**
2nd order reaches	0-2	0.00	0.65	1.13	1.78 (5.4%)
	2-10	0.00	3.44	17.02	20.46 (62.3%)
	10-20	0.00	0.00	8.80	8.80 (26.8%)
	>20	0.00	0.00	1.82	1.82 (5.5%)
	Totals	**0.00 (0%)**	**4.09 (12.4%)**	**28.76 (87.6%)**	**32.85**
3rd order reaches	0-2	0.00	0.00	2.16	2.16 (14.7%)
	2-10	3.72	1.46	5.79	10.97 (74.3%)
	10-20	0.00	1.62	0.00	1.62 (11.0%)
	>20	0.00	0.00	0.00	0.00 (0%)
	Totals	**3.72 (25.2%)**	**3.08 (20.9%)**	**7.95 (53.9%)**	**14.75**
4th order reaches	0-2	2.11	0.00	0.00	2.11 (31.2%)
	2-10	4.64	0.00	0.00	4.64 (68.8%)
	10-20	0.00	0.00	0.00	0.00 (0%)
	>20	0.00	0.00	0.00	0.00 (0%)
	Totals	**6.74 (100%)**	**0.00 (0%)**	**0.00 (0%)**	**6.74**

Table 6. Fish presence and absence in the Tagetochlain and Hill Tout sub-basins.

	% Gradient Range	Fish Confirmed Present	Fish Suspected Present	Fish Absent/ Suspected Absent	Totals
1st order reaches	0-2	0.00	0.00	2.25	2.25 (5.6%)
	2-10	0.00	0.00	7.33	7.33 (18.2%)
	10-20	0.00	0.74	9.8	10.54 (26.2%)
	>20	0.00	0.00	20.12	20.12 (50%)
	Totals	**0.00 (0%)**	**0.74 (1.8%)**	**39.50 (98.2%)**	**40.24**
2nd order reaches	0-2	0.00	0.00	0.00	0.00 (0%)
	2-10	0.00	0.47	6.98	7.44 (39.5%)
	10-20	0.00	0.00	3.30	3.30 (17.5%)
	>20	0.00	0.00	8.11	8.11 (43.0%)
	Totals	**0.00 (0%)**	**0.47 (2.5%)**	**18.39 (97.5%)**	**18.86**
3rd order reaches	0-2	0.00	0.00	0.00	0.00 (0%)
	2-10	0.00	0.00	0.40	0.40 (11.6%)
	10-20	0.00	0.00	1.99	1.99 (57.8%)
	>20	0.00	0.00	1.05	1.05 (30.6%)
	Totals	**0.00 (0%)**	**0.00 (0%)**	**3.44 (100%)**	**3.44**
4th order reaches	0-2	10.33	1.13	0.00	11.46 (11.4%)
	2-10	26.46	13.81	10.75	51.02 (50.7%)
	10-20	2.04	6.27	26.07	34.38 (34.1%)
	>20	0.00	0.00	3.86	3.86 (3.8%)
	Totals	**38.83 (38.6%)**	**21.21 (21.0%)**	**40.69 (40.4%)**	**100.73**

Table 7. Fish presence and absence in the Cliff sub-basin.

	% Gradient Range	Fish Confirmed Present	Fish Suspected Present	Fish Absent/ Suspected Absent	Totals
1st order reaches	0-2	0.00	0.00	0.34	0.34 (1.3%)
	2-10	0.00	0.89	10.61	11.50 (43.1%)
	10-20	0.00	0.60	7.53	8.13 (30.4%)
	>20	0.00	0.00	1.75	6.75 (25.2%)
	Totals	**0.00 (0%)**	**1.49 (5.6%)**	**25.23 (94.4%)**	**26.72**
2nr order reaches	0-2	0.00	0.44	0.55	0.99 (4.8%)
	2-10	3.69	2.32	2.87	8.88 (42.9%)
	10-20	0.97	3.16	4.57	8.70 (42.1%)
	>20	0.00	0.00	2.11	2.11 (10.2%)
	Totals	**4.66 (22.5%)**	**5.92 (28.6%)**	**10.1 (48.8%)**	**20.67**
3rd order reaches	0-2	0.00	0.00	0.00	0.00 (0%)
	2-10	7.62	0.00	0.00	7.62 (91.7%)
	10-20	0.69	0.00	0.00	0.69 (8.3%)
	>20	0.00	0.00	0.00	0.00 (0%)
	Totals	**8.31 (100%)**	**0.00 (0%)**	**0.00 (0%)**	**8.31**
4th order reaches	0-2	0.00	0.00	0.00	0.00 (0%)
	2-10	3.71	0.00	0.00	0.00 (0%)
	10-20	0.00	0.00	0.00	0.00 (0%)
	>20	0.00	0.00	0.00	0.00 (0%)
	Totals	**3.71 (100%)**	**0.00 (0%)**	**0.00 (0%)**	**3.71**

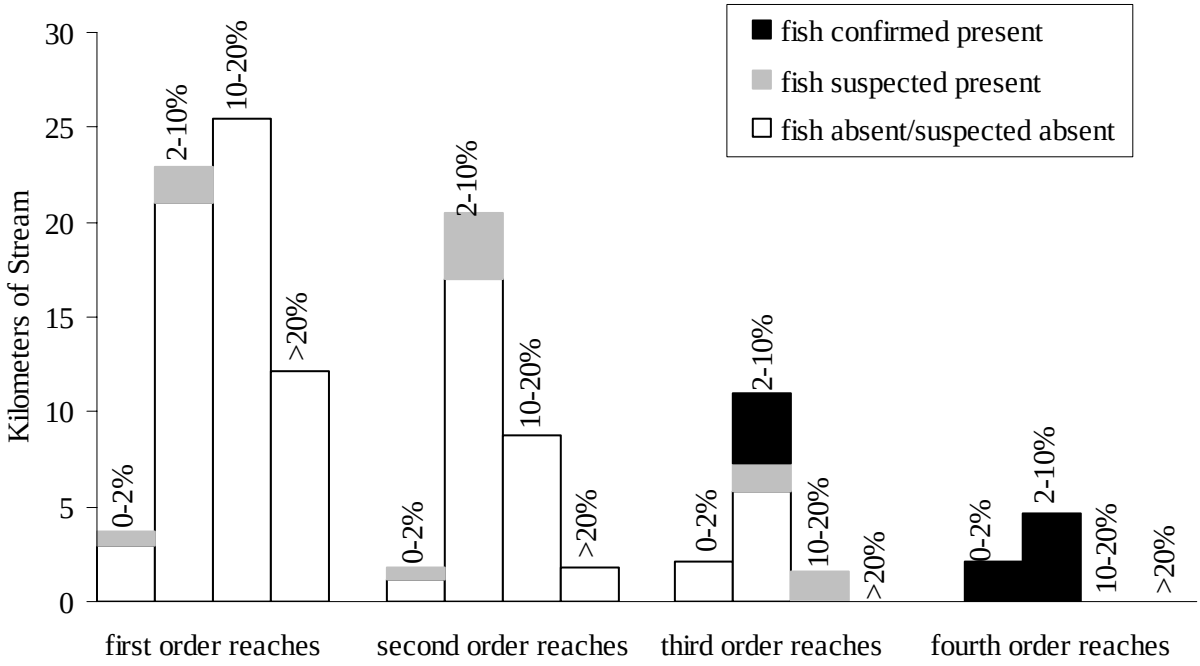

Figure 2. Distribution of fish presence and absence in different order and gradient classes of stream reaches in the Hay Meadow sub-basin as determined from 1:20,000 TRIM maps *(for details* see Table 5). Data labels indicate gradient classes within each stream order.

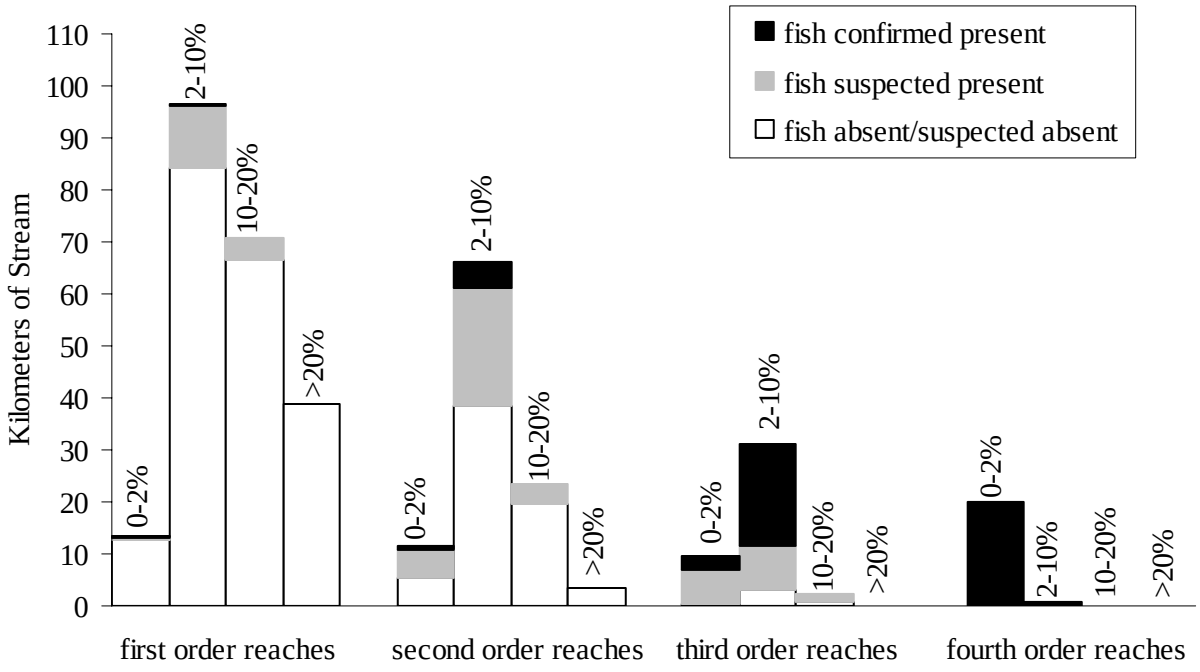

Figure 3. Distribution of fish presence and absence in different order and gradient classes of stream reaches in the Tagetochlain and Hill Tout sub-basins as determined from 1:20,000 TRIM maps *(for details* see Table 6). Data labels indicate gradient classes within each stream order.

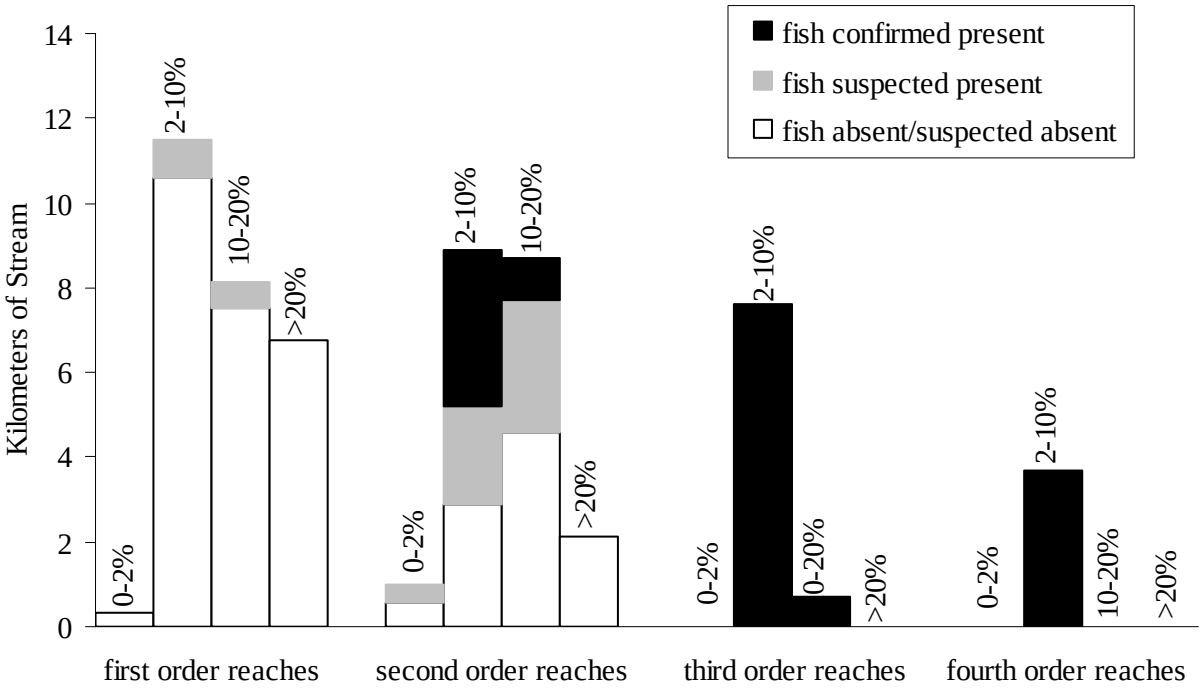

Figure 4. Distribution of fish presence and absence in different order and gradient classes of stream reaches in the Cliff sub-basin as determined from 1:20,000 TRIM maps *(for details* see Table 7). Data labels indicate gradient classes within each stream order.

