

Stave River Project Water Use Plan

Monitoring Program Terms of Reference

- **SFLMON-8 – Seasonal Timing and Assemblage of Resident Fish**

Addendum 3

August 29, 2014

Addendum to SFLMON-8 – Seasonal Timing and Assemblage of Resident Fish

A1.1 Addendum Rationale

A data gap identified by the Stave River Water Use Plan (SFL WUP) Monitoring Advisory Committee (MAC) in 2005 was that there is insufficient information available on seasonal use of the river downstream of Ruskin Dam by resident fish, which limits the assessment of potential impacts of operational changes specified by the plan.

The assumptions of the Stave WUP were that water releases intended to optimize anadromous salmonid productivity (including establishing a target base flow and constraining flow variability) would not adversely impact target resident fish species. The key management question from the original terms of reference is:

Do (Stave Falls Water Use Plan) operations based on anadromous salmonid rearing and spawning criteria conflict with the seasonal habitat use patterns of other resident fish species? [SIC]

The initial three years of data collection focused on reconnaissance-level surveys (terms of reference addendums 1&2) as a method to determine if flows for anadromous species are found to benefit or impact resident fish species. The methods could not be applied consistently and levels of effort could not yield enough data to answer the management question. The methodologies of this monitoring study as described in the original terms of reference (TOR) (BC Hydro 2006) and addendums (BC Hydro 2010, 2013) have therefore been changed in an attempt to better answer the management question. BC Hydro and the SFL WUP MAC recommend a revised approach for the final year of SFLMON8 that will provide the basis for assessing the resident rearing capacity of the Lower Stave River relative to other comparable Lower Fraser River tributaries. Resident species to be assessed in this study were outlined in the original TOR as Rainbow Trout, Cutthroat Trout, Mountain Whitefish and Brassy Minnow.

A1.2 Study Design

To assist in answering the management question, the following impact hypothesis was defined in the original TOR:

H01: Releases downstream of Ruskin dam do not impact the seasonal habitat-use patterns of resident fish species, particularly non-salmonid species.

To test the hypothesis, summer rearing habitat capacity will be established for the target species as dictated by the hydraulic and habitat attributes seen during late summer sampling. Fish densities will be determined and compared to other Lower Fraser River tributaries and theoretical capacity dictated by coastal productivity estimates, as described in available published and grey literature. Finally, the consultant team will determine the causes of any deviations in Lower Stave River fish densities from reference stream indices by testing:

- (a) If the hydraulic and habitat capacities observed in the summer are suitable for resident rearing. This will be tested using habitat suitability data collected in this study;
- (b) If the attributes of winter flow regimes (average/peak flows, flow variation/consistency) represent limiting factors for overwintering survival. This will be tested by reviewing the summer and winter operations over the years of study and inferring the potential for any critical factors identified to impact overwintering survival; or

- (c) If there are other environmental or Fraser River (tidal/freshet) factors that may represent limiting factors for overall rearing in the Lower Stave River. This will be tested by reviewing the literature, Lower Fraser River flow records, and relevant environmental data to infer any potential issue that may impact productivity of rearing fish in the Lower Stave River.

It is acknowledged that the proposed approach will not directly relate the effectiveness of flow releases to fish rearing capacity. The approach will rely on inferences gained from habitat suitability analysis, fish sampling, comparisons with other systems and biostandards for productivity to determine whether the Stave River flow regime impacts resident fish production.

Sampling will take place using the same timing and flow levels as in previous years, to ensure that previous data can be utilized to augment the findings of this report. As such, the study will take place in late September and flows out of Ruskin Dam will be held at 100cms for the duration of the study.

A1.3 Methods

Methods for fish collection and habitat suitability will follow stock assessment and physical habitat analysis procedures (e.g. Anon 1995 and Burt and Horchik 1999), respectively, for each habitat sampling location. Assessment of habitat capacity will follow those outlined in Ptolemy (1993). Comparisons of fish densities with other Lower Fraser River tributaries, and evaluations of limiting factors (where warranted by lower than expected fish densities in the Lower Stave River) will be inferred through systematic review of literature, flow records and fish life history requirements.

A1.3.1 Site Selection

To ensure consistency with previous methods, site selection will focus on the same 1.5km of the Lower Stave River previously sampled for this monitoring program. For the same reason, flows below Ruskin Dam will remain constant at 100m³/s for the duration of the four day sampling period.

Existing mapping of the Lower Stave River will be analyzed to determine electrofishing sites, with mainstem shoreline habitats (less than 1.5m depth) divided into 100m² habitat types defined by hydraulics (riffle, pool, glide) and substrate (fines, gravel, cobble). This exercise will incorporate existing information augmented by ground truthing where required.

