

North Pacific Research Board: Semiannual Progress Report

Project #: R0327

Title: Early marine ecology of juvenile chum salmon (*Oncorhynchus keta*) in Kuskokwim Bay, Alaska

Principal Investigator(s) and Recipient Organization(s):

Nicola Hillgruber (UAF),	n.hillgruber@uaf.edu
Christian E. Zimmerman (USGS),	czimmerman@usgs.gov
Lewis J. Haldorson (UAF),	lew.haldorson@uaf.edu

Contract Period and Amount of Funding: May 1, 2003 – April 30, 2006 \$624,025

Report Period: July 1 to December 31, 2004

Report Date: January 15, 2005

Lead Authors of Report: Nicola Hillgruber & Christian E. Zimmerman

Project Summary: Our project aims at examining the early marine ecology of chum salmon (*Oncorhynchus keta*) in Kuskokwim Bay, Alaska. The overall goal is to assess the effects of physical, biological, and environmental factors on distribution, feeding, condition, and growth of juvenile chum salmon during their estuary residence. Using a bioenergetically-based food web model based on directed sampling for prey field, diet composition, growth, size structure, and energy content will help us to understand patterns observed in feeding, growth and condition of chum salmon juveniles. Specifically, our objectives include (1) determining the spatial and seasonal distribution of chum salmon juveniles throughout Kuskokwim Bay, (2) assessing the spatial and seasonal patterns of environmental variables, and (3) describing the relationship between juvenile distribution patterns and these variables. In addition, we will (4) describe food habits, (5) analyze length, weight, condition, (6) diurnal feeding patterns, and (7) growth of chum salmon. Finally, (8) we will model the bioenergetics and growth of chum salmon juveniles in Kuskokwim Bay

Progress Summary: Juvenile chum salmon were sampled on a station grid with a modified Kvichak trawl, from June through August in 2003, and from May through June in 2004. Physical data were recorded with a CTD and zooplankton was collected. In both years, rainbow smelt (*Osmerus mordax*) and pond smelt (*Hypomesus olidus*) were the most abundant fish species throughout the bay. In 2003, the proportionate abundance of chum salmon decreased from 7.7% of the total catch in June to 0.1% in July. No chum smolts were collected in August. Mean fork length (FL) of chum salmon increased from 49.2 mm (n = 56, SD = 3.895) in June to 55.8 mm (n = 3, SD = 6.028) in July of 2003. Mean energy density of juvenile chum salmon was 4751.494 cal/g (n=56, SD=115.375) in June and 4709.446 cal/g (n = 3, SD = 30.088) in July of 2003. In 2004, proportional abundance of juvenile chum salmon gradually increased from 0.3% in May to 47.8% in June. Mean FL of chum salmon increased from 38.3 mm (n = 11, SD = 2.490) in May to 51.3 mm (n = 808, SD = 4.516) in June of 2004. In both years, density of juvenile chum salmon was highest closest to the river mouth. Out-migrating chum salmon juveniles appeared to be following the main river channels and the eastern shore of the bay. Preliminary results on diet suggest that juvenile chum salmon frequently fed on adult dipterans indicating that chum salmon were feeding at the water surface.

Laboratory analyses are ongoing. To date, all juvenile salmonids collected have been measured and weighed, their gut contents removed and preserved, and the remaining fish freeze-dried for subsequent analysis of energetic content. Calorimetry has been completed for all 2003 chum salmon juveniles and analysis of samples collected in 2004 is in progress. Otoliths have been extracted and are currently being prepared for analysis of microchemistry and microstructure (Figure 1). In addition, analyses of zooplankton, oceanographic variables, and fish distribution are ongoing.

In November 2004, we presented a paper at the Alaska Chapter American Fisheries Society Meeting in Sitka, Alaska (Burril et al. 2004). We are currently preparing a presentation for the Pink and Chum Salmon Workshop (Ketchikan, Alaska, February 2005).

Completed Presentations and Reports:

Burril, S., N. Hillgruber, and C.E. Zimmerman. Estuarine ecology of juvenile chum salmon (*Oncorhynchus keta*) in Kuskokwim Bay, Alaska. Alaska Chapter American Fisheries Society Annual Meeting. Sitka, Alaska. November 2004.

Zimmerman, C.E., N.T. Hillgruber, S.E. Burril, M.A. St. Peters, and J.D. Wetzel. In press. Offshore marine observation of willow ptarmigan (*Lagopus lagopus*) including water landings, Kuskokwim Bay, Alaska. The Wilson Bulletin.

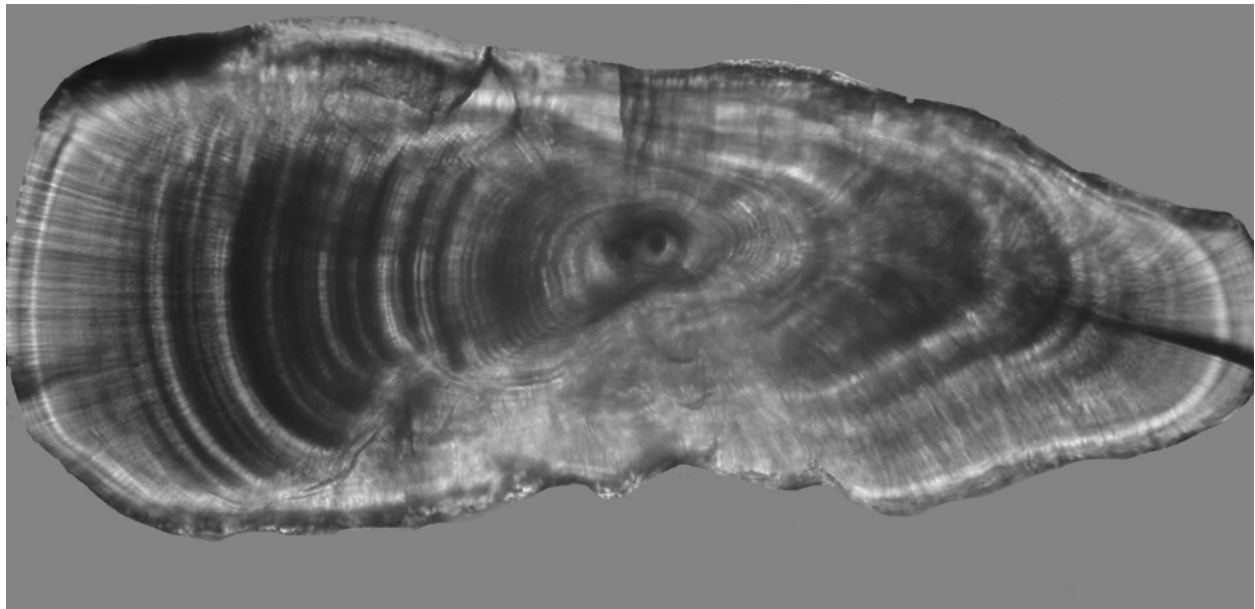


Figure 1. Transverse section of a juvenile chum salmon otolith collected from the lower Kuskokwim River, Alaska.