TOWARD RECONSTRUCTING LIFE HISTORY VARIATION, COMPOSITION AND FITNESS DIFFERENCES AMONG SUBBASIN POPULATIONS OF UWR CHINOOK SALMON

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Life history variation contributes to population production, stability and resilence and maintaining this variation is a key element of recovery planning. We have been investigating several elements of life history variation in spring Chinook salmon in several Willamette River tributaries. We have used a combination of scale analysis, otolith microchemistry and microstructure, and screw trap data to simulatenously evaluate life history reconstruction methods and document variation in outmigration timing, juvenile rearing habitats, juvenile growth rates, and how life history variation contributes to adult returns.

In some locations, juvenile Chinook salmon can be reasonably classified into discrete life history 'types' (e.g., subyearling/ocean-type; yearling/stream-type). However, when viewed range-wide, Chinook salmon demonstrate considerable variation in outmigration timing and rearing habitat use that include a spectrum of timing and habitat use. We have compiled and summarized reported variation in life history from the literature and suggest that life history 'pathways' described by the timing of transitions among habitats during juvenile rearing and outmigration provide a useful conceptual framework for both identifying life history types and for generating hypotheses about the selective pressures that generate and maintain life history pathways.

Life history traits of Willamette River spring Chinook salmon have been collected and archived in ODFW's scale archive, by ODFW collection of otoliths from adult salmon, and from recent scale and otolith collection by UI. In previous years, three primary spring Chinook salmon life history types have been recognized from scales: subyearlings, yearlings, and a "Pattern X" life history exhibiting high freshwater growth rates and evidence of winter outmigration near the end of the first year of life. Our previous work and that of others has indicated that many Pattern X Chinook salmon rear and grow at high rates in reservoirs with relatively limited rearing in the lower main stem Columbia River or Columbia River Estuary. Currently, some uncertainty remains about the contribution of rearing in the lower main stem

Willamette to the Pattern X life history. In general, these data suggest a broad continuum of rearing locations and outmigration timing across spring Chinook types within the Willamette Valley Project (WVP). Identifying both rearing location and migration timing is challenging with either scale data or otolith data alone, but the combination has provided new insights into life history variation in the Willamette. To what degree the life history pathways evident in the WVP are adaptive remains unknown, but screw trap data suggest that the Pattern X pathway results – at least in part – from seasonally-blocked downstream passage at high-head dams (i.e., 'reservoir entrapment').

The ODFW scale archive and future scale analysis represent a potentially valuable way to quantify changes in life history composition within and among WVP populations. We are performing QA/QC testing to ensure that historical and contemporary life history classifications are consistent using several approaches. Preliminary, unvalidated summaries of life histories suggest life history composition differs within and among sub-basins through time. We are using these data to develop a modeling framework to estimate the relative contribution of life history pathways to adult escapement by sub-basin, identify plausible differences in the relative smolt-to-adult returns (SAR) among juvenile life history pathways, and to identify critical monitoring gaps for future estimation of fitness. Such data will be necessary to evaluate the effectiveness of BiOp implemenation because the fitness of life history pathways will likely be altered and thereby influence overall population growth rate.