NORTON SOUND AREA

(Greg T. Ruggerone)

RETROSPECTIVE ANALYSIS OF ARCTIC-YUKON-KUSKOKWIM CHUM AND COHO SALMON

PROJECT 614

PRINCIPAL INVESTIGATOR

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RESEARCH PERIOD

July 2006 - June 2008

BUDGET

$135,099.00

HISTORICAL CLUES TO COMPLEX INTERACTIONS

As a keystone species, Pacific salmon are considered to be a critical component of a watershed. Yet, in a relatively pristine region of Alaska, exceptionally low numbers of salmon returned to Norton Sound and the Yukon and Kuskokwim rivers in the late 1990s and early 2000s. Large scale climate changes and regional oceanic conditions may be important factors in this decline. Furthermore, interactions with pink salmon, Asian hatchery-raised fish, and pollock also may affect these populations.

OUR OBJECTIVES

Reconstruct annual and seasonal growth of Kwiniuk River chum salmon, and Unalakleet and Kuskokwim river coho salmon during the past several decades.

Evaluate the effects of climate change, pink salmon and Asian hatchery chum salmon abundance, and pollock larval biomass on these populations.

Estimate Norton Sound chum salmon returns from each brood year, and compare productivity with Kwiniuk River chum salmon growth, climate factors, and competition with other salmon.

HOW WE DID IT

We measured growth rings on salmon scales collected on the Kwiniuk, Unalakleet, and Kuskokwim rivers

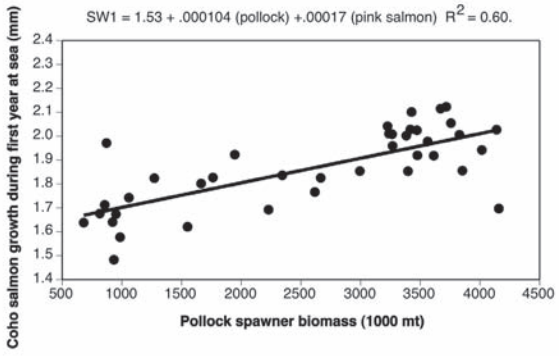
RESEARCH FRAMEWORKS:
SALMON LIFE CYCLE – *PRIORITY #1;*

SYNTHESIS & PREDICTION – *PRIORITY #7*

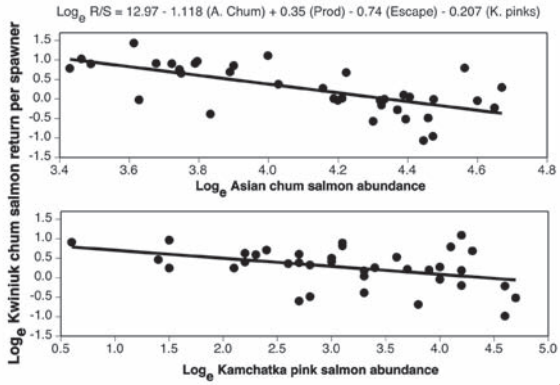
SNAPSHOT

Historical data were used to examine the population trends of Norton Sound chum salmon and Kuskokwim and Unalakleet river coho salmon.

Ocean/climate shifts in 1977 and 1989 resulted in increases in the coho salmon populations, while decreases correlated with climate changes in the late 1990s. Norton Sound chum salmon were negatively affected by increases in pink salmon and Asian hatchery chum salmon, while Asian pink salmon indirectly influenced the coho salmon populations.



Scale growth of Kuskokwim River coho salmon since 1965 was positively correlated with abundance of pollock spawner biomass, which provided an index of larval pollock, a key prey of immature coho salmon in the Bering Sea. Coho salmon abundance was greater when abundance of pollock larvae was relatively high. (Ruggerone, NRC)



This relationship shows the partial effects of Asian chum and pink salmon on Norton Sound chum salmon after accounting for early marine productivity (Prod), and parent spawning abundance of Kwiniuk River salmon (Escape). (Ruggerone, NRC)

since 1975, 1980, and 1965, respectively. We obtained brood tables and escapement data for Kwiniuk River chum salmon, and estimated chum salmon abundance for all of Norton Sound using available age composition and escapement data. We obtained catch per unit effort data on Unalakleet and Kuskokwim river coho, and environmental data from several agencies and online sources.

WHAT WE DISCOVERED

Our analysis indicated that growth was important to the productivity of these salmon stocks. We found that Norton Sound chum salmon may compete with Asian chum salmon (mostly hatchery fish), Kamchatka pink salmon, and with Norton Sound pink salmon during early marine life. In contrast, juvenile Kuskokwim River coho salmon appear to benefit from pink salmon in freshwater habitats, and from larval pollock in the Bering Sea. We also found that ocean regime shifts in 1977 and 1989 led to progressively greater abundance of coho salmon, whereas the 1997 El Niño led to an abrupt decline in coho salmon abundance. Early marine growth of coho salmon was key to determining coho salmon abundance, but additional unknown factors associated with climate variables also influenced abundance.

PRODUCTS AND OUTREACH

Findings were presented at four meetings involving communities from western Alaska and two scientific conferences. Two journal manuscripts are in preparation.

WHAT'S NEXT?

The alternating year pattern of coho salmon growth and abundance that we found highlights the complexity of species interactions in the ocean. Further research is needed to identify the prey and the life history patterns that may contribute to alternating year patterns of AYK salmon. Further research is also needed to evaluate competition between Asian hatchery chum salmon and AYK chum salmon.

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

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