

Technical Report Project 2 – Effects of contaminants on Fraser River sockeye salmon

Project description: The researcher will prepare an inventory of aquatic contaminants in the Fraser River in relation to the distribution of sockeye Conservation units. This will include an evaluation of pulp mill effluent contaminants, non-point source contaminants, endocrine disruptors and other contaminants, including sewage discharges from the Lower Mainland and other urban centres in the Fraser Watershed.

Researcher:

Don MacDonald earned a Bachelor of Science in Zoology while attending UBC and formed MacDonald Environmental Sciences Limited (MESL) in 1989 offering consulting services related to the assessment and management of aquatic and terrestrial ecosystems. He is internationally recognized as an industry leader in three primary fields of practice: environmental impact assessment, natural resource damage assessment, and ecological risk assessment. Mr. MacDonald has scientific expertise in the fields of environmental chemistry, fishery/forestry interactions, water quality/water use interactions, sediment quality assessment, environmental quality guidelines, ecosystem-based management, ecological risk assessment, and natural resource damage assessment.

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In order to evaluate the potential effects of contaminants on Fraser River sockeye salmon, the researchers developed an inventory of aquatic contaminants for the Fraser River Basin. More than 200 substances of concern were identified that have been or may have been released into the various ecosystems used by Fraser River sockeye.

This study evaluated the potential effects of water-borne contaminants, sediment-associated contaminants, and contaminants that accumulate in fish tissues. Each contaminant was evaluated to determine if its release into the freshwater ecosystems of the watershed caused or substantially contributed to the decline of Fraser River sockeye salmon over the past 20 years or to the poor returns of 2009. In addition, a water quality index was used to evaluate the effects of contaminants acting together.

The results of the study showed that, while metals and phenols were elevated at several locations, they likely did not adversely affect sockeye salmon in the Fraser River. The sediment risk assessment showed that concentrations of iron and nickel were elevated at a few locations within the basin, but exposure to these contaminants was unlikely to have affected the survival, growth or reproduction of sockeye salmon. Concentrations of selenium and dioxin toxic equivalents were found in salmon eggs at high-enough levels that were likely to affect sockeye salmon reproduction.

A qualitative evaluation was also conducted to look at the potential effects of exposure to endocrine disruptive chemicals (substances that act like hormones in the endocrine system and disrupt the physiologic function of original hormones) or contaminants of emerging concern on Fraser River sockeye.

The report concludes that declines in sockeye salmon abundance over the past 20 years or in 2009 were not likely caused by water-borne contaminants.

While it is unlikely that exposure to contaminants is the sole cause of the decline in sockeye salmon abundance, there is a strong possibility that exposure to contaminants of concern, endocrine disrupting chemicals, and/or contaminants of emerging concern has contributed to the decline of sockeye salmon abundance in the Fraser River Basin over the past 20 years.

## **Recommendations**

The report suggests future research be directed in areas such as:

- Routine effluent and non-effluent monitoring programs for all industrial sectors to provide the data needed to characterize exposure of sockeye salmon to aquatic contaminants.
- Improved coordination among government agencies and industry to ensure the requisite data are being collected and are compiled into a single database.
- Evaluation of the interactive effects of contaminants (such as endocrine disrupting compounds), disease agents, and/or water temperatures on sockeye salmon during outmigration of smolts and upstream migration of adults.
- A screening survey upstream and downstream of fish processing plants to evaluate the presence of sockeye salmon disease organisms during and following peak salmon processing periods.