Table 8. Summary of historic and new barriers to fish migration found in the Hay Meadow, Hill Tout, Tagetochlain and Cliff sub-basins of the Nadina Watershed (sorted by sub-basin ILP and reach number).

sub-basin	ILP	TRIM map #	Reach	Barrier			
				Type	Height (m)	Verified in field	Description
Hay Meadow	20479	093E.097	1	C	1	Y	3 meter long cascade downstream of falls (SKR and Oikos 1999)
	20479	093E.097	1	F	1.5	Y	1. 5 m falls upstream of cascade (SKR and Oikos 1999)
	20800	093E.097	9	F	2	Y	2 meter falls
	20800	093E.097	13	F	3	Y	3 meter falls at lower extent of this steep gradient reach
	20868	093E.097	1	CV		Y	Water flows under rather than through the culvert
Hill Tout	21543	093E.095	1	CV	0.2	Y	The perched culvert appears to be an obstruction but not a barrier to fish passage; rainbow trout and Dolly Varden were captured downstream, but no fish were captured upstream of the culvert
	21547	093E.095	1	FSB		Y	A 40 m long seepage section located 140 m upstream of ILP 21543 was identified as a barrier to fish passage
	21567	093E.095	1	CV	0.3	Y	Culvert may obstruct fish passage at some flows, but rainbow trout and Dolly Varden were captured upstream
	21584	093E.095	2	CV	0.2	Y	35% gradient over 20 m downstream of perched culvert
	21763	093E.095	2	BD	1	Y	90 m downstream of lake
	21833	093E.096	1	CV	1.3	Y	Perched culvert in steep gradient reach (30% downstream of road, 20% upstream with CP morphology)
Tagetochlain	20944	093L.006	3	F	1.5	Y	
	20944	093L.006	3	C	25	Y	20 m long cascade
	20958	093L.006	2	F	8	Y	8 m falls at upper extent of reach (SKR and Oikos 1999)
	21013	093L.006	10	FD		Y	6 m long ford 260 m downstream of lake in reach 11; rainbow caught in reach 8 and in lake upstream
	21015	093L.005	2	F	2	Y	2 m bedrock falls with 0.3 m plunge pool at base
Cliff	22012	093E.096	1	CV		Y	Perched culvert (SKR and Oikos 1999); Dolly Varden were captured upstream
	22023	093E.096	2	F	10	Y	10 m high bedrock falls at upper extent of reach 1
	22088	093E.096	1	C	40	Y	40 m long cascade at confluence with mainstem (ILP 22012)
	22686	093E.096	2	FD		Y	A 7 m long ford allows ATV access; this reach appears to have been impacted significantly by harvest activities

[1] FSB = seepage, F = falls, C = cascade, BD = beaver dam, FD = ford, CV = culvert

4.4 FISH AGE, SIZE AND LIFE HISTORY

Rainbow trout, Dolly Varden, burbot, prickly sculpin, longnose suckers, longnose dace, chub, and redside shiners were captured in the portions of the Nadina watershed that were surveyed in July and August 2001. Of the species captured in this study, rainbow trout were most abundant, followed by Dolly Varden, chub, redside shiners, prickly sculpin, longnose suckers, burbot and longnose dace. The following sub-sections summarize the acquired fish data and provide interpretations and discussions of fish size and age distributions, and species life histories.

4.4.1 Rainbow trout

Rainbow trout was the most common and wide spread salmonid species captured within reaches sampled in the Hay Meadow, Tagetochlain, Hill Tout and Cliff sub-basins in July to August 2001. Of the 109 stream reaches and two lakes sampled for fish in July and August 2001, rainbow trout were captured in 17 stream reaches and one lake. Rainbow trout were most abundant in the Tagetochlain sub-basin, where 67.6% of the 111 rainbow trout were captured, but rainbow trout were not as wide spread or abundant in the Hay Meadow sub-basin where a total of only three rainbow trout were captured at only two of the 15 sites sampled. Rainbow trout were also captured throughout other sub-basins in the Nadina watershed (SKR 2000a, b, 2001a, b, c, d, e, f). As in the sub-basins sampled in 1999 and 2000, rainbow trout appears to be the most widespread and abundant species in the reaches sampled within the Nadina watershed in the summer of 2001.

Forty-three scale samples (38.7%) were collected from the 111 rainbow trout captured. Three of these scale samples were lost during a bear encounter, and twelve of the scale samples were not suitable for age determination. Ages were determined for the remaining 28 of the 111 rainbow trout captured. Scale samples were not collected randomly. No scale samples were collected from rainbow trout measuring less than 60 mm, thus resulting in a lack of age structures from age 0 rainbow trout. Length at age data for the 28 rainbow trout aged by scale sample analysis are summarized in Table 9. Length frequency histograms for rainbow trout captured in the four sub-basins sampled are illustrated in Figure 5. Size ranges of the different age classes present in the sample of rainbow trout captured in the four sub-basins, as estimated from aged rainbow trout and length frequency distribution are also shown in Figure 5. The three largest, and oldest rainbow trout were captured in a lake sampled in the Tagetochlain sub-basin (SKR 2002b). Rainbow trout captured in sub-basins of the Nadina watershed sampled in 2001 represented seven distinct age classes, ranging from young of the year (age 0) to age 6 mature rainbow trout. Age at sexual maturity was 6 for the sample of rainbow trout captured, and the rainbow trout aged as 4 and 5 year old were maturing. Age at maturity was documented as 5 years in reaches sampled in 2001 (SKR 2001a). Scott and Crossman (1973) indicate that rainbow trout generally mature between ages 3-5 with males often maturing one year earlier than females, which is slightly younger than the age at maturity found in this study, based on a relatively small sample size of three rainbow trout aged older than 3 years of age.

Table 9. Length at age for 28 rainbow trout aged from scales.

Age	N	Fork Length (mm)			
		min.	max.	mean	SE
1	12	60	78	72.00	1.446
2	12	78	102	86.58	1.998
3	1	107	107	107	---
4	1	125	125	125	---
5	1	225	225	225	---
6	1	330	330	330	---

Length at age data for the 28 rainbow trout aged from scales were used to generate a Ford-Walford plot (Figure 6) to illustrate growth trajectory for rainbow trout captured. In addition, rainbow trout smaller than 60 mm were assumed to be age 0, and were included in the Ford-Walford plot to increase the number of age categories. Mean fork length at age n was plotted against mean fork length at age n+1, assuming a linear relationship. The regression equation for rainbow trout and corresponding r^2 values for the trend line in Figure 6 are presented below:

rainbow trout:

(FL at age n+1) = 1.5163 (FL at age n) – 8.1703 $r^2 = 0.9286$
sample size = 5 age range = 0 to 6

The Ford-Walford plot illustrates that the line generated by linear regression has a slope greater than 1, with a negative y intercept. Therefore, the equation cannot be used to estimate the asymptopic length ($L\infty$) for rainbow trout. This is partly attributable to the fact that the sample size for larger, older rainbow trout is very small, resulting in a greater likelihood for inaccurate length at age information. In addition, the three older, larger rainbow trout, representing three distinct age classes were obtained during lake sampling (SKR 2002b), while the remaining 24 rainbow trout, which were aged, and the 51 rainbow trout with fork length less than 60 mm were captured in stream reaches. Differences in life history between the rainbow trout captured in the lake by angling, and those captured in the stream reaches by electrofishing may account for the relatively large size at age for 4, 5 and 6 year old rainbow trout when compared to the size at age for juvenile rainbow trout. Asymptopic length is likely to be near 330 mm, when sexual maturity is reached. As fish mature, energy is utilized more for reproductive purposes than for growth, resulting in lower growth increments (Ricker 1975, Bagenal 1978, Moyle and Cech 1988). The Ford-Walford plot illustrated in Figure 4 should be viewed with considerations to the limitations and biases of the size at age data collected.

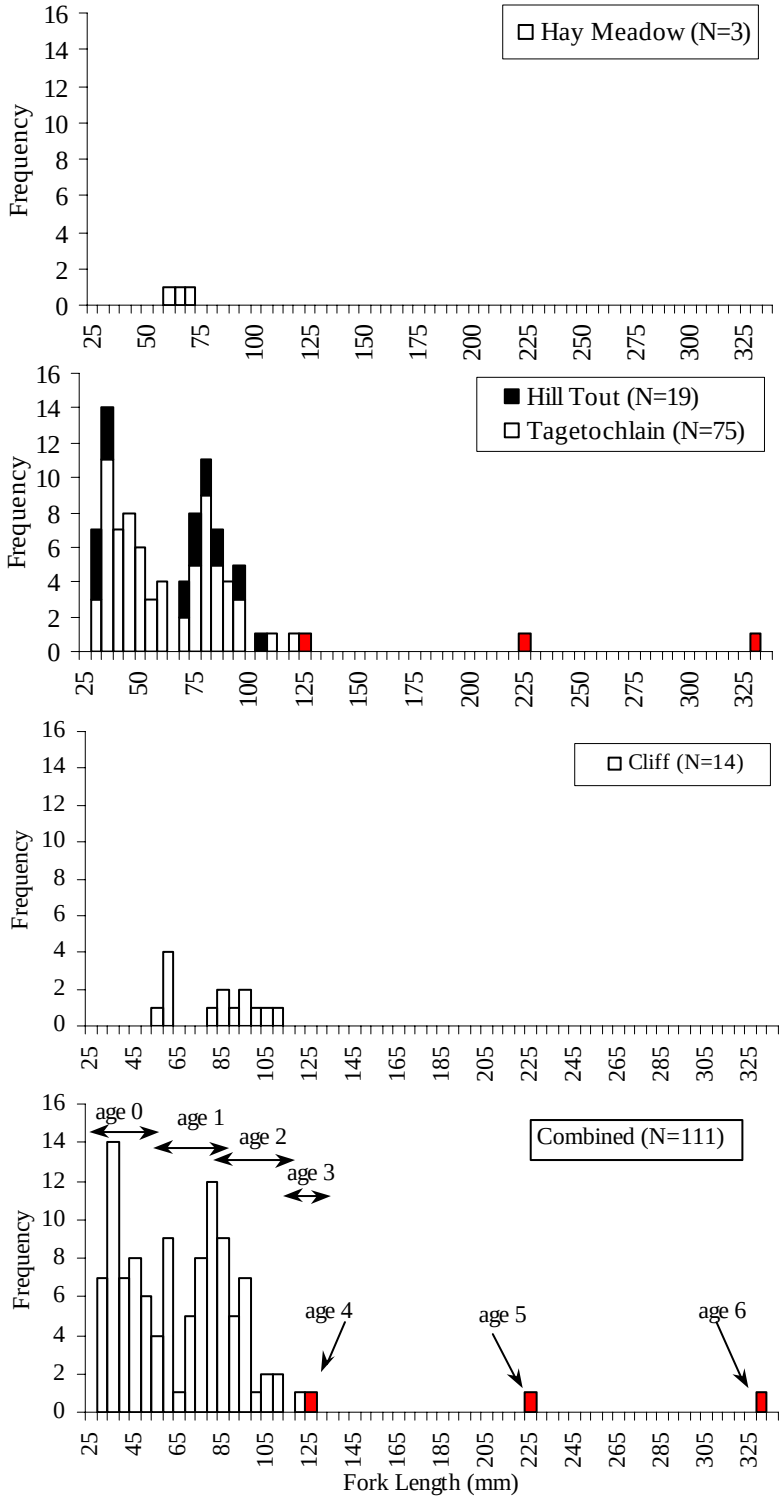

Figure 5. Length frequency histogram of rainbow trout captured in streams and lakes sampled in the Nadina watershed. Red bars identify rainbow trout captured in the lake sampled in the Tagetochlain sub-basin (SKR 2002b).

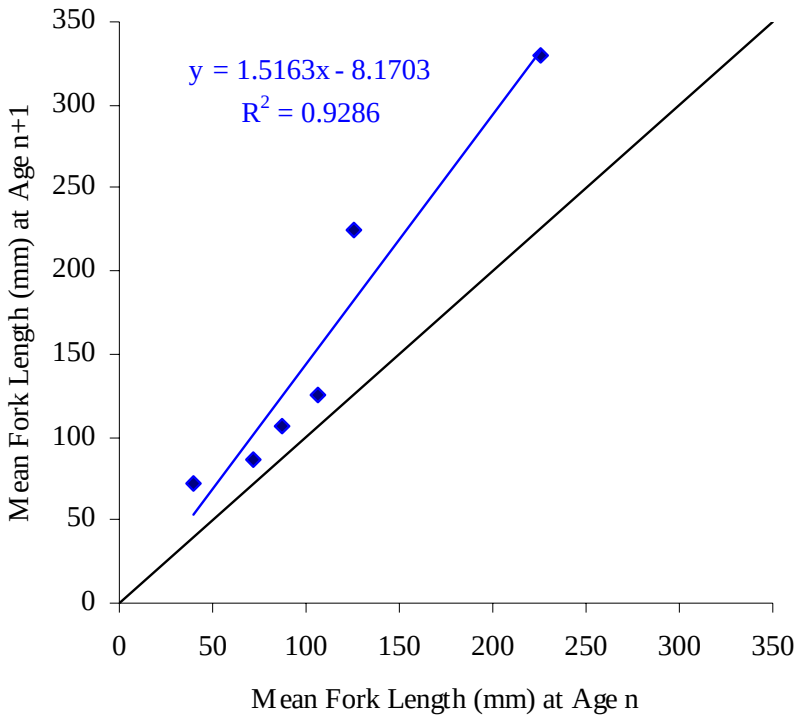

Figure 6. Ford-Walford plot for rainbow trout captured in the Hay Meadow, Tagetochlain, Hill Tout and Cliff sub-basins in the Nadina River watershed. The 45^{o} line is included to illustrate a uniform absolute increase in length with age.

Rainbow trout were captured throughout many of the stream reaches in the four sub-basins of the Nadina River watershed sampled. These populations may exhibit a lacustrine – adfluvial or fluvial life history. The presence of rainbow trout in several of the lakes sampled in the Tagetochlain and Hill Tout sub-basins (FISS, Burns and Tredger 1974b, SKR 2002b) indicates that the majority of the rainbow trout exhibit an adfluvial life history in these sub-basins. The presence of lakes in the Hay Meadow sub-basin also suggests that adfluvial populations of rainbow trout are present, but the lack of lacustrine habitat in the Cliff sub-basins indicates that rainbow trout in this sub-basin are fluvial-adfluvial and/or stream resident.

4.4.2 Dolly Varden

Dolly Varden were captured in several stream reaches, particularly in the Cliff sub-basin, although the total number of Dolly Varden captured (57) was considerably lower than the total number of rainbow trout (111). Dolly Varden were captured in 15 of the 71 stream reaches sampled in July and August 2001, but Dolly Varden were not captured in any of the two lakes surveyed (SKR 2002a, b), or in lakes sampled previously in the Tagetochlain and Hill Tout sub-basins (FISS, Burns and Tredger 1974). Dolly Varden have also been captured in the other sub-basins sampled in the Nadina River watershed (SKR 2000a, b, 2001e), as well as in Nadina Lake (FISS), Newcombe Lake (DeGisi and Schell 1997) and Francois Lake (FISS). While Dolly Varden did not appear as wide spread as rainbow trout, this species was commonly captured in

the Cliff and Hay Meadow sub-basins, but was relatively uncommon in the Tagetochlain and Hill Tout sub-basins.

