

Is declining sockeye salmon survival the result of competition at sea and declining carrying capacity?

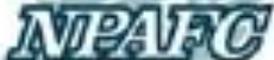
Jim Irvine¹

Scott Akenhead²

¹Fisheries & Oceans Canada, PBS, Nanaimo BC Canada

²Ladysmith Institute, Ladysmith, BC Canada

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The logo for the North Pacific Anadromous Fish Commission (NPAFAC), featuring the acronym in a stylized, bold font with a blue and white color scheme.

**NORTH PACIFIC
ANADROMOUS FISH
COMMISSION**



*3rd International Workshop on
Migration and Survival Mechanisms
of Juvenile Salmon and Steelhead in
Ocean Ecosystems*

Background

- Fraser River sockeye salmon declined from 1992-2009; 2009 return the lowest since 1947
- Canadian Government established a Judicial Inquiry on Fraser sockeye
- Inquiry took 2.5 years to complete
 - 128 days of hearings
 - 2,145 exhibits
 - testimony from 179 expert witnesses
 - 15 technical reports & various primary pub.'s

Background (cont'd)

- Inquiry unable to determine the relative importance of specific marine factors
- Motivated us to carry out a detailed investigation of survival patterns of Chilko Lake sockeye salmon
- Chilko the only Fraser River population with a long time series of smolt-to-adult survival (*SAR*) data
- Most of results presented here are from a manuscript in review

Objectives

- To describe a new time series of smolt survival (*SAR*) for Chilko Lake sockeye
- To examine potential linkages between *SAR* and:
 - Density dependent processes at sea as represented by indices of multi-species salmon abundance
 - Marine conditions represented by various North Pacific & regional indices

Summary

- **The only clear pattern break in smolt survival occurred about 1991, when a trend of**
 - **Increasing survival 1960-1990 changed to**
 - **Lower / decreasing survival 1992-2008**
- **Survival is more similar to indices of sockeye, chum & pink abundance than to indices of global, regional or local ocean climate**
- **Our results are consistent with the hypothesis that salmon productivity declined soon after 1990**

Summary (cont'd)

- **Simple model presented to illustrate how increased competition at sea**
 - **related in part to large hatchery releases,**
 - **in conjunction with changes in productivity**
- **May have produced changes in productivity**
 - **Pre-1991: improved survival but reduced growth**
 - **Post-1991: reduced survival while growth of survivors showed no effect**