



AYK SUSTAINABLE SALMON INITIATIVE

Project Synopsis

AYK REGION-WIDE



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(Christian E. Zimmerman)

PROJECT 303

PRINCIPAL INVESTIGATOR

Daniel Goodman
Montana State
University

RESEARCH PERIOD

June 2003 -
May 2004

BUDGET

\$35,000.00

UNCERTAINTIES IN SALMON MANAGEMENT

Many western Alaska chum salmon stocks have experienced low productivity and reduced runs in recent years, causing hardship for subsistence users. Management of the harvests of these stocks is guided by biological escapement goals based on estimates of the maximum sustained yield. Concerns expressed about this management model have been ecological (depletion of marine-derived nutrients), statistical (stock recruitment estimates are subject to several sources of error), and environmental (lack of realism in the assumption of a constant environment).

OUR OBJECTIVES

Conduct a formal, but preliminary, uncertainty analysis for several western Alaska chum salmon stocks.

Investigate the nature of the recent productivity decline.

HOW WE DID IT

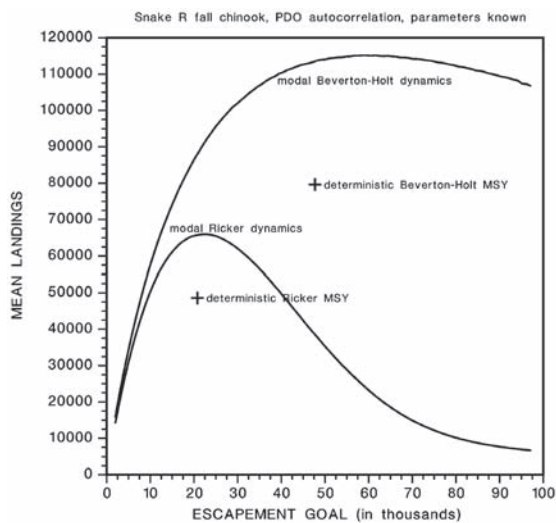
We used the stock recruitment data for summer chum salmon from the Andreafsky (1972–1995) and Anvik (1972–1997) rivers, and chum salmon stocks from the Kwiniuk River (1965–1995). We quantified uncertainties in the data for the purpose of setting escapement goals. We focused on the uncertainty about the estimate of the escapement level that is associated with maximum sustained yield, uncertainty about the recruitment rate at spawning escapements well above the unharvested

**RESEARCH
FRAMEWORK:**
SYNTHESIS &
PREDICTION –
PRIORITY #8

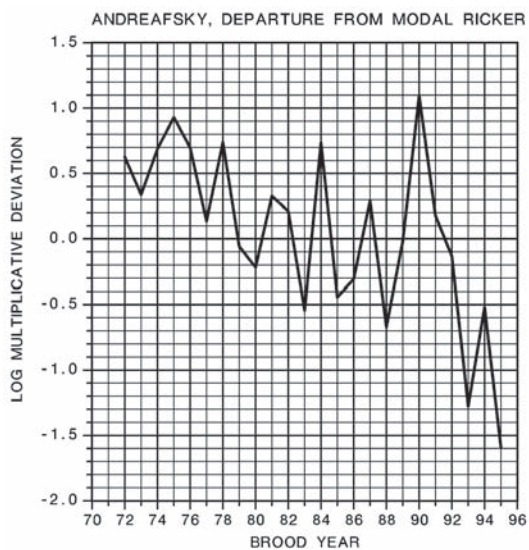
SNAPSHOT

Strong correlations in the declines of all three stocks indicated that one or more regional processes are driving the observed declines.

A formal uncertainty analysis for three western Alaska chum salmon stocks yielded no evidence of over-escapement, which fisheries managers define as an excess of salmon, beyond current escapement goals, arriving to spawn at natal rivers or streams.



Management strategy evaluation of constant escapement goal policies applied to Ricker and Beverton-Holt operating models that were fit to the same real data. (Goodman, MSU)



A very marked downward trend that is essentially linear. Biologically this tells us that the Andreafsky chum salmon stock has been experiencing a fairly continuous downward trend in productivity over the 24 year period of record. (Goodman, MSU)

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

equilibrium, and patterns in the departure of productivity from the expected level.

WHAT WE DISCOVERED

All three stocks show large recent declines in productivity and large uncertainty in the parameters of their stock-recruitment curves, exhibit the same, nearly linear, downward trend in the recent two decades, and all three conform to an early episode of increasing trend. These between-stock correlations in declining productivity show there is promise in a search for specific environmental variables that are the drivers of the ongoing declines and variation. There is no evidence for over-escapement in any of the three Arctic-Yukon-Kuskokwim chum salmon stocks analyzed in this study.

Additionally, all three stocks show large uncertainty in the parameters of the stock-recruitment curve, resulting in large uncertainty in setting maximum sustained yield escapements.

PRODUCTS AND OUTREACH

Our results and recommendations have been made available to Arctic-Yukon-Kuskokwim region salmon managers.

WHAT'S NEXT?

There is promise in a search for specific environmental variables that are the drivers, and to elucidate the causes of the ongoing decline and episodic deviations. The fact of the correlation indicates that the cause almost certainly includes one or more common factors operating on a regional scale—this could be a meteorological factor affecting the freshwater phase of the life history, an oceanographic factor affecting the saltwater phase, competition in saltwater, or variation in ocean harvest mortality that is not accounted for in the run reconstructions.

We recommend that managers do not decrease escapement goals in response to a trend of decreasing productivity of these stocks. This strategy will position the stocks to capitalize on higher productivity events when they occur. Some high productivity events can arise from the high frequency variation, even in the time before the long-term trend turns around. The strong correlation between the declines of the three stocks suggests a regional cause. Further study in this area would be valuable.