Forty scale samples (73.7%) were collected from the 57 Dolly Varden trout captured. Six of these scale samples were lost during a bear encounter, and 12 of these scale samples were not suitable for age determination. Ages were determined for the remaining 22 of the 57 Dolly Varden captured (38.6%). Scale samples were not collected randomly. No scale samples were collected from Dolly Varden measuring less than 61 mm. Consequently, age 0+ Dolly Varden were under represented in the scale samples collected from Dolly Varden captured in the Nadina watershed in July and August 2001. Length at age data for the 25 Dolly Varden aged by scale sample analysis are summarized in Table 10. Length frequency histograms for Dolly Varden captured in the four sub-basins sampled are illustrated in Figure 7. Size ranges of the different age classes present in the sample of Dolly Varden captured in the four sub-basins where this species was captured, as estimated from aged Dolly Varden and length frequency distribution are also shown in Figure 7. Dolly Varden captured in sub-basins of the Nadina watershed sampled in 2001 represented four distinct age classes, ranging from young of the year (age 0+) to age 3+ mature Dolly Varden. Age at maturity for Dolly Varden reported by Scott and Crossman (1973) is generally between ages 3 and 4, with males frequently maturing one year earlier than females, which corresponds to the age at sexual maturity found in the samples collected from the Nadina watershed.

Table 10. Length at age for 22 Dolly Varden aged from scales.

Age	N	Fork Length (mm)			
		min.	max.	mean	SE
0+	2	62	65	63.5	1.5
1+	15	67	95	85.93	2.233
2+	4	97	107	100.5	2.217
3+	1	114	114	114	---

Length at age data for the 22 Dolly Varden aged from scales were used to generate a Ford-Walford plot (Figure 8) to illustrate growth trajectory for Dolly Varden captured. In addition, rainbow trout smaller than 62 mm were assumed to be age 0, and were included in the Ford-Walford plot to increase the number of age categories. Mean fork length at age n was plotted against mean fork length at age n+1, assuming a linear relationship. The regression equation for Dolly Varden and corresponding r^2 values for the trend line in Figure 8 are presented below:

Dolly Varden:

(FL at age n+1) = 0.5629 (FL at age n) + 55.258 $r^2 = 0.9609$
sample size = 3 age range = 0+ to 3+

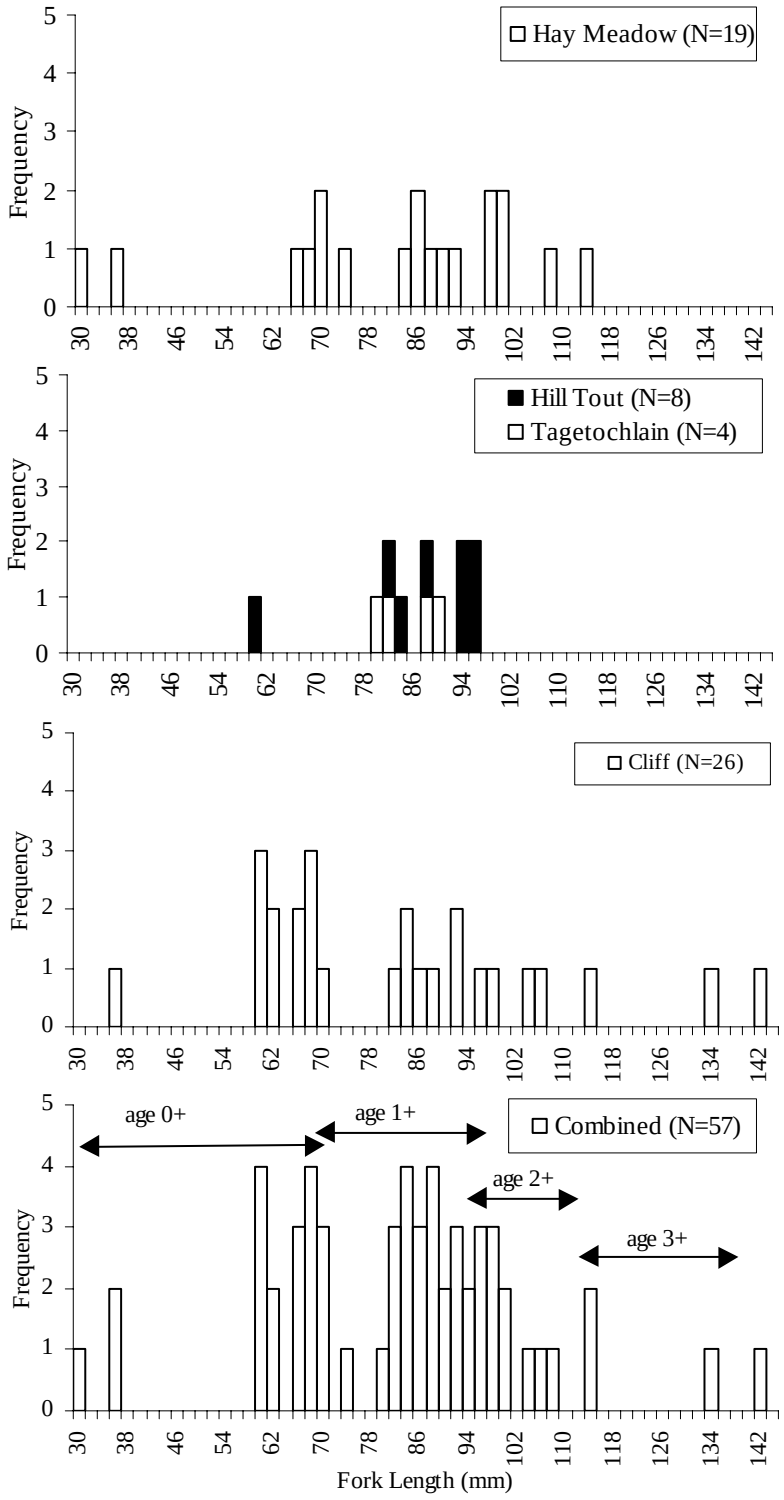

Figure 7. Length frequency histogram of Dolly Varden captured in the Hay Meadow, Tagetochlain, Hill Tout and Cliff sub-basins in July and August 2001. Arrows in the combined graph refer to estimated age categories.

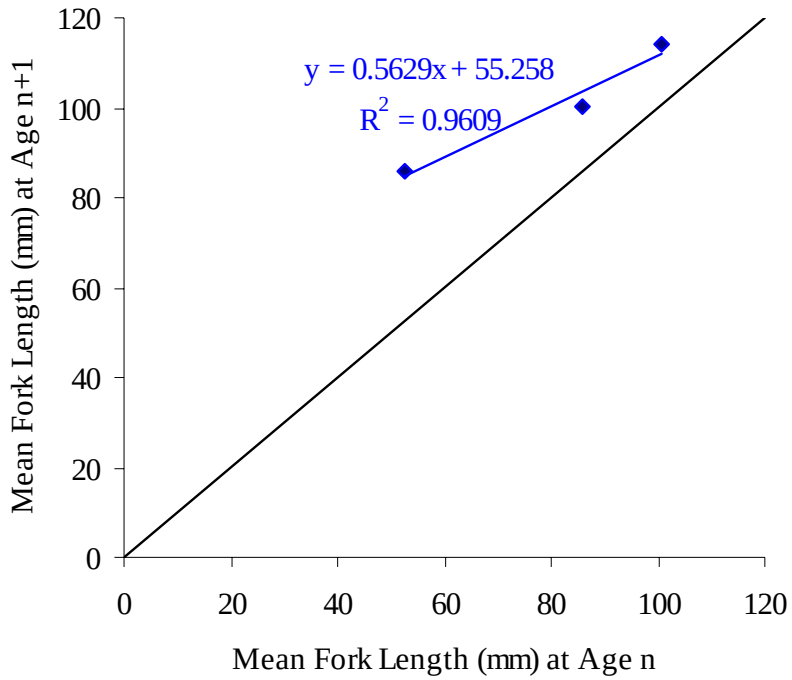

Figure 8. Ford-Walford plot for Dolly Varden captured in the Hay Meadow, Tagetochlain, Hill Tout and Cliff sub-basins in the Nadina River watershed. The 45^{o} line is included to illustrate a uniform absolute increase in length with age.

The Ford-Walford plot illustrates that the line generated by linear regression has a slope less than 1, and is convergent with the 45^{o} diagonal, with a slope of 1. The asymptopic length (L∞) is estimated as 126.4 mm based on the Ford-Walford plot illustrated in Figure 6. The low asymptopic length calculated from aged Dolly Varden is an underestimate of the true asymptopic length, since Dolly Varden captured during previous sampling in the Nadina watershed exceeded the asymptopic length calculated using the Ford-Walford plot, where Dolly Varden greater than 160 mm in length were captured (SKR 2000d). This is likely due to the low sample size (only four classes), and the potential for an overestimate of mean length at age for the 0+ age group. Sampling methodology may be size selective, resulting in a reduced efficiency for sampling small fish. During sampling conducted in 2000 (SKR 2000d), the Ford-Walford plot had a slope greater than 1, and asymptopic length could not be calculated. As in the previous year of the study, it is speculated that Dolly Varden in the Nadina River watershed attain their asymptopic length at age 5+ or 6+. The Ford-Walford plot illustrated in Figure 6 should be viewed with considerations to the limitations and biases of the size at age data collected.

Dolly Varden were captured throughout many of the stream reaches, particularly in the Cliff sub-basin. Dolly Varden were also present in the Hay Meadow sub-basin, but this species was rarely captured in the Hill Tout or Tagetochlain sub-basins. The wide spread distribution and relatively large number of Dolly Varden captured in the Cliff sub-basin, when compared to the other three sub-basins sampled in July and August 2001, suggest that most of the Dolly Varden represent a fluvial-adfluvial or stream resident life history. No lakes are present in the Cliff sub-basin, thus

resulting in a lack of suitable habitat for an adfluvial life history for the Dolly Varden captured in this area. While lakes are present in the Hay Meadow, Hill Tout and Tagetochlain sub-basin, Dolly Varden was the more numerous and wide spread species in the Cliff sub-basin. Dolly Varden were not captured in any of the lakes sampled during this or previous studies (FISS, Burns and Tredger 1974b, SKR 2002 a,b), which is additional circumstantial evidence that Dolly Varden likely do not utilize the lakes in these sub-basins to a large degree. The relatively high number of Dolly Varden captured in the Cliff sub-basin indicates that this system is important for Dolly Varden recruitment to the Nadina River.

4.4.3 Other Species

In addition to rainbow trout and Dolly Varden, seven chub, six redside shiners, five prickly sculpin, three longnose suckers, two burbot, and two longnose dace were captured during this study. Fork length data for these species are summarized in Table 11. All of the burbot, prickly sculpin, chub, longnose suckers, longnose dace, and redside shiners were captured in the Tagetochlain or the Hill Tout sub-basins, while only Dolly Varden and rainbow trout were captured in the Cliff and Hay Meadow sub-basins. Capture locations for all of these species were near lakes or in mainstems (> 3rd order) within the Nadina River watershed. This is not surprising since the species captured generally inhabit lentic waters. Prickly sculpin generally prefer quiet waters, and avoid strong currents (McPhail and Lindsey 1970, Scott and Crossman 1973). This species may be found in streams or along lake shores, and have been known to spawn under larger substrate particles (e.g. cobbles and boulders) (McPhail and Lindsey 1970, Scott and Crossman 1973). Longnose suckers, the most widespread cypriniformes in the north, is generally found in lakes or associated tributary streams. Similarly, chub are generally found in weedy littoral areas of lakes or rivers. Redside shiners generally occur in large lakes, moderately swift streams and small ponds where they form schools (Scott and Crossman 1973). Burbot are primarily lacustrine, but have also been documented in streams near lakes (Scott and Crossman 1973, McPhail 1997). The two burbot were captured in reach 1 of Tagetochlain Creek (site 16), a fifth order tributary to the Nadina River. Burbot have also been documented in Tagetochlain Lake, located approximately 3.1 km upstream of the sample site, and in the Nadina River near the confluence with Tagetochlain Creek (Fielden 1995).

Table 11. Fork length data for burbot, prickly sculpin, longnose suckers, chub, longnose dace and redside shiners captured in the Hay Meadow, Hill Tout, Tagetochlain and Cliff sub-basins of the Nadina watershed.

Species	N	Fork Length (mm)			
		min.	max.	mean	SE
Burbot	2	64	71	67.5	3.5
Prickly sculpin	5	62	108	94.8	8.315
Chub	7	20	26	22.4	0.869
Longnose suckers	3	108	174	143.0	19.157
Longnose dace	2	45	50	47.5	2.5
Redside shiners	6	45	74	64.5	4.264

4.5 SIGNIFICANT FEATURES AND FISHERIES OBSERVATIONS

Of the four sub-basins sampled in the Nadina River watershed in July and August 2001, the Tagetochlain and Hill Tout sub-basins offer more abundant and higher quality fish habitat, while the Hay Meadow sub-basin offers the least abundant and accessible fish habitat. Rainbow trout were frequently captured throughout the Tagetochlain and Hill Tout sub-basin, as well as in accessible reaches within the Hay Meadow sub-basin, while the Dolly Varden was the dominant species in the Cliff sub-basin. Both of these species have also been captured during previous inventory work in the Nadina watershed, and these two species are the most widespread of any of the species captured during this or previous studies (SKR 2000a, b, 2001a, b, c, d). Other salmonids including sockeye, chinook, kokanee and bull trout have also been documented in the Nadina River watershed (Fielden 1995, SKR 2001d FISS). The following sections describe interesting features related to fish, fish habitat, and habitat protection concerns in the study area within the Nadina River watershed based on historical information and the findings from this study.