10-15 sites will be chosen within the Lower Stave River using a stratified random sampling design to ensure representation of each habitat type mapped. The number of sites sampled will correspond with available resources and represent available habitats within the study area (Decker et al 1999). Three to five sites per day will be sampled over a four day period, depending on logistics and sampling efficiency.

A1.3.2 Fish Capture and Habitat Assessment

Fish collection permits must be obtained from regulatory agencies for this work; it is anticipated that electrofishing will take place outside of chum spawning timing but DFO may require notification of work before proceeding.

A standard stock assessment method using closed site 3-pass electrofishing (Anon 1995), will be used at all sites as permitted by conditions conducive to effective electrofishing. Fish densities by size class will be determined for each site, with the four target species as the focus of the habitat analysis.

All species captured will be anaesthetized if needed, identified to species, life stage, weighed and measured for fork length (nearest mm), placed into a recovery bucket and then released back into the site following the completion of sampling.

Detailed habitat assessments will be conducted at each site: a minimum of 3 transects will be established within each site, perpendicular to the bank and extending to the site boundary, along which at a minimum of 0.5m intervals, depth, velocity (average column at 0.6d), and substrate class (Anon 1995) will be documented.

Alkalinity will also be measured at each site and compared to existing data available through EMS database.

A1.1.1 Literature Review and Data Analysis

A literature review will be conducted to compare densities/species composition found in the tidally influenced Lower Stave River to sampling conducted in the tidally affected portions of the nearby Pitt River or other Lower Fraser River tributaries as dictated by data availability. The review will include a summary of the previous years of data collection from this study, where such data was relevant to support the conclusions of this study.

Weighted usable area (WUA) for each of the 4 resident species will be calculated for each site as an extrapolation of the three transects collected. Based on the classification of habitats in the original mapping exercise, the total WUA for the river will be estimated, limiting the calculation to that portion of the flow available to resident fish.

Resident fish densities for each site will be summarized and related to theoretical productive capacity measurements defined by the relationship between alkalinity and fish density/biomass (Ptolemy 1993).

Seasonal influences will need to be interpreted as a function of the fall sampling. Where fall sampling indicates that habitat use (fish density) and habitat capacity (as defined by alkalinity potential weighted by usable area and as compared to other Lower Fraser tributaries) are below levels predicted for summer/fall habitats, then this assessment will review winter/spring operations to determine if habitats during those operations would be compromised with respect to resident fish overwintering requirements. This assessment will rely on best judgement of the program biologists in identifying potential limiting factors in meeting fish densities prediction by the comparisons above.

A1.4 Final Report and Analysis

A final interpretive report will be prepared at the end of the 2014 field season for this study component to highlight the following:

- background, scope and setting;
- methods used including details on changes to the TOR, and explanation of how the changes will affect comparison with historic and future observations;
- calculation of uncertainty; and
- conclusions including any flow-related limiting factors that require further discussion in future WUP Order Reviews.

A1.5 Budget

Total Revised Program Cost: \$143,497.

A1.6 References

- Anon. 1995. Lake and stream inventory standards and procedures. *Edited by* Fisheries Branch. Ministry of Environment Lands and Parks.
- BC Hydro 2006. Study program terms of reference: SFLMON8 – Seasonal timing and assemblage of resident fish. Prepared for BC Hydro Environment and Social Issues Water License Requirements, Burnaby, BC.
- BC Hydro 2010. Study program terms of reference: SFLMON8 Addendum 1 – Seasonal timing and assemblage of resident fish. Prepared for BC Hydro Environment and Social Issues Water License Requirements, Burnaby, BC.
- BC Hydro 2006. Study program terms of reference: SFLMON8 Addendum 2 – Seasonal timing and assemblage of resident fish. Prepared for BC Hydro Environmental Risk Management Water License Requirements, Burnaby, BC.
- Burt, D.W. and J.W. Horchik. 1998. Habitat, abundance, and rearing capacity of salmonids in the Bella Coola Watershed. Report for Ministry of Fisheries, Victoria, B.C., and Ministry of Environment, Lands and Parks, Williams Lake, B.C.: 97 p.
- Decker, A.S., J.M. Bratty, S.C. Riley, and J. Korman. 1999. Estimating standing stock of juvenile coho salmon (*Oncorhynchus kisutch*) and cutthroat trout (*O. clarki*) in a small stream: a comparison of sampling designs. *Can. Tech. Rep. Fish. Aquat. Sci.* 2282: 34p.
- Ptolemy, R. A. 1993. Maximum salmonid densities in fluvial habitats in British Columbia. Pages 223-250 *in* L. Berg and P. W. Delaney, editors. Proceedings of the Coho Workshop, Nanaimo, BC, May 26-28, 1992. Canada Department of Fisheries and Oceans.