PCCRC Projects—Pacific Salmon

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Current Projects

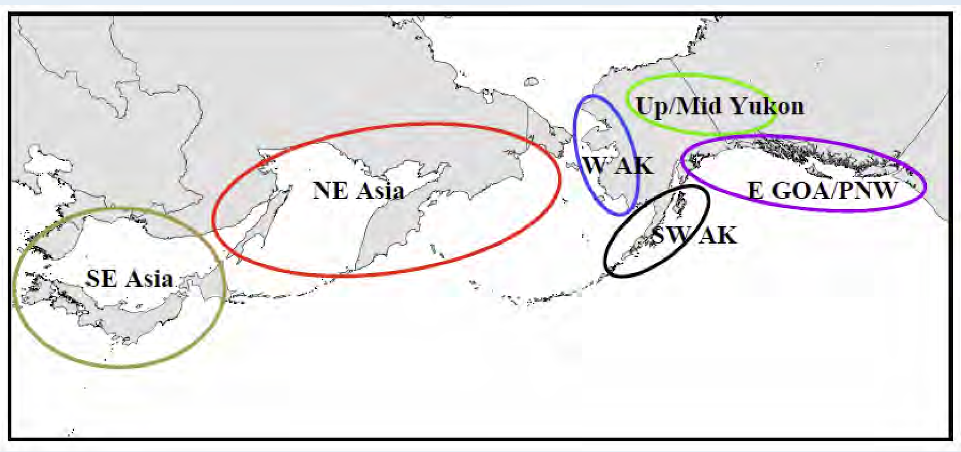
Using a stage structured population dynamics model to determine key environmental and fishery-related drivers of AYK Chinook salmon survival (Milo Adkison, Peter Westley, Curry J. Cunningham; 9/1/2015 — 12/31/2018)
Summary: Understanding how species might respond to climate change involves disentangling the influence of co-occurring environmental factors on population dynamics, and is especially problematic for species like Pacific salmon that move between ecosystems. Debate surrounding the decline in Yukon River Chinook salmon abundance has centered on whether factors in freshwater or marine environments control variation in survival, and how these populations at the northern extremity of the species range will respond to climate change. To estimate the effect of factors in marine and freshwater environments on Chinook salmon survival, we constructed a stage-structured assessment model that incorporates the best available data, estimates incidental marine bycatch mortality in trawl fisheries, and uses Bayesian model selection methods to quantify support for alternative hypotheses. Results indicate that processes in the nearshore and marine environments are the most important determinants of survival. Specifically, survival declines when ice leaves the Yukon River later in the spring, increases with wintertime temperature in the Bering Sea, and declines with the abundance of globally enhanced salmon species consistent with competition at sea. In addition, we found support for density-dependent survival limitations in freshwater but not marine portions of the life cycle, increasing average survival with ocean age, and age-specific selectivity of bycatch mortality in the Bering Sea. Overall, these analyses suggest that mortality at sea is the primary driver of population dynamics, yet under warming climate Chinook salmon populations at the northern extent of the species' range may be expected to fare better than southern populations, but are influenced by foreign salmon production.

Improved resolution of chum salmon genetic stock identification (Megan McPhee, Garrett McKinney, Jim Seeb, Lisa Seeb; 6/1/2017 — 12/31/2018)
Summary: Genetic stock identification is key to management of the harvest of mixed stocks of Pacific salmon, including those accidentally caught in other fisheries such as the Bering Sea pollock fishery. Application of this management tool has been hindered for chum salmon from western Alaska, where limited genetic divergence among populations across coastal western Alaska has made it impossible to accurately apportion stock mixtures to desired reporting groups (e.g., Lower Yukon River, Kuskokwim River) within the region. The proposed project focuses on leveraging previous work to identify a panel of ~500 informative genetic (SNP) markers that can be transferred across laboratory platforms to provide finer resolution of genetic stock identification of chum salmon from western Alaska. The proposed project responds directly to a research priority identified by the PCCRC. The proposed project will also expand genetic stock identification capacity at UAF, NOAA National Marine Fisheries Service, and the Alaska Department of Fish and Game.

