North Pacific Research Board: Semiannual Progress Report

Project #: R0327

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

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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:

During the 2003 field season, we successfully completed a total of three research cruises to Kuskokwim Bay: Cruise 1 from June 23 to June 26, cruise 2 from July 24 to July 26, and cruise 3 from August 26 to August 30, 2003. Sampling in 2003 was conducted off a 48-foot vessel. Sampling at each station included a CTD and Secchi disk cast, a Tucker trawl surface haul for zooplankton and a surface haul with an adapted Kvichak trawl for juvenile fish. After retrieval of the Tucker trawl, the net was rinsed and the plankton sample preserved in 5% seawater formalin solution for later processing. Upon recovery of the juvenile trawl, all fish were identified and measured and all target fish were frozen.

To date, all collected and preserved plankton samples have been processed. Processing of chum salmon juveniles is currently in progress.

Fish sample (above) and preserving plankton (right).

Surface zooplankton densities were highly variable among stations and cruises. Mean surface zooplankton density during the three research cruises was 1621.7 organisms m^{-3} (SD = 2870.5) on cruise 1, 552.0 organisms m^{-3} (SD = 616.0) on cruise 2, and 66.6 organisms m^{-3} (SD = 126.6) on cruise 3. During each survey, sea surface salinity ranged from 0 ppt to 28 ppt among sampling stations. Mean sea surface temperature (± SD) among stations was 14.5 ± 1.2 °C, 14.9 ± 0.3 °C, and 13.5 ± 0.8 °C on cruises 1, 2, and 3, respectively. During the three cruises a total of 18,438 fish were counted, 723 on cruise 1, 4,086 on cruise 2, and 12,996 on cruise 3. Of these fish, 68 were chum salmon juveniles.

	Total Counts (all samples)			% Occurrence (all samples)		
Species	**Cruise 1**	**Cruise 2**	**Cruise 3**	**Cruise 1**	**Cruise 2**	**Cruise 3**
Oncorhynchus keta	56	12	0	7.7	0.3	0.0
Oncorhynchus tshawytscha	3	2	0	0.4	0.0	0.0
Oncorhynchus gorbuscha	2	2	1	0.3	0.0	0.0
Oncorhynchus kisutch	1	0	0	0.1	0.0	0.0
Hypomesus olidus	392	1013	9754	54.2	29.1	75.1
Osmerus mordax	212	206	54	29.3	4.8	0.4
Gasterosteus aculeatus	0	107	807	0.0	4.9	6.2
Pungitius pungitius	49	709	1949	6.8	17.8	15.0
Clupea pallasi	1	2032	431	0.1	43.1	3.3
Eleginus gracilis	0	1	0	0.0	0.0	0.0
Lota lota	0	1	0	0.0	0.0	0.0
Lampetra camtschatica	6	1	0	0.8	0.0	0.0
Pleuronectidae	1	0	0	0.1	0.0	0.0
Total	**723**	**4086**	**12996**	**100.0**	**100.0**	**100.0**

Juvenile chum salmon average fork length increased from 54.2 mm (SD=4.4) during cruise 1 to 69.5 mm (SD = 13.6), resulting in an approximate average growth rate of 0.5 mm d^{-1}. During cruise 3, when over 8 km from shore, we encountered a group of approximately 100 to 125 willow ptarmigan (*Lagopus lagopus*).