Tracking Environmental Bottlenecks in the Coastal Zone for Understanding and Predicting Oregon coho (*Oncorhynchus kisutch*) marine survival

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To better understand and predict Oregon coho (*Oncorhynchus kisutch*) marine survival, we developed a conceptual model that links four semi-independent environmental processes that influence coastal marine habitat important for coho survival. We hypothesize that these 4 processes are related to: (1) winter climate prior to smolt migration from freshwater to ocean, (2) the date of the spring transition from winter downwelling to spring/summer upwelling, (3) the spring upwelling season and (4) winter ocean conditions near the end of the maturing coho's first year at sea. We then parameterized a General Additive Model (GAM) with Oregon Production Index (OPI) coho smolt-to-adult survival estimates from 1969 to 1998 and environmental data representing each process (pre-smolt winter SST, spring transition date, spring upwelling wind indices, and post-smolt winter SST). The model explained a high and significant proportion of the variation in coho survival during the period of record (R2=0.73). In contrast to previous studies that have shown coherence among oceanographic variables that are related to coho survival, the variables in our GAM were essentially uncorrelated with each other. We suggest that it is this lack of coherence that explains a substantial amount of the year-to-year variability in coho marine survival. We have also explored connections between local/regional coastal ocean processes important in our GAM and large scale climate variations. We find that indices tracking ENSO, the PDO, and the Aleutian Low are generally well-correlated with winter coastal ocean temperatures, but poorly correlated with the spring transition date and springtime upwelling wind indices. However, conditional sampling of the local/regional data based on values of the large-scale climate indices identifies tendencies in several parameters that may help explain the documented correspondence between large scale climate indices and indices for coho salmon marine survival.

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