Further examination of the movement, behavior and predation of Chinook salmon in the Bering Sea (Andrew Seitz; 7/15/2017 — 3/31/2019)
Summary: Information about the spatial distribution, movement, vertical distribution, and predation of fishes can help in understanding a species' population dynamics and in informing its management. To add to knowledge gained from a recently completed study on 17 Chinook salmon in the Bering Sea, we propose a continuation of our study in which another 10 large, immature Chinook salmon (>60 cm) will be captured near Dutch Harbor and tagged with pop-up satellite archival transmitting tags. While externally attached to the fish, the tags will measure and record ambient light (for daily geoposition estimates), depth and temperature data. On preprogrammed dates, the tags will release from the fish, float to the surface of the ocean and transmit the recorded data to overhead satellites, which will then be retrieved by project investigators. Spatial distribution, movement, depth distribution, thermal environment, and predation of the tagged Chinook salmon will be described and related to regional environmental factors. These analyses should provide a more complete understanding of oceanic phase of large, immature Chinook salmon in the Bering Sea, which may be useful for understanding its population dynamics and susceptibility to interactions with groundfish fisheries.

Completed Projects

Determining the effects of Asian pink and chum salmon on growth and maturation of Alaskan populations of chum and Chinook salmon in the Bering Sea (Megan McPhee, Brian Beckman; 9/1/2014 — 5/31/2018)
Summary: The large number of hatchery salmon, primarily pink and chum salmon, released into the North Pacific has prompted concern that competition for marine resources has contributed to the declines of western Alaska chum and Chinook salmon. Distribution and diet data indicated considerable potential for competition between western Alaska chum salmon and pink and chum salmon from Russia and Japan. Nevertheless, we found limited evidence that abundant pink salmon from Russia were inhibiting the growth of chum salmon from western Alaska. Instead, growth of western Alaskan chum salmon was more responsive to the abundance of Asian chum salmon, primarily hatchery stocks from Japan. We found some evidence for indirect effects of pink salmon on the growth of Chinook salmon, but the direction of the effect (i.e., slightly better Chinook salmon growth and slightly younger males during years of high pink abundance) did not support the idea that pink salmon directly compete with Chinook salmon during later years of Chinook salmon growth. We did find that juvenile Chinook salmon in the eastern Bering Sea had reduced growth rates during their first marine year, as evidenced by IGF-1 levels, during odd years when maturing Russian pink salmon are expected to be abundant. Any causal mechanism behind this relationship is also likely to be indirect, because maturing Russian pink salmon would not be occupying the eastern Bering Sea shelf in mid- to late-summer, when western Alaskan Chinook salmon would be moving offshore. Finally, we found no evidence that decreased hatchery production of chum salmon due to the 2011 earthquake and tsunami in Japan led to enhanced growth of western Alaska chum salmon. Recent increases in the abundance of Russian chum salmon may have obscured that relationship.



Freshwater growth and survival in AYK Chinook salmon: maternal health, predation mortality, and the ultimate effects on stock productivity (Milo Adkison, Lara Dehn, Megan McPhee, Shannon Atkinson, Amanda Rosenburger, Trent Sutton; 4/1/2010 — 12/31/2014)

Developing DNA markers for the analysis of chum salmon bycatch in Alaskan trawl fisheries (Anthony J. Gharrett; 7/1/2004 — 6/30/2007)

Factors affecting nearshore survival and production of juvenile sockeye salmon from Kvichak Bay (Stephen Jewett, Paul Rusanowski, Max Hoberg, T. Christopher Stark, Milo Adkison, Franz Mueter; 4/15/2001 — 4/14/2002)

DNA analysis of the origins of Chinook salmon bycatch in Alaskan trawl fisheries (Anthony J. Gharrett, V.A. Brykov; 3/1/2001 — 3/31/2004)

Fellowships

Under what scenarios could salmon shark predation impact Chinook salmon production (Kaitlyn Manishin; 7/1/2016 — 6/30/2018)

Evaluation of growth, survival, and recruitment of Chinook salmon in southeast Alaska Rivers (Cory Graham; 7/1/2015 — 12/31/2016)

How oceanographic conditions affect the growth, health, and survival of pink salmon in their first few months in the ocean (Sarah Miller; 7/1/2009 — 6/30/2011)