

Technical Report Project 3 – Fraser River Freshwater Ecology and Status of Sockeye Salmon Conservation Units

Project description: – The researcher will investigate several aspects of Fraser sockeye ecology, including the status of sockeye Conservation Units, a review of industrial and urban impacts on freshwater ecology and salmon life history, and an expert assessment of potential impacts from historical industrial and urban activities on Fraser River sockeye.

Researcher: ESSA Technologies Ltd. is an independent Canadian environmental consulting company headquartered in Vancouver with offices in Toronto and Ottawa. Established in 1979, ESSA has grown to become a world leader in the field of environmental consulting and decision support. The team at ESSA have expertise in fisheries and aquatic sciences, terrestrial ecosystem sciences and ecological modelling, adaptive management, decision analysis, and environmental information systems.

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This report is focused on evaluating changes in freshwater ecology and its role in recent sockeye salmon declines, including the status of sockeye salmon populations and habitats and the impacts of human activities on freshwater habitats.

**Status of Conservation Units**

The report identified 36 sockeye Conservations Units (CUs) within the Fraser River basin, including 30 lake and six river-type CUs (a CU is defined by the Wild Salmon Policy as “a group of wild salmon sufficiently isolated from other groups that, if lost, is very unlikely to recolonize naturally within an acceptable time frame”).

The researchers found that 17 of the 36 Fraser sockeye CUs have poor population status and are distributed across all run timing groups. Poor population status was determined by a composite index. CUs in this category include:

- Early Stuart run – Early Stuart, Takla/Trembleur
- Early Summer run – Nahatlatch, Anderson, Francois, Taseko, Bowron, Shuswap Complex
- Summer run – Late Stuart, Takla/Trembleur
- Late run– Cultus, Harrison upstream, Lillooet, Seton, Kamloops, Shuswap Complex
- River CUs – Widgeon

The status of 11 CUs is unknown.

The CUs with the greatest relative habitat vulnerability were identified as the Stuart, Takla/Trembleur of the Early Stuart run timing group, Bowron and Fraser from the Early Summer timing group and McKinley from the Summer timing group.

## **Impact of human activities on freshwater ecology**

The researchers assessed six categories of human activities which have the potential to affect sockeye salmon: forestry, mining, hydroelectricity, urbanization upstream of Hope, agriculture and water use.

The level of forest harvesting within the last 15 years is less than 10 per cent of the area of sockeye salmon watersheds. However, the intensity of Mountain Pine Beetle harvesting has seen disturbance in up to 90 per cent of the area in some sockeye salmon watersheds. The impacts of mining on sockeye salmon are likely small and difficult to detect.

For effects from hydroelectricity development, the researchers found that the Bridge/Seton River and Kemano power projects can affect migrations of smolts and adults, but adverse effects have been largely mitigated by flow management and a temperature compliance program in the Nechako River. Independent Power Projects have not had significant impacts on sockeye salmon populations, due primarily to the small number of projects in proximity to spawning grounds or migration corridors.

Urban environments and agriculture have relatively small footprints within watersheds and riparian zones that influence sockeye salmon, though both have the most intense interaction with sockeye migration corridors. In assessing water use, the researchers found that high water demand is associated with the greatest concentrations of people across the Fraser River basin. Migration corridors have the greatest allocation of water through licensing and the greatest density of water allocation restrictions, largely within the agricultural sector. The CUs of the Lower Mainland are located adjacent to areas with the highest water allocations.

The report acknowledges that human activities can have impacts on freshwater habitats, yet concludes that recent patterns of decline in Fraser River sockeye salmon are unlikely related to patterns of human activities in the freshwater environment. However, the report also draws attention to weaknesses in existing data collected by government and provincial agencies which limit understanding of the full effects of industrial and urban activities on sockeye salmon habitats.

## **Recommendations**

The protection of freshwater habitat remains important to the conservation of Fraser River sockeye due to their importance in maintaining overall sockeye diversity and resilience. The researchers recommend further study to improve:

- estimates of juvenile abundance, overwinter survival, and mortality during smolt outmigration
- information about the abundance and distribution of small lake and all river CUs
- information on habitats monitored in a consistent manner on a regular basis across a larger number of rivers and nursery lakes
- estimates of the biological consequences of disturbance as a function of increasing stress
- transparency in the science and related decision making