



AYK SUSTAINABLE SALMON INITIATIVE

Project Synopsis

YUKON RIVER WATERSHED



(Christian E. Zimmerman)

PROJECT 607

PRINCIPAL INVESTIGATOR

Jeffrey F. Bromaghin
*United States Fish and
Wildlife Service*

CONTRIBUTING ORGANIZATIONS

*National Oceanic
and Atmospheric
Administration*

*Western EcoSystems
Technology, Inc.*

RESEARCH PERIOD

July 2006 -
June 2008

BUDGET

\$160,079.00

SELECTIVE FISHERY IMPACTS: YUKON RIVER CHINOOK SALMON

A FUTURE OF SMALLER FISH?

Like other northern Chinook salmon populations, Yukon River Chinook salmon are characterized by a high proportion of large-bodied, older individuals. The declines in average weight and the reduced frequency of large Chinook salmon in several spawning populations, combined with unexpectedly low abundance in recent years, have precipitated concern that fishery management practices or other unknown factors may be changing fundamental characteristics of this iconic run of fish. The complex natural and fishery selection pressures operating on this population combined with the lack of experimental controls makes it difficult to definitively address these questions using empirical observations.

OUR OBJECTIVES

Investigate the potential for selective exploitation to alter population productivity and demographics—using computer simulation.

Evaluate whether or not selective fishing pressures at the rates found on the Yukon River are likely to induce adaptation.

Develop recommendations for fishery managers to take evolutionary considerations into account.

HOW WE DID IT

We first conceptualized population dynamics as the result of a series of sequential stages within Chinook salmon life history. We developed a sub-model for each stage

RESEARCH FRAMEWORKS:

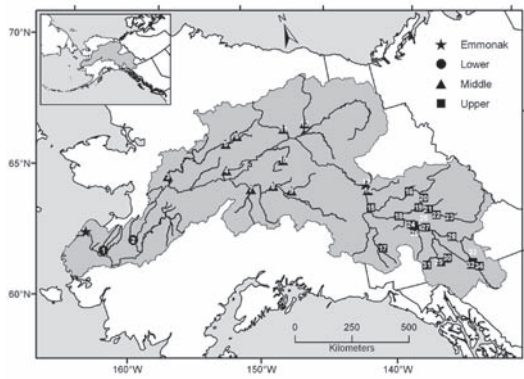
SALMON LIFE CYCLE –
PRIORITY #3;

SYNTHESIS &
PREDICTION –
PRIORITY #9

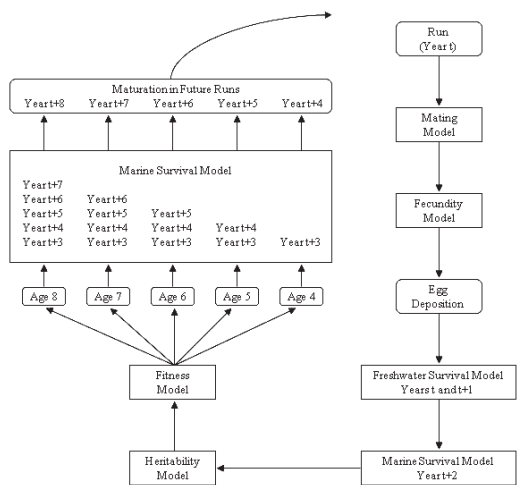
SNAPSHOT

This project used computer simulation to investigate the potential evolutionary consequences of size-selective fishing for Chinook salmon. Researchers found that such pressure could shift the average length and age-at-maturation within 50 to 60 years.

Mitigating effects of various management responses were also explored.



Map of the Yukon River drainage in Alaska and Canada, showing locations of 774 baseline sample collections and the base of mixture sampling in Emmonak, Alaska. (Bromaghin, USFWS)



Schematic diagram of the primary components of the Chinook salmon population dynamics model. Rectangles with squared corners represent model components, while rectangles with rounded corners represent sub-model results. (Bromaghin, USFWS)

(mating, fecundity, egg deposition, freshwater survival, marine survival, and so on) using the best available information. Our final model consisted of all the sub-models operating in sequence.

WHAT WE DISCOVERED

Our results suggest that size-selective fisheries for Chinook salmon employing large-mesh gillnets could shift population demographics and reduce productivity through evolution of length and age-at-maturation within ten generations (about 50 to 60 years). Our model also indicates that maintaining large escapements, especially in years of small returns, may increase the stock's resiliency to selection in later generations. Reducing the fishing intensity and the net mesh size together were much more effective in increasing salmon length and age than either was implemented alone.

PRODUCTS AND OUTREACH

We have submitted a manuscript for publication in a peer-reviewed journal.

WHAT'S NEXT?

An advantage of modeling—simplifying a complex system to understand the interactions of its components—means that assumptions about those components must be adopted. Further research providing improved information about the various parts of our model will increase the accuracy of its predictions. In the meantime, we recommend that managers adopt a precautionary perspective with respect to selective exploitation. This might forestall future decline and increase the potential for the Yukon River Chinook salmon population to persist as a viable and diverse resource that can support a fishery and successfully adapt to future natural challenges.

AYK SSI Mission: To collaboratively develop and implement a comprehensive research plan to understand the causes of the declines and recoveries of AYK salmon.

ARCTIC-YUKON-KUSKOKWIM SUSTAINABLE SALMON INITIATIVE

BERING SEA FISHERMEN'S ASSOCIATION
110 W. 15TH AVENUE
ANCHORAGE, AK 99501
(907) 279-6519