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GLOBEC 2000:
Growth and Survival of Coho Salmon Utilizing the Coastal Gulf of Alaska

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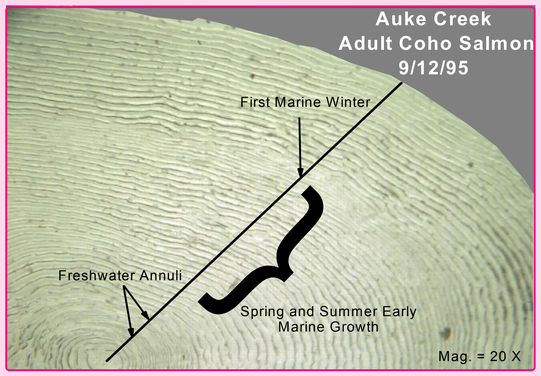
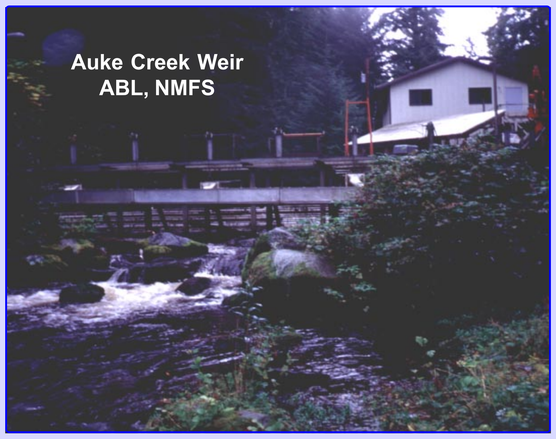
Summary

Growth rates during the first year of marine residence critically influence survival to adulthood; the relationship between growth and survival of salmon at specific phases of the marine life history underlies the major hypotheses of the Global Ecosystem (GLOBEC) research program in the Gulf of Alaska. This project examines 1) the relationship of coho salmon growth during specific marine phases to subsequent survival to adult and to size at maturity, and 2) how these parameters vary in relation to biophysical parameters. Coho salmon population trends in the northeastern Pacific differ substantially between the Pacific Northwest and Alaska. In the Pacific Northwest, coho salmon abundance has declined precipitously since the 1970's, to the extent that many populations are threatened or endangered under the federal Endangered Species Act. In Alaska, coho salmon abundance has been at historically high levels during this same time period (1990's). Conditions in the marine environment have contributed to these population trends, as indicated by regional differences in marine survival that are generally consistent with the inverse response in the two regions. Ocean survival of Oregon Production Index coho salmon declined from an average of nearly 6% throughout the 1970s to 0.5% in recent years, during the same time period that ocean survival of Auke Creek coho salmon in Southeast Alaska averaged 19% (range 8 to 37%).

The study approach is a retrospective analysis of scales collected from coho salmon by two long-term, on-going monitoring programs supported by the NOAA Auke Bay Laboratory. The Southeast Coastal Monitoring Program (SECM) has collected data on size, abundance, distribution, scales, and growth of juvenile salmon in nearshore and coastal waters of Southeast Alaska and on biophysical parameters since 1997. The Auke Creek Weir program has collected scales and size data from adult and jack (precocious male) coho salmon returning to Auke Creek since 1971. Ocean survival of coded-wire tagged smolts emigrating from Auke Creek has been estimated since the 1977 return year, and is significantly correlated with regional catch levels ($r > 0.7$). Scales from juvenile coho salmon captured by SECM and scales from adult fish returning to Auke Creek will be digitized. Juvenile scale patterns will be analyzed to identify the time of transition from nearshore waters of Southeast Alaska to the Gulf of Alaska, and, based on this analysis, marine growth patterns in the adult scales will be broken into three phases: juvenile nearshore/coastal; juvenile Gulf of Alaska; and adult. These growth data will be used to develop a model relating growth and environmental variates to survival and regional abundance. In FY02, we anticipate preliminary results from the retrospective analysis of scale data and continued development of data series for juvenile coho salmon for incorporation into hindcast and forecast models of growth, survival, and regional run strength.

