

Evidence for competition at sea between Norton Sound chum salmon and Asian hatchery chum salmon

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Increasing production of hatchery salmon over the past four decades has led to concerns about possible density-dependent effects on wild Pacific salmon populations in the North Pacific Ocean. The concern arises because salmon from distant regions overlap in the ocean, and wild salmon populations having low productivity may compete for food with abundant hatchery populations. We tested the hypothesis that adult length-at-age, age-at-maturation, productivity, and abundance of a Norton Sound, Alaska, chum salmon population were influenced by Asian hatchery chum salmon, which have become exceptionally abundant and surpassed the abundance of wild chum salmon in the North Pacific beginning in the early 1980s. We found that smaller adult length-at-age, delayed age-at-maturation, and reduced productivity and abundance of the Norton Sound salmon population were associated with greater production of Asian hatchery chum salmon since 1965. Modeling of the density-dependent relationship, while controlling for other influential variables, indicated that an increase in adult hatchery chum salmon abundance from 10 million to 80 million adult fish led to a 72% reduction in the abundance of the wild chum salmon population. These findings indicate that competition with hatchery chum salmon contributed to the low productivity and abundance of Norton Sound chum salmon, which includes several stocks that are classified as Stocks of Concern by the State of Alaska. This study provides new evidence indicating that large-scale hatchery production may influence body size, age-at-maturation, productivity and abundance of a distant wild salmon population.

Keywords: Arctic-Yukon-Kuskokwim, Alaska, Chum salmon, Hatchery versus wild salmon, Competition, Density-dependence, Tragedy of the commons