Synthesis of Empirical Anadromous Coastal Cutthroat Smolt Abundance and the Prediction of Wild Smolt Production at the Watershed or Sub-Basin Level

Abstract

Species by ecotype threat assessment, regional habitat and fisheries management planning requires estimates of the capacity of watersheds to produce salmonids. To predict the average abundance of smolts of anadromous Coastal Cutthroat Trout *Oncorhynchus clarkii* produced by streams and rivers, I related estimates of mean smolt abundance to habitat features derived from maps, discharge, and other records. I assembled a database of 862 annual estimates of smolt abundance from 83 streams and rivers in western North America for this analysis (BC, WA, OR, CA). I found that only ostensible CCT-bearing stream length and to a lesser extent watershed area or long-term mean annual discharge were useful in predicting mean smolt abundance. The simple predictive equation Ln(Mean Smolt Count) = 4.65 + 1.19*Ln(CCT-bearing Stream Length, km) accounted for 79% of the variation among streams. Another model using CCT smolt production rate (smolts/km) and summer baseflow accounted for 35% of the variability in production rate. The frequency distribution of annual estimates of smolt abundance from individual streams tended towards a normal rather than the more usual lognormal distribution; the median coefficient of variation in abundance was 40%. My results are consistent with the simple view that, on average, smolt abundance is limited by spatial habitat, but that there is significant annual variation in abundance probably due to variation in habitat quality caused by climate, flow, or other factors. I conclude that forecasting smolt yield from stream length and basin area is feasible at the watershed or regional level, but the precision of a prediction for a single stream is poor. A far more detailed approach will be required for local forecasting (quality and diversity of rearing space, food supply, summer baseflows, true species spatial extent) to account for complete loss of some historically healthy adult fisheries and coupled local juvenile populations.