4.5.1 Fish and Fish Habitat

The higher order and moderate-low gradient reaches of mainstems within the study area appear to offer the most suitable and abundant fish spawning, rearing and overwintering habitat. Overwintering and rearing habitat is also provided by a number of moderate and large sized lakes in the Hay Meadow, Tagetochlain and Hill Tout sub-basins, as well as by the Nadina River. In addition to rainbow trout, Dolly Varden and burbot that were captured during the inventory conducted in July and August 2001, other species historically documented in the Nadina River watershed (e.g. kokanee, whitefish, bull trout) may also use spawning habitat in higher order reaches near the Nadina River mainstem (e.g. Tagetochlain Lake or Hill Tout Lake).

The majority of Dolly Varden captured in July and August 2002 were found in the Cliff sub-basin. Twenty-six of the 57 Dolly Varden captured (45.6%) in the four sub-basins sampled in 2001 were captured in stream reaches within the Cliff sub-basin, while only 16.9% (12 of 71) fish sampling sites were located in this sub-basin. This indicates that Dolly Varden are relatively wide spread, and present at high densities in stream reaches in this area, and that this sub-basin is likely important in maintaining Dolly Varden populations in the Nadina River.

Bull trout have been documented present in the lower Nadina River (Fielden 1995). The species is also likely present in Francois Lake, as indicated by a large specimen identified as a Dolly Varden (DeLeeuw 1992). This specimen was identified as a Dolly Varden at a time when the taxonomy of bull trout and Dolly Varden was still in question (Haas and McPhail 1991), and is likely a bull trout as indicated by the large size of the specimen (92 cm long, 13 years old). Both Dolly Varden and bull trout are blue listed species and are considered vulnerable to human disturbances and natural catastrophes (B.C. Environment 2001).

Two distinct sockeye stocks are distinguished between for the Nadina River. This distinction is based on run timing, with peak of spawning for the early Nadina sockeye stock generally occurring in late August to early September (Aug 28 – Sept. 2). The peak spawning of the late Nadina sockeye stock generally occurs in mid September (Sept. 13-25). While returns for both stocks have declined in the early to mid 1990's, returns for the early sockeye stock dropped to 0 in 1989 and 1990 (SKR 1998 c). The spawning sockeye observed in a tributary to Glacier Creek

was likely part of the late Nadina stock, as indicated by the timing of the observation (October 3, 2000 SKR personal observation). The sockeye salmon observed at site 2 in the Nadina River mainstem on September 9th, 2000 are speculated to be part of the early Nadina stock since a significant proportion of the fish observed were noted to have spawned prior to the sample date. The early Nadina stock may therefore still be present in the Nadina River, but it is unclear what the escapement of this stock is.

Relatively high water temperatures during the warm summer months have recently been recorded in the mainstem of the Nadina River (Anon. 1997). Since water temperature during the summer can be an important determinant of fish health and survival, the lower portion of the watershed (downstream of Nadina Lake) has been designated a temperature sensitive watershed requiring additional riparian retention around all streams in this portion of the system (Witt personal communication 1998).

4.5.2 Habitat Protection Concerns

4.5.2.1 Fisheries Sensitive Zones

No fisheries sensitive zones were identified in the Hay Meadow, Hill Tout, Tagetochlain and Cliff sub-basins. However, the highly braided nature of reach 1 of Tagetochlain Creek indicates that a fisheries sensitive zones may be present in this area.

4.5.2.2 Fish above 20% gradient

No fish were captured in reaches with gradients greater than 20%.

4.5.2.3 Rare and Endangered Species

Dolly Varden were captured in the Nadina River watershed during this and previous studies, and bull trout have been reported in the lower Nadina River (Fielden 1995). Bull trout are also suspected present in Francois Lake (DeLeeuw 1992). Both Dolly Varden and bull trout are blue listed by the Conservation Data Center (B.C. Environment 2001).

4.5.2.4 High Value Sport Fishing

Several species attractive for sport fishing have been documented in the Nadina River watershed, including rainbow trout, lake trout, coho, Dolly Varden and bull trout. Sport fishing opportunities exist in the mainstem of the Nadina River, and in several of the lakes in the drainage (e.g. Nadina Lake, Tagetochlain Lake), but Buck Creek is currently closed to fishing (B.C. Fisheries 2001). No noteable sport fishing opportunities were noted at sites sampled during the reconnaissance fish and fish habitat inventory project conducted in July and August 2001.

4.5.2.5 Restoration and Rehabilitation Opportunities

A significant proportion of forest has been harvested in the Nadina River watershed, particularly downstream of Nadina Lake (Anon. 1997, SKR 1998 c), and further harvest has been proposed. Many of the reaches sampled were dry (4% of first order reaches, 18% of second order reaches, and 5% of third order reaches), or did not have a defined channel (52% of first order reaches,

16% of second order reaches and 15% of third order reaches). The ephemeral nature of many of the sampled reaches is partly attributable to the timing of sampling (late summer and fall). However, the lack of wetted reaches in the system appears to be relatively common, and may be partly be due to the level of harvest in the watershed, which may result in increased high flow levels that last for a shorter duration, and resulted in decreased low flow levels. This is supported by circumstantial evidence that sub-basins with higher levels of harvest had a higher frequency of NCD or dry reaches (Table 12). Changes in hydrology of the watershed may have resulted from the harvest in this generally low gradient system, but these affects are difficult to restore.

Table 12. Harvest levels (Anon. 1997) and proportions of dry or NCD reaches in the Hay Meadow, Hill Tout, Tagetochlain and Cliff sub-basins.

Sub-basin	% sub-basin harvested	First order			Second order			Third order		
		Total	% NCD	% dry	Total	% NCD	% dry	Total	% NCD	% dry
Hay Meadow	22%	3	100%	0%	9	0%	33%	2	0%	0%
Hill Tout	25%	12	41.7%	8.3%	18	22.2%	22.2%	13	15.4%	0%
Tagetochlain	22%[1]	7	57.1%	0%	20	15%	10%	7	14.3%	14.3%
Cliff	12%	3	33%	0%	7	14.3%	0%	3	0%	0%
Combined		25	52%	4%	50	16%	18%	20	15%	5%

[1] 3% of the Tagetochlain sub-basin is open range (Anon. 1997)

Broader scale impacts of landuse management are difficult to assess and restore, but some of these impacts have been identified in previous studies (Anon. 1997, Oikos 1999, SKR 1998d, SKR and Oikos 1999, SKR 2001d). In addition, some specific sites offering rehabilitation opportunities were identified during this study in the lower Nadina sub-basins (Table 13). No restoration opportunities were identified in the Gates, Shelford or upper Nadina sub-basin sampled in 2000 (SKR 2001d), and no restoration opportunities were identified during reconnaissance level fish and fish habitat inventory in the Glacier and Larkin sub-basins in 1999 (SKR 2000a, b).

Table 13. Summary of restoration and rehabilitation opportunities identified in reaches sampled in the Hay Meadow, Hill Tout, Tagetochlain and Cliff sub-basins in the Nadina River watershed sampled in July and August 2001.

Sub-basin	ILP	Reach	Site	TRIM Map	Comments
Hay Meadow	20868	1	6	093E.097	Water flows under rather than through this culvert; some of the road fill is washing out; this culvert appears impassable to fish due to a lack of flow through the culvert
Hill Tout	21904	2	24	093E.096	This reach is located in a previously harvested area; the reach appears to have been adversely impacted by harvest activities; a layer of silt was noted on the stream substrate, reducing the suitability of substrate for spawning; fish presence in this reach has not been confirmed
Hill Tout	21567	1	58	093E.095	0.3 m perched culvert may be obstructing fish passage at some flows, but rainbow trout and Dolly Varden were captured upstream
Hill Tout	21543	1	52	093E.095	A 0.2 m perched culvert in this reach appears to be an obstruction but not a barrier to fish passage; rainbow trout and Dolly Varden were captured downstream but not upstream of the culvert
Tagetochlain	20944	1	69	093E.096	Some damage to the stream banks, impacting stream stability, and resulting in some aggraded areas appear to have resulted from cattle in the area; Dolly Varden were captured at this site
Tagetochlain	20948	1	73	093E.096	Some cattle damage to stream banks was noted at the upper end of the reach; fish presence in this reach has not been confirmed
Tagetochlain	21013	10	80, 81	093L.006	A ford in this reach is impacting fish passage and fish habitat quality/stability; rainbow trout were captured downstream in reach 8, and upstream in a lake (reach 11), indicating that rainbow trout migrate through this reach
Cliff	22099	1	102	093E.096	This reach appears to have been heavily impacted by previous harvest activities; the stream banks are unstable, and a large amount of LWD and SWD is in and across the channel; riparian vegetation is re-establishing naturally; Dolly Varden were captured in this reach
Cliff	22686	2	104	093E.096	This reach appears to have been impacted significantly by harvest activities, and a ford located in this reach which is utilized for ATV access; several avulsions (some recent) were noted in the block, and unstable banks were present; the reach was dewatered at the time of survey, and the channel is aggrading at the ford crossing, but surface water was present 30 m downstream of the ford; in addition to the avulsions, several abandoned channels were noted, and the stream braids extensively in some locations; riparian retention was not retained during harvest, and the lack of deep or extensive root systems on the stream bank are speculated to have contributed to the current instability of the reach; Dolly Varden and rainbow trout were captured in this reach
Cliff	22020	1	106	093E.096	A portion of this reach is located in a harvested area; the habitat quality within the block is notably lower than downstream; harvest activities appear to have resulted in decreased stream bank stability, excessive amounts of LWD and SWD in and across the stream channel; and a thick layer of silt on the stream substrate; rainbow trout and Dolly Varden were captured in this reach

4.6 FISH BEARING STATUS

Fish distribution in the study area is limited by a combination of gradient barriers to fish migration, and intermittent channels. Fish bearing reaches are summarized in Table 14, while proposed non-fish bearing reaches are summarized in Table 15. Reaches upstream of barriers to fish migration where no fish were captured, or where no perennial fish habitat was identified, are classified as non-fish bearing based on one season of sampling. Some reaches where no fish were captured, but no definite barrier to fish migration was observed, were noted to require further sampling to conclusively establish fish presence or absence (Table 16).

4.6.1 Fish Bearing Reaches

Fish bearing status was assigned to all reaches in which species listed in the Forest Practices Code Fish Stream Identification guidebook were captured (FPC 1998). In addition, reaches in which no fish were captured, but where fish presence has been documented upstream, and where no barriers to fish migration have been identified were defaulted as fish bearing. Table 14 summarizes reaches that were documented to be fish bearing during this study. Of the 109 stream reaches sampled in July and August 2001, fish were captured in 28 stream reaches (Table 14). In addition, salmonids were captured in one of the two lakes sampled (SKR 2002 b). Other potential fish bearing reaches are indicated on the Fisheries Interpretive Map (Appendix 5).

4.6.2 Non - Fish Bearing Reaches

Non-fish bearing status was assigned to 44 reaches sampled upstream of barriers to fish migration in which no fish were captured in one season of sampling or which did not offer perennial fish habitat (Table 15). This indicates a lack of resident fish upstream of these barriers. In addition, one lake was found to be barren (SKR 2002a).

4.6.3 Follow – Up Sampling Required

Fish presence or absence was not conclusively determined for 41 reaches sampled in the Hay Meadow, Hill Tout, Tagetochlain and Cliff sub-basins during the reconnaissance fish and fish habitat inventory project conducted in July and August 2001 (Table 16). These reaches require re-sampling to indicate if seasonal fish use is present and to confirm fish absence as described under Forest Practices Code standards (FPC 1998).

Table 14. Summary of data from 28 fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in June and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream name	ILP/ Watershed Code	TRIM map	Reach	Species	Channel			
						Width (m)	Site gradient (%)	Proposed Riparian Class	Comments
1	Hay Meadow/ Unnamed	20800	093E.097	7	RB, DV	5.37	2.2	**S2**	One juvenile rainbow trout and five juvenile Dolly Varden were captured in this reach; good spawning habitat, excellent rearing habitat and some good potential overwintering habitat were noted in this reach
9	Hay Meadow/ Unnamed	20840	093E.097	2	RB, DV	1.55	8	**S3**	Two juvenile rainbow trout, nine juvenile Dolly Varden (including two fry), and one adult Dolly Varden were captured in this reach; the presence of excellent spawning habitat, and both fry and adult Dolly Varden suggest that this is a Dolly Varden spawning location
10	Hay Meadow/ Unnamed	20843	093E.097	1	DV	1.38	9	**S4**	One adult and three juvenile Dolly Varden were captured in this reach, which provided good rearing habitat, and some spawning habitat
16	Tagetochlain/ Tagetochlain (Poplar)	21915	093E.096	1	RB, BB, LNC	9.83	2	**S2**	Eight rainbow trout fry, two juvenile burbot, and one adult longnose dace were captured in this reach, which was one of at least four distinct distributaries of the Poplar Creek mainstem; several larger fish (suspected to be adult rainbow trout) were also observed; extensive braiding in this reach indicates that fisheries sensitive zone are likely present
20	Hill Tout/ Hill Tout Creek	21855	093E.096	1	RB, LSU, CAS	5.40	2	**S2**	28 juvenile rainbow trout (including 13 fry), three longnose suckers, and four prickly sculpin were captured in this reach, which provided excellent rearing, good overwintering and moderate spawning habitat
21	Hill Tout/ Hill Tout Creek	21855	093E.096	6	RB	2.40	2.8	**S3**	Ten juvenile rainbow trout were captured in this reach, which offered excellent rearing and spawning habitat as well as good overwintering habitat

