AFSC/ABL: Karluk sockeye salmon scale time series

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To better understand how density-dependent growth of ocean-dwelling Pacific salmon varied with climate and population dynamics, we examined the marine growth of sockeye salmon in relation to an index of sockeye salmon abundances among climate regimes, population abundances, and body sizes under varied life history stages, from 1925 to 1998 using ordinary least squares and multivariate adaptive regression spline threshold models. The annual marine growth and body size during the juvenile, immature, and maturing life stages were estimated from increments on the scales of adult age 2.2 sockeye salmon that returned to spawn at Karluk River and Lake on Kodiak Island, Alaska. Intra-specific density-dependent growth was inferred from inverse relationships between growth and sockeye salmon abundance based on commercial harvest. Density-dependent growth occurred in all marine life stages, during the cool regime, at lower abundance levels, and at smaller body sizes at the start of the juvenile life stage. The finding that density-dependence occurred during the cool regime and at low population abundances suggests that a shift to a cool regime or extreme warm regime at higher population abundances could further reduce the marine growth of salmon and increase competition for resources.

Alaska salmon production fluctuates with climate and ocean conditions in the North Pacific Ocean. In this study, we evaluated the hypothesis that faster marine growth was related to higher survival as a consequence of more favorable ocean conditions for growth during the 1927-46 and 1977-2000 warm regimes, and slower growth was related to lower survival as a consequence of less favorable climatic and oceanic conditions for growth during the 1947-76 cool regime. We measured and compared the annual growth on scales collected from age 2.2 sockeye salmon that returned to Karluk Lake on Kodiak Island, Alaska from 1927 to 2000 to regime periods, climatic and oceanic indices, and survival. First and second marine-year scale growth fluctuated with the cool regime and recent warm regime. Survival estimated as the ratio of offspring to parental escapement was lower during the 1925-46 warm regime and 1947-76 cool regime. Survival was positively related to first and second marine year scale growth, eastern North Pacific atmospheric circulation, and reduced winter and spring coastal downwelling in the Gulf of Alaska. Winter and spring climatic and oceanic conditions influences on first and second year marine growth of Karluk Lake sockeye are a possible mechanisms linking Karluk Lake sockeye salmon survival to climate over the past half century.