

Technical report project 7 – Fraser River sockeye fisheries and fisheries management and comparison with Bristol Bay sockeye fisheries

Project description: The researcher will investigate Fraser River sockeye fisheries harvesting (First Nations, commercial and recreational) and fisheries management (pre-season forecasting, in-season and post-season run-size abundance estimation methods and escapement enumeration methods), will analyze historical performance of the in-season assessment process, will evaluate the scientific basis for determining escapement targets, will evaluate the extent of any over-harvesting since 1985, and will summarize the current conservation status of the Cultus Lake sockeye population. The researchers will also compile information related to the Bristol Bay, Alaska sockeye fishery and compare its sockeye harvesting practices and fisheries management with those in the Fraser River.

Researcher: LGL Limited is one of North America's leading ecological research companies with expertise in a broad range of disciplines, such as birds, mammals (terrestrial and marine), reptiles, amphibians, fish and invertebrates; freshwater, marine, terrestrial and wetland ecology; habitat assessment, disturbance effects; environmental assessment; ecological restoration; monitoring; geology; environmental planning; GIS and data analysis.

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**Fisheries Review and Management**

This report reviews fisheries for Fraser sockeye including commercial, recreational and First Nations fisheries and offers a functional description of fisheries management for Fraser River sockeye.

**Fisheries Harvesting and Catch Monitoring**

A complicated system of managing catches in First Nations Food, Social and Ceremonial fisheries has been developed to annually allocate 1,030,000 Fraser sockeye in marine areas, as well as in the Lower and Upper Fraser River. An important recreational fishery for sockeye occurs in non-tidal areas of the Fraser. A review of commercial catch estimates found limited documentation for Fisheries and Oceans Canada's (DFO) catch monitoring program, few estimates of precision and minimal verification at landing sites for most Canadian commercial fisheries. The researchers concluded that this leaves substantial room for improvement in the commercial catch monitoring programs.

**Non-retention Fisheries**

The researchers examined non-retention fisheries, meaning those fish caught and released and those fish that encounter fishing gear but escape capture. The largest en-route losses occur at times and locations where upstream migrating sockeye are stressed by a combination of elevated water temperature, in-river fisheries and difficult passage points. It may be possible to minimize such effects by changing the timing and location of in-river fisheries away from these stressors.

**Forecasting**

Pre-season forecasts explained 60% of the year-to-year variation in Fraser sockeye returns between 1980 and 2009. The recognized challenges with forecasting salmon returns have led most managers to rely on in-season information to manage sockeye fisheries. The accuracy and precision of in-season run size estimates vary through the season and between the different run-timing groups (Early Stuart, Early Summer, Summer-run, and Late-run stocks). In general, in-season forecasts have been sufficiently accurate, precise, and timely to make the necessary management decisions to achieve harvest rate goals defined for each of the four run-timing groups.

## **Escapement**

Post-season escapement estimates are much more reliable than in-season estimates for Fraser sockeye. Virtually every type of enumeration method used to estimate escapement for salmon has been used or tested in the Fraser watershed for Fraser sockeye. The methods currently used are appropriate and the best of the available alternatives for Fraser sockeye.

To define escapement targets, the methods were relatively simple from 1987-2002, more complex from 2004-2010 and are destined to become more complex in the future as Wild Salmon Policy benchmarks are identified for each sockeye Conservation Unit. The large year-to-year variability in escapement targets makes it difficult to regulate fisheries and evaluate management performance. A clearly defined set of escapement goals for each run-timing group and indicator stock would be easier to communicate to fishers than the current complex system. These escapement goals would still allow managers the latitude to implement harvest rate ceilings to protect less productive stocks when returns of the target stocks are large.

Low escapement benchmarks have been defined for each Fraser sockeye indicator stock and run-timing group. For three of the four run-timing groups, escapements to spawning areas have been consistently above the benchmarks. Escapements for the Early Stuart timing group fell below its lower benchmark goal from 2005-09 but no commercial fisheries have been permitted to target early run-timing group in these years. Some harvesting of Early Stuart sockeye has been permitted in middle and upper Fraser First Nations fisheries. Escapement of all summer-run stocks declined rapidly from 2003 to 2009 and most sockeye fisheries were closed from 2007-09 to maximize escapements for these stocks. Within the Early Summer and Late-run timing groups, two stocks (Bowron and Cultus) have been consistently below their benchmarks in recent years.

## **Abundance**

For most salmon stocks, total abundance is estimated by adding together catch and escapement. For Fraser sockeye, en-route losses (not accounted for in the catch and escapement estimates) can, on occasion, exceed 90% of fish that did enter the Fraser River. The location, timing, and magnitude of these en-route losses are critical for estimating total abundance and exploitation rates for Fraser sockeye.

Based on available estimates of abundance and exploitation rates, it is likely that overharvesting occurred for Early Stuart sockeye between 1984 and 2000 and for Early Summer-run sockeye from 1960-1989. No evidence of overharvesting was detected for the other two run-timing groups as a whole but there is clear evidence that at least one component of the Late-run group (Cultus Lake sockeye) was overharvested during the late 1980s and early 1990s.

Progress has been made on reducing predator abundance in Cultus Lake, reducing harvest rates on Cultus adult sockeye and increasing smolt production through hatchery supplementation efforts, but these have not resulted in meeting defined recovery objectives for the population. Given the uncertainties, these actions need to be considered 'experimental' and thus require ongoing and rigorous monitoring programs.

## **Bristol Bay**

This report also discusses and develops conclusions about the differences and similarities in sockeye fisheries management practices in the Fraser River and Bristol Bay sockeye fisheries. Relative to most sockeye stocks, the river-specific catch and escapement information from Bristol Bay is some of the most accurate and precise in salmon biology today. The substantial differences between the Fraser River and Bristol Bay fisheries make many of the approaches used in Bristol Bay inappropriate for Fraser sockeye stocks and fisheries. One aspect of the Bristol Bay fisheries that should be considered seriously for application to the Fraser is the clarity and priority associated with sockeye escapement goals. A clearly defined set of escapement goals for Fraser sockeye would not guarantee success but is one way that the management of Fraser sockeye stocks could be made simpler and increase the potential for achieving these escapement goals.