

NON-ANADROMOUS REACH FISH SAMPLING PROGRAM

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1.0 Introduction

This document summarizes a proposed fish and fish habitat survey of the non-anadromous reach of the Cheakamus River, beginning approximately 17 km upstream of the confluence with the Squamish River. The primary focus of the survey is to describe post spill salmonid populations in this section of the Cheakamus River. However, data will also be collected on petromyzids, cottids and other fish captured in the sampling areas. This document outlines the proposed sampling programs in the non-anadromous reach, describing recommended fish sampling techniques and habitat survey methods.

2.0 Fish and Fish Habitat Surveys

A review of air photos and a field reconnaissance of the non-anadromous reach conducted by rail in November 2005 indicate only 0.5 km of channel is accessible for fish sampling downstream of the spill site. Fish sampling and habitat surveys will be conducted within this 500 m section and at a second, 500 m long site upstream of the spill site, which will be identified in the field based on similar morphology.

The proposed fish-sampling plan will include a combination of the following sampling techniques:

- minnow trapping, and
- electrofishing

Snorkelling and angling were considered as part of the sampling plan, but were discounted due to logistical and safety concerns related to access, and the difficulty associated with replicating sampling methods and efforts for comparative purposes. Where feasible selective pole seining may be conducted to supplement the proposed program, however it is anticipated the large substrate size will preclude effective pole seining.

Fish sampling will be conducted seasonally, flows permitting, by a four (4) person sampling crew. A four person crew will be required in order to transport and effectively deploy sampling gear within this difficult to access reach, as well as collect physical habitat characteristics data. Where feasible and appropriate, the sampling dates will be consistent with those used in salmonid distribution studies in the anadromous reaches of the Cheakamus River conducted by BC Hydro in 1999 and 2000. These studies included the following time frames (Sneep, 2001):

- February / March, to evaluate overwintering habitat use
- May, to assess salmon fry (char fry) post emergence habitat selection
- September / October, to sample the widest range of edge habitats and assess juvenile distribution

The proposed area of study downstream of the spill site is located within steep canyon terrain with difficult walk-in access and can only be reached by along the CN track using hi-rail

equipped vehicles. These conditions present concerns about crew safety and require logistical coordination with CN maintenance staff. Therefore sampling will only be conducted during the day to address access and safety concerns about topographic site limitations. Liability consideration, and contractor training requirements for access along CN property will likely prohibit the use of volunteers to assist with proposed studies in the non-anadromous reach. Therefore it is expected all field work will be conducted by qualified professionals under contract to CN.

2.1 Minnow Trapping

Minnow traps will be set during each sampling trial. Traps will be baited with salmon roe and will be set at a density of 10 traps/100 m in each sampling area, totaling approximately 50 traps/500 m sampling site. The traps will be baited with approximately 2 g of salmon roe and set overnight for approximately 24 hours. Trap locations will be marked in the field and geo-referenced using hand held geographic positioning (GPS) units. Other data recorded at each trapping location will include hydraulic unit type (riffle, pool, glide), trap depth, proximity of nearby cover features and cover type.

2.2 Electrofishing

Electrofishing will be conducted during each sampling trial. The wide channel width (typically >10 m) bedrock and large cobble/boulder substrate and steeply sloping side walls will preclude closed site electrofishing in most sections of the non-anadromous reach. Sampling sites will be selected to represent various habitat types within each site and will be sampled by multiple pass removal to maximize opportunities for identifying species composition and fish densities in surveyed areas. Each electrofishing site will be measured to nearest meter, geo-referenced, and marked with flagging tape at the upstream and downstream end for replication on future surveys.

2.3 Biological Data Collection

Captured fish will be anaesthetized, identified to species and enumerated by size classes. A subset of captured fish will be anaesthetized, and measured for length (to the nearest mm) and weight (1/100 gm). Project-specific data forms will be developed to ensure consistency of data collection. Captured fish will be allowed to recover in aerated buckets and will be released back into the river near the vicinity of capture. No live fish will be sacrificed for voucher specimens. However, any inadvertent mortalities will be recorded and if requested could be retained for voucher specimens.

3.0 Fish Habitat Surveys

A modified Level 1 detailed Habitat Survey from the provincial Fish Habitat Assessment Procedure (FHAP) is recommended for fish sampling areas in the non-anadromous reach. The FHAP is based on a series of fish habitat condition diagnostics (Appendix 1) describing fish habitat as poor, fair or good for summer and winter rearing, adult migration and spawning and incubation. The survey will be conducted in summer and will include the collection of the following data where safe and feasible:

- Habitat Type (pool, riffle, glide, run)
- Length of habitat unit (m)
- Elevation (m)
- Bankfull depth (m)
- Water depth (m)
- Bankfull width and wetted width (m) (m)
- Conductivity
- Residual pool depth (m)
- Bed material composition (%)
- Summer concentrations of NO₃-N and SRP¹
- Spawning gravels (Y/N) % area
- Functional LWD tally
- % and type of instream cover
- Available off-channel habitat
- Disturbance indicators
- Riparian vegetation type, structure
- Canopy closure
- % pools in sampling area
- Water velocity in surveyed area
- Water temperature (°C) and