Table 14 (cont). Summary of data from 28 fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream name	ILP/ Watershed Code	TRIM map	Reach	Species	Channel		Proposed Riparian Class	Comments
						Width (m)	Site gradient (%)		
22	Hill Tout/ Hill Tout Creek	21855	093E.096	10	RB	1.53	10.5	**S3**	Two juvenile rainbow trout were captured in this reach which provided good rearing, fair spawning and poor overwintering habitat
41	Hill Tout/ Unnamed	21763	093E.096	1	RB, CAS, RSC	1.50	1	**S3**	One juvenile rainbow trout, one prickly sculpin and six redside shiners were captured in this reach which provided excellent rearing, spawning and overwintering habitat
42	Hill Tout/ Unnamed	21763	093E.096	2	RB	2.58	0.5	**S3**	Five juvenile rainbow trout (including four fry) were captured in this reach, which provided excellent rearing, spawning and overwintering habitat; a beaver dam was identified in this reach
46	Hill Tout/ Unnamed	21780	093E.095	1	RB	0.90	7.5	**S4**	Six juvenile rainbow trout (including three fry) were captured in this reach, which provided good spawning, moderate rearing and poor overwintering habitat
52	Hill Tout/ Unnamed	21543	093E.095	1	RB, DV	1.57	3.25	**S3**	One juvenile rainbow trout and five juvenile Dolly Varden were captured in this reach, which provided good rearing and spawning habitat and fair overwintering habitat; all fish were captured below the Duel Lakes FSR; the culvert at the Duel Lakes FSR appears to be an obstruction but not a barrier to fish passage; no fish were captured upstream of the culvert
58	Hill Tout/ Unnamed	21567	093E.095	1	RB, DV	1.33	4.5	**S4**	Two juvenile rainbow trout and three juvenile Dolly Varden were captured in this reach, which provided good rearing and spawning habitat and poor overwintering habitat; a 0.3 m perched culvert at the CP 138-1 and CP 138-2 access road may obstruct fish passage at some flows, but fish were captured upstream of the culvert

Table 14 (cont). Summary of data from 28 fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream name	ILP/ Watershed Code	TRIM map	Reach	Species	Channel		Proposed Riparian Class	Comments
						Width (m)	Site gradient (%)		
64	Hill Tout/ Unnamed	21600	093E.095	1	RB	1.37	3.5	**S4**	Four juvenile rainbow trout were captured in this reach, which provided excellent rearing and spawning habitat, and good overwintering habitat
69	Tagetochlain/ Unnamed	20944	093E.096	1	DV	2.43	6	**S3**	Four juvenile Dolly Varden were captured in this reach, which provided good spawning and rearing habitat and moderate overwintering habitat; some impacts to the stream bank from cattle were noted
80	Tagetochlain/ Unnamed	21013	093L.006	8	RB	2.12	5.5	**S3**	Three juvenile rainbow trout (including two fry) were captured in this reach, which provided good rearing and spawning habitat but no overwintering habitat
81	Tagetochlain/ Unnamed	21013	093L.006	10	RB	1.02	1.8	**S4**	This reach was not sampled by electrofishing, but rainbow trout were captured downstream in reach 8 (site 80), and upstream in the lake in reach 11 (sites 122-127)
84	Tagetochlain/ Unnamed	21015	093L.005	2	RB	1.82	12	**S3**	Four juvenile rainbow trout (including two fry) were captured in this reach, which provided moderate rearing and spawning habitat, and poor overwintering habitat; a 2 m falls was identified as a barrier to fish passage in this reach; fish were captured downstream of the falls
95	Tagetochlain/ Unnamed	21003	093L.005	2	RB	2.03	6	**S3**	One adult rainbow trout and 16 juvenile rainbow trout (including three fry) were captured in this reach, which provided good rearing, moderate spawning and no overwintering habitat
97	Cliff/ Unnamed	22012	093E.096	1	RB, DV	5.08	1.8	**S2**	Nine juvenile rainbow trout, one adult Dolly Varden and seven juvenile Dolly Varden were captured in this reach, which provided good rearing and overwintering habitat as well as moderate spawning habitat

Table 14 (cont). Summary of data from 28 fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream name	ILP/ Watershed Code	TRIM map	Reach	Species	Channel		Proposed Riparian Class	Comments
						Width (m)	Site gradient (%)		
98	Cliff/ Unnamed	22012	093E.096	3	DV	3.50	10	**S3**	Four juvenile Dolly Varden were captured in this reach, which provided good rearing, excellent spawning and fair overwintering habitat
99	Cliff/ Unnamed	22076	093E.096	1	DV	3.53	5	**S3**	One juvenile Dolly Varden was captured in this reach, which provided excellent spawning, good rearing, and fair overwintering habitat
101	Cliff/ Unnamed	22097	093E.096	1	DV	1.50	5.5	**S3**	Two juvenile Dolly Varden were captured in this reach, which provided good rearing and spawning habitat and poor overwintering habitat
102	Cliff/ Unnamed	22099	093E.096	1	DV	1.38	9.5	**S4**	One juvenile Dolly Varden was captured in this reach, which provided moderate rearing and spawning habitat, and poor overwintering habitat
104	Cliff/ Unnamed	22686	093E.096	2	RB, DV	3.53	4	**S3**	One juvenile rainbow trout, two juvenile Dolly Varden and one adult Dolly Varden were captured in this reach, which provided excellent rearing and spawning habitat and good overwintering habitat downstream of the harvested area; within the block, the channel has been significantly disturbed; several avulsions were noted (some very recent), and some eroding banks are present; a ford within this reach further impacts fish habitat quality
105	Cliff/ Unnamed	22686	093E.096	5	DV	1.18	5	**S4**	Three juvenile Dolly Varden were captured in this reach, which provided good rearing, moderate spawning, and fair overwintering habitat

Table 14 (cont). Summary of data from 28 fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream name	ILP/ Watershed Code	TRIM map	Reach	Species	Channel		Proposed Riparian Class	Comments
						Width (m)	Site gradient (%)		
106	Cliff/ Unnamed	22020	093E.096	1	RB, DV	1.57	3.5	**S3**	Four juvenile rainbow trout and one juvenile Dolly Varden were captured in this reach, which provided good rearing and spawning habitat and poor overwintering habitat; 350 m upstream of the confluence with ILP 22686, the reach is located in a harvested area, and habitat quality deteriorates in this section of the stream (e.g. excessive amounts of LWD and SWD in channel, unstable banks)
107	Cliff/ Unnamed	22079	093E.096	2	DV	1.38	9.5	**S4**	Three juvenile Dolly Varden were captured in this reach which provided good rearing and spawning habitat and fair overwintering habitat
122 to 127	Tagetochlain 00672 FRAN	51352	093L.006	11	RB	Lake	0	**L1**	One rainbow trout was captured by angling in this lake; no fish were captured in minnow traps (SKR 2002b)

Table 15. Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
2	Hay Meadow/ Unnamed	20800	10	093E.097	4.5	1.70	100	592	10	14	L	C	---	08/21	**S6**	This reach is located upstream of a 2 meter falls in reach 9 of this system, which is a barrier to fish passage; limited spawning and overwintering habitat were observed at the sample site due to a lack of suitable gravels, and a lack of deep pools; no fish were captured at three other sites sampled upstream of the falls (sites 3, 4 and 15); fish presence in the lake in reach 11 of this system is not suspected due to the lack of fish in the lake outlet or two of its inlets.
3	Hay Meadow/ Unnamed	20800	12	093E.097	3.5	1.10	85	384	30	8.5	L	C	---	08/21	**S6**	This intermittent reach is located upstream of a 2 meter falls in reach 9 of this system, which is a barrier to fish passage; less than 100 m of the stream were sampled by electrofishing since the reach was primarily dry at the time of sampling; no perennial fish habitat was observed in the reach, which offered no suitable overwintering habitat (intermittent), and no suitable spawning habitat; no fish were captured at three other sites sampled upstream of the falls (site 2, 4 and 15); fish presence in the lake in reach 11 of this system is not suspected due to the lack of fish in the lake outlet or two of its inlets.

Table 15. Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
4	Hay Meadow/ Unnamed	20800	13	93E.097	19.5	1.55	---	---	---	---	Dry	---	---	08/21	**S6**	This intermittent reach was dry at the time of survey; no suitable overwintering, spawning or rearing habitat were noted in this steep gradient reach due to an average site gradient of 19.5%, and the lack of surface water; a 3 m falls at the lower end of the reach was identified as a barrier to fish passage; in addition, a 2 m falls in reach 9 of this stream is a barrier to fish passage; no fish were captured upstream of the 2 m falls in reach 3 or at three other sites sampled (sites 2, 3 and 15); fish presence in the lake in reach 11 of this system is not suspected due to the lack of fish in the lake outlet or two of its inlets.
7	Hay Meadow/ Unnamed	20869	2	93E.097	18.5	---	---	---	---	---	---	---	---	08/08	**NCD**	A short, 10 m long section was observed just upstream of the FSR crossing (280 m upstream of ILP 20868), but several long seepage sections (30-50 m long) between a few puddles were noted to be definite barriers to fish passage in this reach; no fish habitat was noted in the section surveyed (lower 300 m of this reach)

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
12	Hay Meadow/ Unnamed	20855	4	93E.097	12	1.10	---	---	60	6.5	M	C	---	08/07	**S6**	This reach is located upstream of an extensive seepage section at the upper portion of reach 3 (see site 11), which was identified as a barrier to fish passage; the majority of this reach lacks a continuous channel, but a defined channel is present at the road crossing, with 50% of the flow draining via the stream channel, and the other 50% of the flow draining through a ditch; both of these "channels" disappear 20-30 m downstream of the road crossing; no perennial fish habitat was noted in the section surveyed, upstream of the barrier to fish passage at the upper portion of reach 3, due to the lack of suitable overwintering habitat (no deep pools)
13	Hay Meadow/ Unnamed	20855	5	93E.097	12	1.25	---	---	---	---	Dry	---	---	08/08	**S6**	This reach is located upstream of an extensive seepage section at the upper portion of reach 3 (see site 11), which was identified as a barrier to fish passage; in addition, a 30 m long 50% gradient section in reach 4 is a barrier to fish passage; a dry continuous channel was found in the lower 280 m of the reach, but the channel was difficult to follow in the old harvested area upstream of this location; no perennial fish habitat was identified in this reach, due to the lack of perennial habitat

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
14	Hay Meadow/ Unnamed	20856	2	93E.097	13	---	---	---	---	---	---	---	---	08/08	**NCD**	No visible channel was found in the lower 450 m section of this reach (section surveyed); a visible riparian band was present in the forested section of the reach, but the riparian band was not readily distinguishable in the harvested area
15	Hay Meadow/ Unnamed	20836	1	93E.097	7	1.15	---	---	---	---	Dry	---	---	08/21	**S6**	This intermittent reach is located upstream of a 2 meter falls in reach 9 of the mainstem (ILP 20800), which is a barrier to fish passage; the reach was dry at the time of sampling, demonstrating a lack of perennial fish habitat; evidence of heavy scouring was observed in some short sections of the reach; in addition to the 2 m falls in the mainstem, extensive seepage sections (1-10 m long) in the lower 100 m of the reach were noted to be barriers to fish passage; no fish were captured at three other sites sampled upstream of the falls (site 2, 3 and 4); fish presence in the lake in reach 11 of ILP 20800 of this system is not suspected due to the lack of fish in the lake outlet or two of its inlets.

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
19	Tagetochlain/ Unnamed	21947	1	93E.096	2.5	---	---	---	---	---	---	---	---	08/14	**NCD**	The lower 500 m of this reach were surveyed; the entire section surveyed was located in an old harvested area, with a very distinct riparian band; confinement varies from occasionally confined in the lower portion of the reach to confined in the upper extent of the surveyed section; some scoured section (up to 20 m long) were identified in the section surveyed, but long seepage sections (30-50 m long) separated the occasional channelized sections
25	Hill Tout/ Unnamed	21907	1	93E.096	6.5	---	---	---	---	---	---	---	---	07/27	**NCD**	No stream was identified in the section surveyed (lower 350 m of the reach), which consisted of a distinct riparian band located in a slight depression; replanted pine trees delineated the riparian band
26	Hill Tout/ Unnamed	21890	4	93E.096	4	---	---	---	---	---	---	---	---	07/26	**NCD**	Some muddy puddles, and sections of discontinuous channel were noted in the section surveyed (lower 390 m of the reach), but no visible channel was noted upstream of tributary ILP 21892; the lack of a continuous channel in this reach, which was located in a 30 m wide riparian band, indicates that this reach is a non-classified drainage

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
27	Hill Tout/ Unnamed	21888	1	93E.096	1	---	---	---	---	---	---	---	---	07/26	**NCD**	No sign of a channel was found within a defined riparian band located in a gully downstream of the Hill Tout FSR, or the depression upstream of the Hill Tout FSR, within the section surveyed (lower 500 m of reach); in addition, no defined channel was found in the wetland which is mapped to connect this reach with ILP 21890
28	Hill Tout/ Unnamed	21882	1	93E.096	1.5	---	---	---	---	---	---	---	---	07/26	**NCD**	This reach consisted of a 30-40 m wide riparian band in a wet depression downstream of the Hill Tout FSR, and no sign of a riparian band or channel upstream of the road; the lower 1400 m of the reach were surveyed
29	Hill Tout/ Unnamed	21876	4	93E.096	7.3	0.50	---	---	---	---	Dry	---	---	07/26	**NCD**	While a defined, dry channel was found downstream of the Hill Tout Main FSR (Table 16), no continuous channel was found upstream of the road; this section of the reach can be managed as NCD due to the lack of a continuous, defined channel
30	Hill Tout/ Unnamed	21879	1	93E.096	---	---	---	---	---	---	---	---	---	07/26	**NCD**	No visible channel was found in this reach; the reach was located in a shallow gully; this reach is located in a harvested area, and is a barrier to fish passage due to the lack of a defined channel; the wetland located downstream (ILP 21876 reach 3) had a dry, 0.3-0.4 m wide muddy channel;

