

Exploring Ecosystem Improvements through the Columbia River Treaty Info Sheet – Restoring Anadromous Salmon June 2022

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Background

This Info Sheet provides an overview of the Indigenous-led research and assessments underway to determine how reservoir and river operations might be modified through the Columbia River Treaty (CRT) to improve aquatic and riparian ecosystems for salmon in the B.C. portion of the Columbia Basin.

See the [Background Info Sheet](#) for more information about the overall process. This Info Sheet provides a summary of the research and ongoing development of performance measures investigating the impacts of the hydro-system regulation changes on anadromous salmon.

Salmon once migrated from the upper Columbia River Basin to the sea every year and returned by the hundreds of thousands to spawn. To fulfill objectives of flood control and hydropower generation, multiple high-head dams on both sides of the CAN-USA border have been constructed over the decades, blocking adult salmon from returning to historic spawning grounds. As well, dam operations create highly fluctuating flows and water levels in key sections of Columbia River. These fluctuations can be challenging for many salmon life stages, including migration, and are the focus of this work. This study is coordinated with the [Columbia River Salmon Reintroduction Initiative](#), where fish passage over the dams and other matters are being explored.

Ecosystem Goal and Objective

The Salmon and Indigenous Peoples are intricately interwoven from time immemorial. Achieving healthy and sustainable salmon populations across the entire Columbia River Basin – One River - is a critical cultural value and ecosystem goal. In this work we let anadromous salmon tell us their story, as an ‘umbrella’ species for assessing the cumulative impacts of hydro-system operations on salmon populations.

The objective of the anadromous salmon ecosystem element is to consider the impact of flow regimes on juvenile downstream migration and adult upstream migration. Performance measures that indicate the effects on salmon transit times through the many reservoirs and their survival, as well as impacts on different life stages of the run are being explored so that dam operations can be developed to assist salmon movement during these critical periods.

Study Description

CRT performance measures are being derived from a larger body of work to develop a life-cycle-model (LCM) that is capable of accounting for major sources of mortality to Columbia River salmon over the full salmon life cycle. Okanagan Sockeye (which comprise roughly 80% of Columbia River Sockeye) is the current focus of the LCM, but it will be extended to other anadromous salmon populations in the upper Columbia in B.C. in the future. Components of the LCM are being extracted and used as the basis of the CRT anadromous salmon performance measures. When completed, the LCM will provide quantitative assessments of ‘what-if’ scenarios related to an array of factors including hydro-system management, climate change, fisheries and land management, with the goal of predicting long-term viability of salmon populations. As work on both the LCM and CRT performance measures progress further there will be additional opportunities to share information between the two modelling efforts.

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Study Findings

1. Data have been collated from various B.C. and U.S. governmental and indigenous fisheries agencies for incorporation into the LCM. Various data gaps and assumptions have been identified to guide future experimental field work design.
2. Intensive tagging studies of Okanagan Sockeye (adults 1,500/year and juveniles 5,000+/year) have established the Okanagan River as an indicator stock for the Columbia River. These studies track the transit and survival of individual fish as they migrate through the river system.
3. For juvenile salmon migration:
 - lower dam outflow discharge is associated with slower fish transit times along the mainstem Columbia by 20+ more days for travel to the ocean; and
 - lower survival rates - under current dam operations juvenile smolt survival ranges from 35-45% from nursery lakes to the ocean estuary, as reported by the [Fish Passage Centre](#) of the U.S. Northwest Power and Conservation Council.

Performance Measure Description

The work to date has focused on creating performance measures (PMs) for juvenile migration. These are based on moving virtual cohorts of salmon through the model of the hydro-system, then predicting transit time and survival based on flow conditions experienced by each virtual cohort, with predictions coming from models developed from long-term monitoring studies. Transit times and survival are the two juvenile migration PMs being investigated.

Performance measures are calculated for early, middle, and late timed migrants, providing insights on how flow regime changes may disproportionately affect one portion of the run relative to another. For example, a flow scenario that shifts flow volumes earlier, perhaps from June to May, would be expected to benefit earlier timed juvenile migrants, but negatively impact later timed migrants. Comparing run-timing based PMs provides the relative effect on each migrant cohort, while PMs considering overall effects provides a measure of whether the run in its entirety benefits from the flow regime change.

Further Work

1. Development of PMs that consider adult survival of Okanagan salmon during upstream migration.
2. Adapt juvenile and adult PMs for scenarios of reintroduction upstream of Chief Joseph Dam.
3. Further LCM development includes:
 - further refinement of juvenile outmigration timing and downstream passage;
 - refining the adult components, including marine survival and upstream passage scenarios;
 - integrating with the [Fish Water Management Tool – Okanagan Basin](#); and
 - adding climate change scenarios.

Feedback Invited

Your feedback on this work is appreciated. You are encouraged to provide your input at [online survey](#) or contact columbiarivertreaty@gov.bc.ca to receive a digital or paper copy. We hope to hear from you by 4 PM Pacific Time on July 11, 2022.