Site topography conditions may prevent collection of detailed measurements for some of the above described parameters such as pool depth, % area of spawning gravels. Other parameters may be difficult to measure because of potentially unsafe wading conditions and water depths or turbidity obscuring the bed material. Similarly, velocity may also be difficult to measure at water depths > 0.50 m. The survey crew will use the most accurate and feasible methods available to determine habitat and site characteristics within each sampling site during each survey, including but not necessarily limited to:

- Survey level and rod
- Abney level
- Clinometer
- Tape measure
- hip chain
- laser range finder
- current velocity meter

Where parameter measurements cannot be collected using calibrated measuring equipment, ground estimates of habitat or site characteristics will be recorded. The method of data collection will be recorded and reported for each parameter measured during each field survey. During each field survey anecdotal information will also be collected on water quality characteristics including water temperature, pH and conductivity.

4.0 Data Compilation

4.1 Fish Sampling Data

Fish sampling data will be compiled to provide the following information:

- Densities of fish in the sampling areas (expressed as fish / m²) and densities of fish in different habitat units (pool, run, glide)
- Catch Per Unit Effort (CPUE) and % catch by species

□

¹ NO₃-N: nitrate nitrogen, SRP: Soluble reactive phosphorous

- Average fork length (mm)
- Age~length, length~weight and length~frequency data
- Habitat preferences in surveyed areas by species

4.2 FHAP Survey Data

FHAP survey data will be compiled in excel. The mean values for all habitat data collected in the surveyed area will be calculated and then compared with diagnostics of salmon habitat condition to characterize the habitat quality in the sampling areas. It should be noted that these habitat condition diagnostics were developed for channels <15 m in width. However, the FHAP was successfully implemented in the lower Cheakamus by PSlaney Aquatic Science Ltd (2003) and is still appropriate for use in larger channels as they are based on the availability of cover types and channel characteristics critical to fish production in both small and large channels.

5.0 References

Sneep, J. (2001). Cheakamus River Juvenile Salmonid Distribution Assessment September 1999 to July 2000. Cheakamus River Water Use Plan Data Report. Prepared for BC Hydro, 6911 southpoint Drive, Burnaby BC.

Appendix 1. Diagnostics of salmonid habitat condition at the reach level.

Habitat Parameter	Gradient or		Use	Quality		
	W _b	Class		Poor	Fair	Good
Percent pool (by area)	<2%	<15 m wide	summer/winter rearing habitat	<40%	40-55%	>55%
Percent pool (by area)	2-5%	<15 m wide	summer/winter rearing habitat	<30%	30-40%	>40%
Percent pool (by area)	>5%	<15 m wide	summer/winter rearing habitat	<30%	20-30%	>30%
Pool (mean pool spacing) frequency	<2%	<15 m wide	summer/winter rearing habitat	>4 channel widths per pool	2-4 channel widths per pool	<2 channel widths per pool
Pool (mean pool spacing) frequency	2-5%	<15 m wide	summer/winter rearing habitat	>4 channel widths per pool	2-4 channel widths per pool	<2 channel widths per pool
Pool (mean pool spacing) frequency	>5%	<15 m wide	summer/winter rearing habitat	>4 channel widths per pool	2-4 channel widths per pool	<2 channel widths per pool
LWD pieces per bankfull channel width	all		summer/winter rearing habitat	<1	1-2	>2
% wood cover in pools	<5%	<15 m wide	summer/winter rearing habitat	most pools in low category, 0-5%	most pools in moderate category, 6-20%	most pools in high category, >20%
Boulder cover in gravel-cobble riffles	all		summer/winter rearing habitat	<10%	10-30%	>30%
Overhead cover	all		summer/winter rearing habitat	<10%	10-20%	>20%
Substrate	all		winter rearing habitat	interstices filled; sand or small gravel subdominant in cobble or boulder dominant	interstices reduced; sand subdominant in some units with cobble or boulder dominant	interstices clear; sand or small gravel rarely subdominant in any habitat unit
Off-channel habitat	<3% widths	all	winter rearing habitat	few or no backwaters, no off-channel ponds	some backwaters	backwaters with cover and pond, oxbow, and other low-energy off-channel area
Holding pools	all		adult migration	few pools/km >1 m deep with good cover, cool		Adequate pools/km, >1 m deep, with good cover, cool
Access to spawning area	all		adult migration	access blocked by low water, culvert, falls, temperature		no blockages
Gravel quantity	all		spawning and incubation	absent or little		Frequent spawning areas
Gravel quality	all		spawning and incubation	sand is dominant substrate at some sites	sand is subdominant substrate at some sites	sand is never dominant or subdominant substrate

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Habitat Parameter	Gradient or W _b Class	Use	Quality		
			Poor	Fair	Good
Redd scour	all	Spawning and incubation	Evidence of extensive redd scour	Some scour potential	Stable with low potential for scour
Inorganic nutrients	all	Summer rearing habitat	spawner numbers depressed and NO ₃ -N < 20 µg·L ⁻¹ and / or SRP < 1 µg·L	spawner numbers normal; NO ₃ -N from 20-40 µg·L ⁻¹ and SRP from 1-2 µg·L	NO ₃ -N > 60 µg·L ⁻¹ and SRP > 3 µg·L ⁻¹