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
31	Hill Tout/ Unnamed	22102	1	93E.096	2.5	---	---	---	---	---	---	---	---	07/23	**NCD**	This reach is located in 15-25 m wide band of alder, spruce, fir and gooseberry; no defined, continuous channel was identified in this reach; the reach appears to drain as mapped; this reach is a barrier to fish passage due to the lack of a visible channel
32	Hill Tout/ Unnamed	22102	2	93E.096	1	0.35	---	---	90	15	M	C	---	07/23	**S6**	This reach does not provide suitable overwintering habitat (no deep pools) or spawning habitat (no suitable substrate); the reach is located upstream of a barrier to fish passage (reach 1, site 31)
33	Hill Tout/ Unnamed	22103	3	93E.096	26	0.37	---	---	---	---	Dry	---	---	07/23	**S6**	This reach does not provide fish habitat due to a gradient greater than 25% (with CP morphology); in addition, this reach is located upstream of a barrier to fish passage in reach 1 of the mainstem (ILP 22102, site 31)
37	Hill Tout/ Unnamed	21871	1	93E.096	9.8	---	---	---	---	---	---	---	---	07/26	**NCD**	No sign of flowing water, scouring or fluvial deposits were noted in the section surveyed (lower 320 m) except for the presence of a drainage ditch on the upstream side of the Hill Tout FSR; the occasional puddle was observed, but the reach consisted primarily of a 15-20 m wide riparian band in a gully

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
39	Hill Tout/ Unnamed	21835	1	93E.096	22.5	0.30	---	---	---	---	Dry	---	---	07/23	**S6**	This stream drains into Hill Tout Lake; no defined channel was found between Hill Tout Lake and the Duel Lake FSR, and this section is a barrier to fish passage; the steep gradient of this reach (>20% with CP morphology), coupled with the lack of a defined channel upstream of Hill Tout Lake, and the lack of riparian habitat in the reach (steep gradient, intermittent) indicate that the reach is non-fish bearing
40	Hill Tout/ Unnamed	21833	1	93E.096	25	0.33	---	---	---	---	Dry	---	---	07/23	**S6**	This stream drains into Hill Tout Lake; the reach has a gradient of 30% immediately upstream of Hill Tout Lake, and the gradient eases to 20% upstream of the road crossing; a perched culvert was noted at the road crossing; however, this reach is a natural barrier to fish passage due to its steep gradient and Cascade-Pool morphology
45	Hill Tout/ Unnamed	21744	1	93E.095	8	---	---	---	---	---	---	---	---	07/25	**NCD**	This reach consisted of a 15-20 m wide riparian band at the base of a steep hill to the north, occasional patches of mud and stagnant water were observed, but no sign of flow, fluvial deposits or scouring were observed
49	Hill Tout/ Unnamed	21715	2	93E.095	29	0.32	---	---	70	14	M	C	---	07/25	**S6**	The gradient of this reach, coupled with cascade-pool morphology, is a barrier to fish passage; the lower 285 m of the reach were surveyed; no culvert was found at the road crossing at the lower extent of this reach

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
50	Hill Tout/ Unnamed	21554	2	93E.095	11.5	0.23	---	---	120	14	M	C	---	07/23	**S6**	The entire reach was surveyed; the portion of the reach located in the harvested area has virtually no useable fish habitat (no deep pool, no spawning substrate, primarily riffle habitat); a 20 m section with 35% gradient over angular cobble and boulder at the Duel Lakes FSR is a barrier to fish passage; the drainage pattern upstream may differ from that shown on the 1:20,000 TRIM map, but this was not confirmed in the field (see comments for site 51, Table 16)
55	Hill Tout/ Unnamed	21547	3	93E.095	0.8	0.68	100	574	70	14	M	C	---	07/23	**S6**	This reach is located upstream of a 40 m long seepage section in reach 1 (see site 54, Table 16); no fish were captured upstream of the seepage section in one season of sampling; in addition, no perennial fish habitat was present due to the lack of suitable spawning habitat (substrate too large, angular and moss covered), and the lack of overwintering habitat (no deep pools)
59	Hill Tout/ Unnamed	21585	1	93E.095	9	---	---	---	---	---	L	---	---	07/24	**NCD**	No sign of a scoured channel was found in the section of the reach surveyed (lower 300 m); a trickle of water was identified flowing through the wetland adjacent to the lake, but no useable habitat was present; this reach was characterized by a 10-15 m wide riparian band, with no continuous channel

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
60	Hill Tout/ Unnamed	21577	1	93E.095	12	---	---	---	---	---	L	---	---	07/23	**NCD**	Occasional stagnant pools and some sections of flowing water were identified in the section surveyed (lower 250 m), but these did not exceed 5-10 m in length, and were separated by extensive seepage sections; no continuous channel was present
66	Hill Tout/ Unnamed	21599	1	93E.095	12	---	---	---	---	---	Dry	---	---	07/24	**W1**	This reach is located in a large wetland; in the section surveyed (lower 1000 m), the only sign of flowing water and evidence of fluvial deposits was found immediately upstream and downstream of the Hill Tout FSR
68	Tagetochlain/ Unnamed	21826	1	93E.096	6	---	---	---	100	9	L	---	---	08/14	**NCD**	This reach consisted of a 12-15 m wide riparian band with some evidence of scattered puddling, most of which were dry at the time of survey; no surface flow was identified in this reach; no continuous, defined channel was found in this reach
71	Tagetochlain/ Unnamed	20944	3	93L.006	17.5	2.22	100	753	90	7	M	C	---	08/08	**S6**	A cascade and falls, in addition to the overall steep gradient of this reach, were identified as barriers to fish passage; no fish were captured upstream of the falls and cascade in this reach, or at one other site sampled upstream (site 72)

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
72	Tagetochlain/ Unnamed	20944	4	93L.006	8	1.07	100	845	60	7	M	C	---	08/22	**S6**	No spawning habitat (too many fines and only angular gravel), and no overwintering habitat (lack of discharge) were noted in this reach, located upstream of a cascade and falls in reach 3 of this stream; no fish were captured at this site or one other site sampled upstream of the cascade and falls in reach 3, indicating a lack of resident fish
75	Tagetochlain/ Unnamed	21821	5	93E.096	0.5	---	---	---	---	---	---	---	---	08/16	**W1**	This reach consists of a seepage section within a narrow wetland; some puddles were found in the wetland, but all of these were dry, and no continuous channel was identified; even during high discharge periods, the sphagnum in the wetland would absorb most of the water, and prevent surface flow in the wetland
77	Tagetochlain/ Unnamed	21813	2	93E.096	9.5	---	---	---	---	---	---	---	---	08/13	**NCD**	This reach consists of a moist area (spongy ground) with a few scattered puddles (dry at the time of survey); the presence of sedges, alder and grasses in the riparian zone indicate significant seepage flow in this drainage; no continuous channel was found
82	Tagetochlain/ Unnamed	21013	1 2	93L.005	7.5	0.20	---	---	---	---	Dry	---	---	08/09	**NCD**	The lower 150 m of this reach were surveyed; This intermittent reach consisted primarily of seepage sections (>30 m long), with some channelized areas (<20 m long), which appear to have been used as a skidder trail; no continuous channel was identified

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
83	Tagetochlain/ Unnamed	20992	1	93L.006	14.5	0.32	---	---	---	---	Dry	---	---	08/16	**S6**	The lower 200 m of this reach lack a continuous channel, and are best characterized as NCD, with some seepage sections longer than 30 m; this section of the reach is a barrier to fish passage; upstream, an intermittent channel was present as gradient and confinement increased; no perennial fish habitat was found in the channelized portion of the reach due to the steep gradient, the lack of spawning habitat (no suitable substrate), the lack of overwintering habitat (no deep pools, lack of discharge)
85	Tagetochlain/ Unnamed	21015	4	93E.095	4	2.10	100	700	150	8	L	C	---	08/13	**S6**	This reach is located upstream of a 2 meter bedrock falls in reach 2 (Table 8), which is a barrier to fish passage; this reach provided good rearing, moderate spawning and poor overwintering habitat (no deep pools); the lack of fish in one season of sampling demonstrates a lack of resident fish upstream of the falls in reach 2
88	Tagetochlain/ Unnamed	21023	2	93L.005	15	---	---	---	---	---	---	---	---	08/17	**NCD**	This reach consisted of a 15 m wide riparian band; no defined channel or evidence of scour were observed in the section surveyed (lower 250 m)

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
91	Tagetochlain/ Unnamed	21034	2	93L.005	6.5	---	---	---	---	---	---	---	---	08/21	**NCD**	No defined channel was noted in the section surveyed; the reach consisted of a very definite, moist riparian band with a SE aspect; some scattered puddles were observed, but no evidence of scour, or alluvium were present except in a 40 m section 350 m upstream of tributary ILP 22706
94	Tagetochlain/ Unnamed	21031	1	93L.005	15	---	---	---	---	---	---	---	---	08/21	**NCD**	This reach consists of a drainage with scattered puddles located in a swampy area, with a 15-20 m wide riparian band of alder, twinberry, horsetail and grasses; no continuous channel was present
100	Cliff/ Unnamed	22076	3	93E.096	3.8	---	---	---	---	---	---	---	---	07/30	**NCD**	This reach consisted of a drainage identifiable by a 10-20 m wide riparian band; some algae chocked puddles were present (~7m by 4 m), and a pool has collected at the road crossing; no visible channel was noted in the section surveyed (lower 620 m)
103	Cliff/ Unnamed	22088	1	93E.096	17.5	0.78	100	531	40	8	M	C	---	07/30	**S6**	A 40 m long cascade at the confluence of this stream with the mainstem (ILP 22012) is a barrier to fish passage; upstream, fair rearing habitat (limited by gradient of the reach), poor spawning habitat (few patches of marginal substrate) and no overwintering habitat (no deep pools) were identified, indicating a lack of perennial fish habitat; no fish were captured, supporting a lack of resident fish upstream of the cascade (45C40) in the lower 40 m of the reach

Table 15 (cont). Summary of data from 44 non-fish bearing reaches (sorted by site number) in the Nadina River watershed sampled in July and August 2001 (*for details see* Appendix 1).

Site #	Sub-basin/ Stream Name	ILP/ Watershed Code	Reach	TRIM map	Electrofishing specifications								Secondary Method	Date (2001)	Proposed Riparian Class	Comments
					Gradient (%)	Channel Width (m)	Dist. (m)	Time (s)	Cond. (µS)	Temp.	Stage	Turbidity				
109	Cliff/ Unnamed	22023	2	93E.096	6.5	0.95	100	599	30	8.5	L	C	---	08/21	**S6**	This reach is located upstream of a 10 m waterfall at the upper extent of reach 1 (Table 8); the lack of fish in one season of sampling, and the lack of perennial fish habitat at this site (no suitable spawning substrate, no deep pools for overwintering) indicate a lack of resident fish upstream of the falls
110	Cliff/ Unnamed	22034	1	93E.096	4	---	---	---	---	---	---	---	---	08/21	**NCD**	No defined channel was found in the section surveyed (lower 220 m of the reach), which consisted of a 10 m wide moist riparian band with some dried up puddles
111 to 121	Hay Meadow/ 00168 FRAN	51402	2	93E.097	0	Lake	---	---	130	16	---	C	MT GN	08/07 08/07	**L1**	No fish were captured during the secondary lake survey (SKR 2002a), and no fish were captured in the outlet during electrofishing or minnow trapping (SKR and Oikos 1999); a 1.5 m falls in the outlet prevents fish passage (SKR and Oikos 1999)

Table 16. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
5	Hay Meadow/ 20875	5	093E.097	---	Spring or fall	MT	**W1**	This reach consists of a 10-15 m wide wetland with sedges, alder and some willow; no defined channel was observed in the wetland, between a large beaver pond at the reach 4/5 break, and the lake in reach 6; evidence of occasional flooding in the wetland suggest the potential for fish passage; fish sampling in this reach is difficult, and re-sampling efforts should focus on better habitat downstream of this reach, and/or in the small lake in reach 6
6	Hay Meadow/ 20868	2	093E.097	1.52	---	---	**S3**	No fish were captured in 530 seconds of electrofishing over 120 lineal meters (08/08/01); this reach offers some good rearing and spawning habitat, but no overwintering habitat (no deep pools); a culvert crossing in reach 1 was identified as an unnatural barrier to fish passage; water was noted to flow under the culvert, and part of the road fill has been washed out; this reach should be managed as fish bearing and re-sampling is not recommended; the road crossing should be replaced
8	Hay Meadow/ 20817	1	093E.097	0.73	Spring high flows	EF	**S4**	No fish were captured in 120 seconds of electrofishing over 140 lineal meters (08/08/01); the reach was primarily dry at the time of sampling, and limited shockable habitat was present; no spawning habitat, limited rearing habitat and no overwintering habitat were noted in this reach due to the ephemeral nature of the reach, and sections of seepage in the lower 20 m; fish presence is unlikely, but re-sampling of this reach and/or sampling of the lake in reach 2 is recommended

Table 16 cont. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
11	Hay Meadow/ 20855	3	093E.097	0.38	Spring high flows	EF	**S4**	No fish were captured in 380 seconds of electrofishing over 100 lineal meters (07/08/01) despite good sampling efficiency; the reach provides no suitable spawning habitat, but some rearing and overwintering habitat were noted present; the channel disappears in the upper section of the reach, and flow is via seepage; this section is a barrier to fish passage (see sites 12 and 13, Table 13); fish presence in the lower portion of the reach, which exhibits a defined channel is unlikely due to the poor quality habitat, but requires re-sampling to confirm fish absence
17	Tagetochlain/ 20968	1	093E.096	2.90	Spring	EF	**S3**	Six chub were captured in 480 seconds of electrofishing over 40 lineal meters (14/08/01); good rearing habitat, moderate overwintering habitat and no spawning habitat (no gravels) were noted in this reach; FPC listed species may use this reach on a sporadic or seasonal basis
18	Tagetochlain/ 20968	4	093E.096	2.00	Spring	EF	**S3**	No fish were captured in 493 seconds of electrofishing over 100 lineal meters (13/08/01); poor spawning habitat (too much fines), moderate rearing habitat and moderate overwintering habitat were identified in this reach; no fish were seen rising in the small pond in the wetland reach 2; fish presence is unlikely due to the poor quality habitat in this reach; re-sampling is recommended only if fish are captured in reach 1 of ILP 20968 (see site 17)
23	Hill Tout/ 21904	1	093E.096	1.13	Spring	EF	**S4**	No fish were captured in 690 seconds of electrofishing over 100 lineal meters of habitat (27/07/01); some fish habitat was noted at the sample site, but the channel disperses into a thick alder stand about 80 m upstream of Hill Trout Creek; no spawning habitat, some rearing habitat and limited overwintering habitat was identified in the section sampled, which provides better habitat than the majority of the section surveyed; fish presence is unlikely due to the poor quality habitat

