Evaluating data-limited salmon run reconstruction models

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Abstract:

Evaluating hypotheses for AYK Chinook salmon (*Oncorhynchus tshawytscha*) declines and managing these stocks requires that we obtain reliable estimates of stock status, trends, and productivity. These estimates have been obtained from novel drainage-wide run reconstruction models developed specifically for data-limited cases. However, these models have potential pitfalls that warrant further investigation. In particular, the models may be susceptible to bias stemming from incomplete temporal and spatial coverage of run enumeration projects and natural between-stock variation in population dynamics within a drainage. We will investigate the circumstances under which these drainage-wide reconstructions provide accurate and precise estimates of Chinook salmon abundance and productivity. We undertake this work from a Bayesian perspective, which means that we will incorporate into the models different types of uncertainty and will allow the inclusion of prior information on stock abundance and productivity. First we will use a series of computer simulation-estimation analyses to test the influence of (1) among-stock within-drainage temporal variation in population dynamics, (2) data quality, (3) data quantity, and (4) data type on the accuracy and precision of these models. We will also consider the costs of data collection scenarios in light of model performance. This analysis will provide guidance on the reliability of these models under different data collection scenarios and their associated costs, which will aid prioritization of field sampling programs. Second, we will apply the Bayesian state-space formulation of the model to the Kuskokwim River Chinook salmon stock and conduct a thorough sensitivity analysis of abundance, productivity, and hypothetical escapement goals. The application of the Bayesian approach to this stock will more thoroughly deal with the many uncertainties in this system. This project will provide a starting point for any future efforts to incorporate risk and uncertainty into harvest policy analyses for the Kuskokwim Chinook salmon stock.

Project Objectives:

Objective 1: Assess the influence of population dynamics, data quantity, data quality and type on the accuracy, precision and cost of estimates from drainage wide (i.e., stock-aggregated) Bayesian state-space run reconstruction models.

Objective 2: Evaluate the sensitivity of estimates of productivity, abundance, and management quantities (e.g., Smsy) for the Kuskokwim River Chinook salmon stock to adoption of a Bayesian state-space approach.