(Oleg Ivanov)

FACTORS AFFECTING CHUM SALMON GROWTH AND CONDITION

PROJECT 610

PRINCIPAL INVESTIGATOR

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RESEARCH PERIOD

August 2006 - April 2009

BUDGET

$597,194.00

CLIMATE CHANGE AND CHUM SALMON

Every spring, chum salmon fry from the Yukon and Kuskokwim rivers enter the eastern Bering Sea to begin their marine life history stage and an uncertain future. The highest marine mortality rates for salmon occur during their first year in the ocean. According to the "critical size and period" hypothesis, faster growing juvenile salmon are more likely to escape predators soon after leaving freshwater, and larger fish, after their first summer at sea, are believed to be better fit to survive their first winter at sea.

OUR OBJECTIVES

Understand how changes in climate affect the quantity and quality of food resources for juvenile western Alaska chum salmon.

Use bioenergetics models to analyze the impacts of these changes on juvenile chum salmon growth rate potential.

HOW WE DID IT

From 2002–2007, we conducted late summer and fall surveys along the eastern Bering Sea shelf. This period encompassed a period of unusually warm sea surface temperatures (2002–2005) followed by unusually cold temperatures (2006–2007). We collected data on sea surface temperatures, salmon diet, prey availability, and the relative abundance of juvenile chum salmon from the Yukon and Kuskokwim rivers.

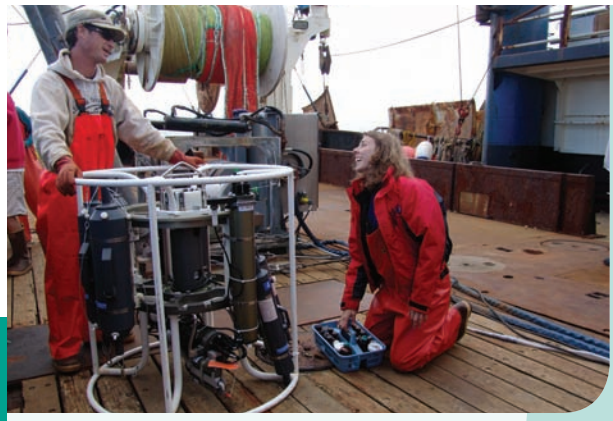
RESEARCH FRAMEWORKS:
SALMON LIFE CYCLE – *PRIORITY #1;*

SYNTHESIS & PREDICTION – *PRIORITY #10*

SNAPSHOT

We studied the ocean growth of juvenile Yukon and Kuskokwim river chum salmon. We measured water temperatures, prey abundance, salmon diet, and the relative abundance of Kuskokwim and Yukon river chum salmon along the eastern Bering Sea shelf.

We created bioenergetics models that suggest an increased growth potential for juvenile chum salmon during years with warmer sea surface temperatures.



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WHAT WE DISCOVERED

Our bioenergetics models indicated that growth rate potential of juvenile chum salmon is much lower during years with cold sea temperatures, due mostly to the quantity of available prey. We also found that the relative abundance of juvenile Kuskokwim River chum salmon and the size of juvenile Yukon River chum salmon are much lower during years with cold sea temperatures. These findings suggest that marine mortality for western Alaska chum salmon is highest during years with unusually cold sea temperatures. However, when we examined the "sensitivity" of our models to increased ocean temperatures, we found that growth rate potential can decline if sea temperatures increase by 20° C above the warmest sea temperatures found during the surveys.

PRODUCTS AND OUTREACH

Our data was used to create a comprehensive database for western Alaska chum salmon. We have prepared seven manuscripts for publication in peer-reviewed journals and presented our findings at a national symposium.

WHAT'S NEXT?

Given climate change predictions, future research must address how western Alaska salmon respond to loss of sea ice, and warming air and sea temperatures along the eastern Bering Sea shelf. For example, we plan to utilize the nutrient-phytoplankton-zooplankton (NPZ) model being developed for the Bering Sea shelf by scientists participating in the North Pacific Research Board's Bering Sea Integrated Research Program. We can use the NPZ model to predict growth rate potential for western Alaska chum salmon under a warming climate scenario to attempt to understand how climate warming will impact early marine growth and survival.

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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