Table 16 cont. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
24	Hill Tout/ 21904	2	093E.096	0.92	Spring	EF	**S4**	No fish were captured in 324 seconds of electrofishing over 100 lineal meters (27/07/01); fair rearing habitat, good spawning habitat (plenty of suitable gravels), but no overwintering habitat (no deep pools) were noted in this reach; the reach is located in a previously harvested area with no retention
29	Hill Tout/ 21876	4	093E.096	0.50	Spring high flows	EF	**S4**	A defined channel was found downstream of the Hill Tout Main FSR crossing within this reach, but the reach was NCD upstream (see Table 16); the defined channel downstream of the road is formed from seepage and water collecting in a road ditch; the channel was dry at the time of survey (26/07/01); fish presence is unlikely, but re-sampling downstream of the Hill Tout Main FSR is recommended during spring high flows; upstream of the Hill Tout Main FSR, the reach can be managed as NCD
34	Hill Tout/ 21870	1	093E.096	1.58	Spring	EF/MT	**W1**	One juvenile chub was captured in 347 seconds of electrofishing over 60 lineal meters of habitat in this wetland reach (22/07/01); sampling efficiency was reduced by the deep nature of the channel (large channel morphology), and treacherous access through the wetland; this wetland reach consists of large beaver ponds and braided channels, which provide good rearing and overwintering habitat, but no spawning habitat (no suitable substrate)
35	Hill Tout 21870	2	093E.096	0.52	Spring high flows	EF	**S4**	This reach was dry at the time of survey (26/07/01); some potential rearing habitat was noted, but no overwintering or spawning habitat was identified in the reach due to the lack of perennial flow, and the lack of suitable spawning gravels; fish presence is unlikely due to the poor quality fish habitat in the reach, but no barriers to fish passage were found in the section surveyed

Table 16 cont. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
36	Hill Tout/ 21870	3	093E.096	0.93	Spring	EF	**S4**	This reach offers moderate rearing habitat, no overwintering habitat (no deep pools) and no spawning habitat (no gravels); no fish sampling was conducted due to the lack of FPC listed species in reach 1, and the lack of water (and fish passage) in reach 2; re-sampling is recommended if fish are captured in reach 2 of this system
38	Hill Tout/ 21874	2	093E.096	1.25	Spring	EF	**S4**	No fish were captured in 849 seconds of electrofishing over 100 lineal meters (26/07/01); poor rearing habitat (few and poor quality pools), no overwintering habitat (no deep pools) and some potential spawning habitat were identified in this reach; this reach appears to be heavily impacted by past harvest activities in the lower portion of the reach; fish presence is unlikely due to the extremely poor quality fish habitat in this reach, and the low level of shading due to the lack of riparian vegetation
43	Hill Tout/ 21763	3	093E.096	1.72	Spring	EF	**S3**	No fish were captured in 1675 seconds of electrofishing over 200 lineal meters of habitat (26/07/01); the stream offered good habitat, particularly for Dolly Varden/bull trout, but appears to be too steep for rainbow trout (6-11% gradient); rainbow trout may utilize the lower section of the reach with moderate gradients; several organic steps in this reach may deter fish passage; a 1 m beaver dam in reach 2 of this system may restrict fish passage, but this is a temporary barrier; re-sampling is not recommended until the beaver dam in reach 2 has washed out, allowing fish access to reach 3
44	Hill Tout/ 21746	1	093E.095	1.35	Spring	EF	**S4**	No fish were captured in 607 seconds of electrofishing over 100 lineal meters of habitat (27/07/01); good rearing habitat, moderate overwintering habitat and moderate spawning habitat were identified in this reach; no barriers to fish passage were noted, although the gradient is relatively steep (10 to 16%); fresh beaver signs, but no beaver dams were identified in the lower gradient section near the lake (lower 130 m)

Table 16 cont. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
47	Hill Tout/ 21787	2	093E.095	0.60	Spring	EF	**S4**	No fish were captured in 509 seconds of electrofishing over 100 lineal meters of habitat (23/07/01); fair rearing habitat, moderate spawning habitat, and no overwintering habitat (no deep pools) were noted in this reach; fish presence is unlikely due to the steep gradient of the reach (16-17%) with several 0.5 to 0.7 m high steps and low habitat quality
48	Hill Tout/ 21715	1	093E.095	0.65	Spring	EF	**S4**	No fish were captured in 273 seconds of electrofishing over 100 lineal meters of habitat (25/07/01); poor rearing habitat, poor spawning habitat and no overwintering habitat were identified in this reach, due to limited discharge, abundant fines, and limited cover; the lower 20 m of the reach fans out before entering the upper Duel Lake; fish presence is unlikely due to limited access through the lower 20 m, and the poor quality habitat upstream
51	Hill Tout/ 21554	4	093E.095	1.62	Spring	EF	**S3**	No fish were captured in 941 seconds of electrofishing over 100 lineal meters of habitat (23/07/01); excellent rearing and spawning habitat and moderate overwintering habitat were noted in this reach; discrepancy in channel width between this reach, and reach 1 downstream (site 50 which had an average width of 0.23 m; Table 16) indicate that the drainage pattern likely differs from that shown on the 1:20,000 TRIM map; while a barrier was identified in reach 1 of ILP 21554, it is suspected that reach 3 of ILP 21554 actually drains into ILP 21737; re-sampling should include confirmation of the drainage pattern of this stream
53	Hill Tout/ 21543	2	093E.095		Spring	EF	**S3**	No fish were captured in this reach in 492 seconds of electrofishing over 150 lineal meters of habitat (23/07/01); suitable fish habitat was identified in the reach; the culvert in reach 1 appears to obstruct fish passage at some flows

Table 16 cont. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
54	Hill Tout/ 21547	1	093E.095	1.27	Spring	EF	**S4**	No fish were captured in 1220 seconds of electrofishing over 100 lineal meters of habitat (23/07/01); good rearing habitat, good spawning habitat and poor overwintering habitat were noted in this reach; the upper 140 m of the reach does not have a defined, scoured channel, or evidence of surface flow, and this portion is a barrier to fish passage; all suitable fish habitat is found in the lower 250 m of the reach; the culvert in reach 1 of ILP 21543 appears to obstruct fish passage at some flows
56	Hill Tout/ 21556	2	093E.095	0.87	Spring	EF	**S4**	No fish were captured in 527 seconds of electrofishing over 100 lineal meters (25/07/01); fair rearing habitat, no spawning habitat (no gravels) and no overwintering habitat (no deep pools) were identified in this reach; no barriers were identified in the lower 250 m of the reach, and the wetland in reach 1 appears passable; fish presence is unlikely due to lack of good fish habitat and limited discharge
57	Hill Tout/ 21564	3	093E.095	0.45	Spring	EF	**S4**	No fish were captured in 583 seconds of electrofishing over 100 lineal meters (25/07/01); fair rearing habitat, limited spawning habitat and no overwintering habitat (no deep pools) were identified in this reach; fish presence is unlikely due to lack of good fish habitat and limited discharge
61	Hill Tout/ 21582	1	093E.095	0.38	Spring high flows	EF	**S4**	No fish were captured in 279 seconds of electrofishing over 100 lineal meters (24/07/01); the stream fans out in the lower 250 m, and loses its defined channel; this section of stream is a likely barrier to fish passage, but should be evaluated at high flows; the reach exhibits seepage flow for the initial 15 m; extremely limited rearing habitat, no overwintering habitat (no deep pools) and no spawning habitat (no gravels) were noted in this reach; fish presence is very unlikely due to difficult passage in the initial 250 m, low discharge, and poor habitat upstream

Table 16 cont. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
62	Hill Tout/ 21588	1	03E.095	1.00	Spring	EF	**S4**	No fish were captured in 276 seconds of electrofishing over 160 lineal meters (24/07/01); fish are likely present in the lower 20 m, which offers moderate rearing habitat and very limited spawning habitat, but the channel narrows upstream, becomes less well defined and is obscured by instream vegetation
63	Hill Tout/ 21588	4	093E.095	1.18	Spring	EF	**S4**	No fish were captured in 583 seconds of electrofishing over 190 lineal meters (24/07/01); moderate rearing habitat, limited spawning habitat and no overwintering habitat (no deep pools) were noted in this reach, but overwintering habitat may be provided by the small pond in reach 3; the lower 20 m of this reach lacks a well defined channel, but the channel is well defined upstream of this; the poorly defined sections in the lower 20 m of this reach, and in the upper extent of reach 1 are likely barriers to fish passage; re-sampling is recommended only if fish are captured during re-sampling in reach 1 (site 62)
65	Hill Tout/ 21596	1	093E.095	0.57	Spring	EF	**S4**	No fish were captured in 358 seconds of electrofishing over 100 lineal meters (24/07/01); this reach is located in a harvested area; it is speculated that this reach was NCD prior to the harvest, but a channel appears to be forming now, likely due to altered hydrology and increased peak flow; the reach consists mostly of overland flow, and is characterized by extensive riffles with no pools; poor rearing habitat, no spawning and no overwintering habitat were noted in this reach; fish presence is unlikely due to the very poor quality fish habitat
67	Tagetochlain/ 21951	1	093E.096	1.33	Spring high flows	EF	**S4**	This reach was dry at the time of sampling (14/08/01); fish habitat was very limited due to the ephemeral nature of the reach; no obstructions were noted in the lower 380 m of the reach

Table 16 cont. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
70	Tagetochlain/ 20944	2	093L.006	2.28	Spring	EF	**S3**	No fish were captured in 1320 seconds of electrofishing over 100 lineal meters (14/08/01); good spawning habitat, good overwintering habitat and excellent rearing habitat were noted in this reach; fish presence is suspected due to the lack of barriers observed in the sections surveyed in reach 1 or in this reach
73	Tagetochlain 20948	1	093L.006	0.37	Spring	EF	**S4**	No fish were captured in 516 seconds of electrofishing over 100 lineal meters (14/08/01); poor rearing and spawning habitat and no overwintering habitat were noted in this reach; cattle damage to the stream bank was noted in several locations; no fish were seen rising in the small lake in reach 2; fish may use this reach and/or reach 2 on a seasonal or sporadic basis
74	Tagetochlain/ 21821	1	093E.096	1.30	Spring	EF	**S4**	No fish were captured in 526 seconds of electrofishing over 100 lineal meters (13/08/01); the stream channel is poorly defined, even downstream of the road crossing located within this reach; evidence of recent flow was found, but the channel is braided; poor rearing habitat, no spawning habitat and no overwintering habitat were noted in this reach; fish presence is unlikely due to the poor quality of the habitat, and the braided and poorly defined nature of the channel
76	Tagetochlain/ 21813	1	093E.096	1.02	Spring	EF	**S4**	No fish were captured in 470 seconds of electrofishing over 100 lineal meters (13/08/01); the stream is poorly defined except at the road crossing found within this reach; the substrate is choked with orange algae about 80 m downstream of the road; the channel is heavily braided in the wetland downstream; fish presence is unlikely due to poor habitat quality, and the poorly defined nature of the channel in the lower portion of the reach

Table 16 cont. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
78	Tagetochlain/ 21809	1	093E.096	1.08	Spring	EF	**S4**	No fish were captured in 510 seconds of electrofishing over 100 lineal meters (13/08/01); this reach is intermittent (1-2 m long dry sections with wet mud substrate); this stream carries more water than reach 2 of the mainstem (ILP 21813); poor rearing habitat, no overwintering habitat and no spawning habitat was noted in this reach; fish presence is unlikely due to the lack of fish captured in reach 1, poor quality fish habitat, and restricted access (see site 76); re-sampling is recommended only if fish are captured during re-sampling in the mainstem (ILP 21813 reach 1, see site 76)
79	Tagetochlain/ 20937	1	093E.096	1.42	Spring	EF	**S4**	No fish were captured in 785 seconds of electrofishing over 100 lineal meters (22/08/01); this reach provides poor spawning habitat, good rearing habitat and poor overwintering habitat; a barrier is suspected in reach 5 of the mainstem (ILP 20958); sampling of the lake in reach 6 of the mainstem (ILP 20958), and ground truthing of reach 5 to document barriers should be conducted before re-sampling this reach
86	Tagetochlain/ 21016	1	093L.005	0.77	Spring	EF	**S4**	No fish were captured in 822 seconds of electrofishing over 100 lineal meters (13/08/01); some small fry (possibly rainbow trout) were observed in the mainstem (ILP 21015) at the confluence with this stream; this reach offered good rearing habitat, moderate spawning habitat and fair overwintering habitat; some areas of >12% gradient, and some 0.4 m high steps were noted in the lower 600 m of the reach, and these sections may impede fish passage; no definite barriers to fish passage were found
87	Tagetochlain/ 21025	4	093L.005	2.00	Spring high flows	EF	**S3**	This reach was dry at the time of survey (21/08/01); some potential rearing and spawning habitat was noted in the reach, but habitat quality is limited by the ephemeral nature of the reach; the reach consisted of a well defined channel, but no water was found within the stream; a light accumulation of detritus was noted in the stream bed

Table 16 cont. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
89	Tagetochlain/ 21027	3	093L.005	1.90	Spring	EF	**S3**	No fish were captured in 679 seconds of electrofishing over 100 lineal meters (21/08/01); this reach provides limited overwintering and rearing habitat due to a lack of deep pools and low flow, but some small pockets of spawning gravels were identified in the reach; beaver dams (temporary barriers) in reach 2 may impede fish passage
90	Tagetochlain/ 21027	5	093L.005	1.85	Spring high flows	EF/MT	**W3**	No fish were captured in 371 seconds of electrofishing over 100 lineal meters (21/08/01); no spawning habitat, some overwintering habitat and good rearing habitat were noted in this wetland reach; the channel was choked with aquatic vegetation, reducing sampling efficiency; re-sampling should be conducted in conjunction with re-sampling in reach 3 (see site 89)
92	Tagetochlain/ 21032	2	093L.005	1.93	Spring	EF	**S3**	No fish were captured in 410 seconds of electrofishing over 100 lineal meters (21/08/01); the lower 200 m of the channel fans out into the wetland reach 1; all of the braids in this section of the reach were dry, but some had evidence of scour indicating significant seasonal flow; the channel was dry at the upper extent of the sample site (800 m upstream of ILP 21025); good rearing habitat, moderate spawning habitat and poor overwintering habitat were found in this reach; re-sampling is recommended if fish are captured during re-sampling in the mainstem (ILP 21025 reach 4; see site 87)
93	Tagetochlain/ 21032	3	093E.095	0.80	Spring	EF	**S4**	No fish were captured in 472 seconds of electrofishing over 100 lineal meters (21/08/01); several gradient barriers are suspected in this reach downstream of the sample site based on map interpretation and helicopter reconnaissance, but their presence was not confirmed; this reach offers good rearing habitat, but no spawning habitat (no suitable substrate) and poor overwintering habitat (no deep pools) were identified; re-sampling, coupled with efforts to document barriers downstream, is recommended if fish are captured during re-sampling in the mainstem (ILP 21025 reach 4; see site 87)

Table 16 cont. Follow - up sampling requirements 41 reaches (sorted by Site number) in the Nadina River watershed that were sampled from June to September 2000 (*for details see* Appendix 1).