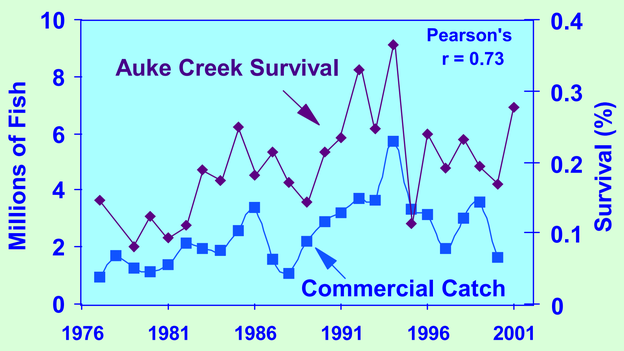


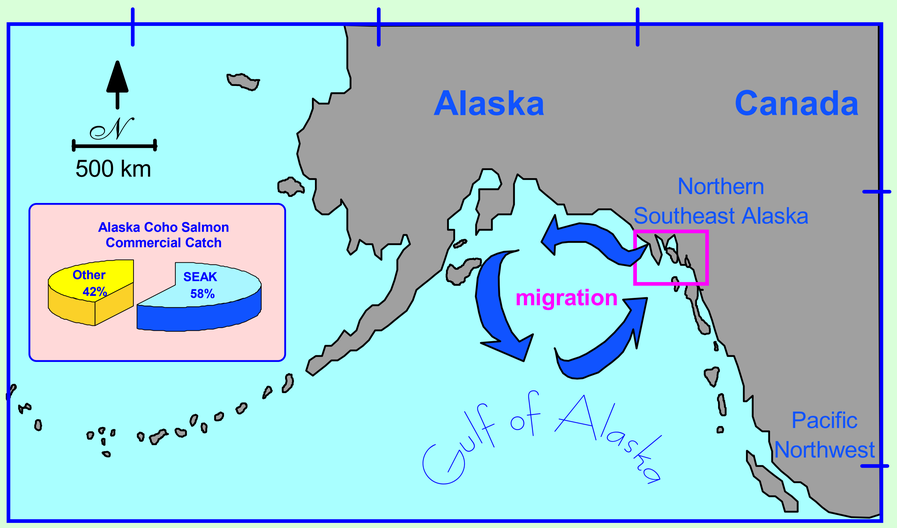
Objective 1
Characterize scale growth of coho salmon to identify the transition period from nearshore to Gulf of Alaska waters.



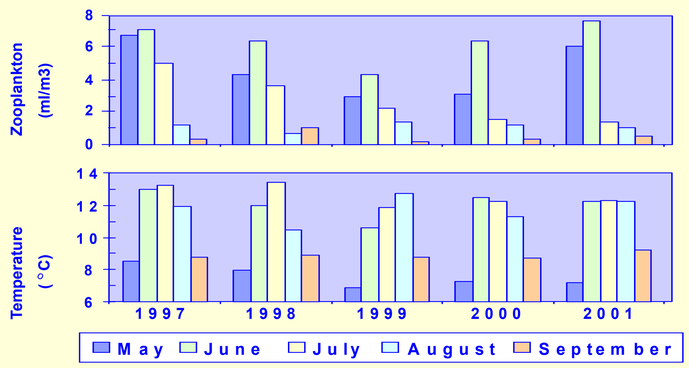
Objective 2
Analyze the archival scale collection from Auke Creek coho salmon to determine growth patterns for coho of known marine survival during both juvenile and adult marine residency.

Objective 3
Quantify the relationship between coho salmon growth (top panel) in different phases of marine residency in the GOA and both stock specific survival and size at return. Southeast Alaska coho catch and survival of Auke Creek coho are highly correlated (bottom panel).

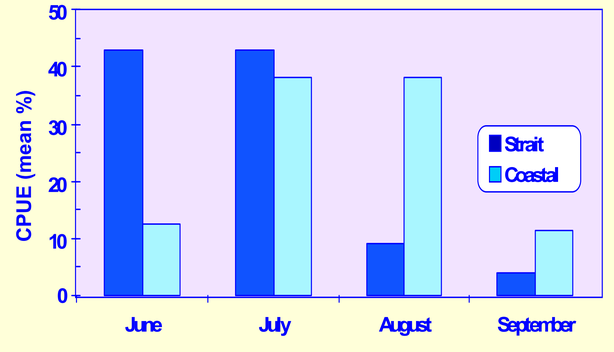




Southeast Alaska coho salmon stocks, such as Auke Creek, migrate as juveniles into the Gulf of Alaska where they spend most of their marine life. Stocks from Southeast Alaska made up an average of 58% of Alaska's commercial catch in the decade of the 1990's.

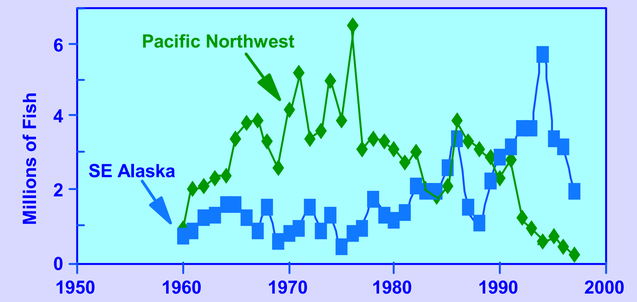


Objective 4
Develop a hindcast model relating growth and associated environmental variates to marine survival, regional abundance, and size at return. Growth at different life stages, and thus survival to adult, is influenced by biophysical parameters in transitional habitats. Zooplankton biomass and temperature in strait habitats, for example, follow seasonal patterns that vary between years (left panel). The timing of seasonal migration from inshore waters through strait and coastal habitats is demonstrated by shifting peaks in abundance (right panel).



Milestones

- Established new contract research assistant position at Juneau Center for Ocean Sciences, University of Alaska
- Initiated digitizing of the Auke Creek archival scale series
- Collected 2001 data for both SECM juvenile and Auke Creek adult coho salmon
- Estimated 2001 coho salmon survival to adult at Auke Creek Weir (27%, 3rd highest on record)
- Collected new data on juvenile coho salmon condition and feeding success: energetic content, gastric evacuation rates, and diel feeding periodicity



Objective 5
Use scale growth characteristics and size, condition, and relative abundance data from marine collections of juvenile coho salmon to predict year-class strength. Coho salmon populations in Southeast Alaska and the northeastern Pacific responded inversely to environmental change (top panel). Coho salmon catch in Southeast Alaska is significantly correlated with Auke Creek coho salmon marine survival and nearshore environmental conditions (June SST), but NOT with the PDO Index (bottom panel).