

Contrasting patterns of productivity and survival rates for stream-type chinook salmon (*Oncorhynchus tshawytscha*) populations of the Snake and Columbia rivers

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Abstract: The effects of increasing hydropower development and operation appear extremely important in the decline and near extirpation of stream-type chinooks almon *Oncorhynchus tshawytscha*) stocks of the upper Columbia and Snake rivers. We evaluated temporal and spatial patterns of productivity and survival rates (for index stocks from the Snake, upper Columbia, and lower Columbia regions) to determine the cause of dramatic declines of the upriver stocks. This evaluation tested hypotheses about nonstationarity (changes over time in average productivity) in the Ricker recruitment function caused by changes in the physical environment. Individual stocks showed recent declines in indicators of productivity and survival rate; however, the comparisons indicate that upriver stocks showed greater declines coincident with the development and operation of the hydropower system. Evidence from the aggregate run indicates that declines over the last 50 years were quite abrupt and corresponded to construction and completion of the hydropower system.