Site #	Sub-basin/ ILP	Reach	TRIM map	Channel Width (m)	Timing	Methods	Proposed Riparian Class	Comments
96	Tagetochlain/ 21007	1	093L.005	2.20	Spring high flows	EF	**S3**	No fish were captured in 371 seconds of electrofishing over 100 lineal meters (17/08/01); moderate rearing habitat, good spawning habitat (limited by low discharge) and no overwintering habitat (no deep pools) were noted in this reach; fish presence is suspected unless a barrier to fish passage is found in the lower portion of the reach; re-sampling should be conducted during periods of higher discharge, and should include ground truthing of the lower section of the reach for documentation of barriers to fish passage
108	Cliff 22081	1	093E.096	0.95	Spring	EF	S4	No fish were captured in 412 seconds of electrofishing over 100 lineal meters (30/07/01); good rearing habitat, good spawning habitat but no overwintering habitat were identified in the section surveyed due to a lack of deep pools; the lower 180 m of the reach is located in a harvested area without retention on both stream banks; this section of the reach has abundant LWD across the channel, most of which is non-functioning; only the river left bank was harvested in the sampled area; Dolly Varden may use this reach on a seasonal basis since no barriers have been identified between the sample site and in reach 2 of the mainstem (ILP 22079, see site 107 in Table 12) where Dolly Varden were captured; the abundant LWD over the channel was noted to reduce sampling efficiency

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SKR Consultants Ltd. 2001b. Reconnaissance Lake Inventory of Unnamed Lake (WBID 00950 FRAN). Unpublished report prepared for Houston Forest Products Co. Houston, B.C..

SKR Consultants Ltd. 2001c. Reconnaissance Lake Inventory of Duck Lake (WBID 00892 FRAN). Unpublished report prepared for Houston Forest Products Co. Houston, B.C..

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SKR Consultants Ltd. 2002b. Secondary Lake Inventory of Unnamed Lake Watershed Code: 180-374000-95200-99500-4980-6340, Waterbody Identifier 00672FRAN located 8.0 km northwest of the outlet of Tagetochlain Lake and 5.4 km east of the northern end of Bittern Lake. Unpublished report prepared for Houston Forest Products Co., Houston, B.C..

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Appendix 1. Sample Site Information including FDIS Site Cards, Fish Forms, and Site Photographs (sorted by site number *see* **Volume 2**).

SITE CARD INDEX

ILP	TRIM Map #	Reach #	Site #	Page #
20800	093E.097	7.0	1	S-1
20800	093E.097	10.0	2	S-2
20800	093E.097	12.0	3	S-3
20800	093E.097	13.0	4	S-4
20817	093E.097	1.0	8	S-8
20836	093E.097	1.0	15	S-15
20840	093E.097	2.0	9	S-9
20843	093E.097	1.0	10	S-10
20855	093E.097	3.0	11	S-11
20855	093E.097	4.0	12	S-12
20855	093E.097	5.0	13	S-13
20856	093E.097	2.0	14	S-14
20868	093E.097	2.0	6	S-6
20869	093E.096	2.0	7	S-7
20875	093E.097	5.0	5	S-5
20937	093L.006	1.0	79	S-79
20944	093L.006	1.0	69	S-69
20944	093L.006	2.0	70	S-70
20944	093L.006	3.0	71	S-71
20944	093L.006	4.0	72	S-72
20948	093L.006	1.0	73	S-73
20968	093E.096	1.0	17	S-17
20968	093E.096	4.0	18	S-18
20992	093L.006	1.0	83	S-83
21003	093L.005	2.0	95	S-95
21007	093L.005	1.0	96	S-96
21013	093L.006	8.0	80	S-80
21013	093L.006	10.0	81	S-81
21013	093L.005	12.0	82	S-82
21015	093L.005	2.0	84	S-84
21015	093E.095	4.0	85	S-85
21016	093L.005	1.0	86	S-86
21023	093L.005	2.0	88	S-88
21025	093L.005	4.0	87	S-87
21027	093L.005	3.0	89	S-89
21027	093L.005	5.0	90	S-90
21031	093E.097	1.0	94	S-94
21032	093L.005	2.0	92	S-92
21032	093E.095	3.0	93	S-93
21034	093L.005	2.0	91	S-91
21543	093E.095	1.0	52	S-52
21543	093E.095	2.0	53	S-53
21547	093E.095	1.0	54	S-54
21547	093E.095	3.0	55	S-55
21554	093E.095	2.0	50	S-50
21554	093E.095	4.0	51	S-51

ILP	TRIM Map #	Reach #	Site #	Page #
21556	093E.095	2.0	56	S-56
21564	093E.095	3.0	57	S-57
21567	93E.095	1.0	58	S-58
21577	093E.095	1.0	60	S-60
21582	093E.095	1.0	61	S-61
21585	093E.095	1.0	59	S-59
21588	093E.095	1.0	62	S-62
21588	093E.095	4.0	63	S-63
21596	093E.095	1.0	65	S-65
21599	93E.095	1.0	66	S-66
21600	093E.095	1.0	64	S-64
21715	093E.095	1.0	48	S-48
21715	093E.095	2.0	49	S-49
21740	093E.095	1.0	44	S-44
21744	093E.095	1.0	45	S-45
21763	093E.095	1.0	41	S-41
21763	093E.096	2.0	42	S-42
21763	093E.096	3.0	43	S-43
21780	093E.095	1.0	46	S-46
21787	093E.095	2.0	47	S-47
21809	093E.096	1.0	78	S-78
21813	093E.096	1.0	76	S-76
21813	093E.096	2.0	77	S-77
21821	093.096	1.0	74	S-74
21821	093E.096	5.0	75	S-75
21826	093E.096	1.0	68	S-68
21833	093E.096	1.0	40	S-40
21835	093E.096	1.0	39	S-39
21855	093E.095	1.0	20	S-20
21855	093E.095	6.0	21	S-21
21855	093E.095	10.0	22	S-22
21870	093E.096	1.0	34	S-34
21870	093E.096	2.0	35	S-35
21870	093E.096	3.0	36	S-36
21871	093E.096	1.0	37	S-37
21874	093E.096	2.0	38	S-38
21876	093E.096	4.0	29	S-29
21879	093E.096	1.0	30	S-30
21882	093E.096	1.0	28	S-28
21888	093E.096	1.0	27	S-27
21890	093E.096	4.0	26	S-26
21904	093E.096	1.0	23	S-23
21904	093E.096	2.0	24	S-24
21907	093E.096	1.0	25	S-25
21915	093E.096	1.0	16	S-16
21947	093E.096	1.0	19	S-19
21951	093E.096	1.0	67	S-67
22012	093E.096	1.0	97	S-97

ILP	TRIM Map #	Reach #	Site #	Page #
22012	093E.096	3.0	98	S-98
22020	093E.096	1.0	106	S-106
22023	093E.096	2.0	109	S-109
22034	093E.096	1.0	110	S-110
22076	093E.096	1.0	99	S-99
22076	093E.096	3.0	100	S-100
22079	093E.096	2.0	107	S-107
22081	093E.096	1.0	108	S-108
22088	093E.096	1.0	103	S-103
22097	093E.096	1.0	101	S-101
22099	093E.096	1.0	102	S-102
22102	093E.096	1.0	31	S-31
22102	093E.096	2.0	32	S-32
22103	093E.096	1.0	33	S-33
22686	093E.096	2.0	104	S-104
22686	093E.096	5.0	105	S-105
51352	093L.006	11.0	122-127	S-122-127
51402	093E.097	2.0	111-121	S-111-121

Appendix 2. Photodocumentation Forms 1 and 2. Negatives and digital images of photos (2 copies) were submitted to Ministry of Sustainable Resources.

Photodocumentation Form 1 – Equipment Details

Survey Start Date: July 23rd, 2001 Survey End Date: August 22nd, 2001
Agency: C141
Crew: RS/ML/DM/NF

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

Roll and or Batches Detail:

Roll #	CD #	Camera	Output Medium	Film Type	ISO
N1	CD#3 (Nadina)	1	negative/ CD Rom	colour print	200
N2	CD#3 (Nadina)	1	negative/ CD Rom	colour print	200
N3	CD#3 (Nadina)	1	negative/ CD Rom	colour print	200
N4	CD#4 (Nadina)	1	negative/ CD Rom	colour print	200
N5	CD#3 (Nadina)	1	negative/ CD Rom	colour print	200
N6	CD#4 (Nadina)	1	negative/ CD Rom	colour print	200
N7	CD#4 (Nadina)	1	negative/ CD Rom	colour print	200
N8	CD#4 (Nadina)	1	negative/ CD Rom	colour print	200
N9	CD#4 (Nadina)	1	negative/ CD Rom	colour print	200
N10	CD#4 (Nadina)	1	negative/ CD Rom	colour print	200
N11	CD#5 (Nadina)	1	negative/ CD Rom	colour print	200
N12	CD#5 (Nadina)	1	negative/ CD Rom	colour print	200
N13	CD#5 (Nadina)	1	negative/ CD Rom	colour print	200
N16	CD#5 (Nadina)	1	negative/ CD Rom	colour print	200
N17	CD#5 (Nadina)	1	negative/ CD Rom	colour print	200
N18	CD#4 (Nadina)	1	negative/ CD Rom	colour print	200
N19	CD#4 (Nadina)	1	negative/ CD Rom	colour print	200

Appendix 3. List of Voucher Specimens and DNA samples submitted to Ministry of Sustainable Resources.

Landscape Unit	ILP	TRIM map	Reach	Site	Date Collected	Voucher	Species ID	Fork Length (mm)	Verified ID
Nadina	21855		1	20	25-Jul-01	LSU1	LSU	147	
Nadina	21855		1	20	25-Jul-01	LSU2	LSU	174	
Nadina	21855		1	20	25-Jul-01	LSU3	LSU	108	
Nadina	21855		1	20	25-Jul-01	RB2	RB	86	
Nadina	21855		1	20	25-Jul-01	RB3	RB	33	
Nadina	21855		1	20	25-Jul-01	RB4	RB	44	
Nadina	21855		1	20	25-Jul-01	RB5	RB	117	
Nadina	21855		1	20	25-Jul-01	CAS3	CAS	108	
Nadina	21855		1	20	25-Jul-01	CAS4	CAS	100	
Nadina	21855		1	20	25-Jul-01	CAS5	CAS	62	
Nadina	21567		1	58	25-Jul-01	DV3	DV	95	
Nadina	21567		1	58	25-Jul-01	DV4	DV	87	
Nadina	21567		1	58	25-Jul-01	DV5	DV	60	
Nadina	21763		1	41	25-Jul-01	RSC1	RSC	73	
Nadina	21763		1	41	25-Jul-01	RSC2	RSC	64	
Nadina	21763		1	41	25-Jul-01	RSC3	RSC	45	
Nadina	21763		1	41	25-Jul-01	RSC4	RSC	65	
Nadina	21763		1	41	25-Jul-01	RSC5	RSC	74	
Nadina	21915		1	16	16-Jul-01	LNC1	LNC	50	
Nadina	21915		1	16	16-Jul-01	LNC2	LNC	45	
Fulton	40208		1	1	18-Jul-01	DV1	DV	111	
Fulton	40208		1	1	18-Jul-01	DV2	DV	58	
Fulton	40208		1	1	18-Jul-01	CT4	CT	109	
Fulton	40208		1	1	18-Jul-01	RB1	RB	128	
Fulton	40356		1	23	18-Jul-01	CO1	CO	69	
Fulton	40356		1	23	18-Jul-01	CO2	CO	62	
Fulton	40356		1	23	18-Jul-01	CO3	CO	74	
Fulton	40356		1	23	18-Jul-01	CO4	CO	55	
Fulton	40356		1	23	18-Jul-01	CO5	CO	75	
Fulton	40356		1	23	18-Jul-01	CT1	CT	114	
Fulton	40356		1	23	18-Jul-01	CT2	CT	104	
Fulton	40356		1	23	18-Jul-01	CT3	CT	97	
Fulton	40356		1	23	18-Jul-01	CAS1	CAS	70	
Fulton	40356		1	23	18-Jul-01	CAS2	CAS	72	
Tahtsa	61775		7	14	02-Aug-01	BB1	BB	193	
Tahtsa	61773		1	11	31-Jul-01	MW1	MW	153	
Tahtsa	61778		3	18	31-Jul-01	LKC1	LKC	116	

Appendix 4. QA/QC Communications

Appendix 5. 1:20,000 Fisheries Project/Interpretive Maps for the Hay Meadow, Hill Tout, Tagetochlain, and Cliff Sub-basins of the Nadina watershed.

Fisheries Project/Interpretive Maps:

093E.095
093E.096
093E.097
093L.005
093L.006