Effects of Temporary Tributary Use on Escapement Estimates of Adult Fall Chinook Salmon in the Deschutes River, Oregon

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Abstract.—International managers use escapement estimates of the Deschutes River, Oregon, population of fall Chinook salmon Oncorhynchus tshawytscha to forecast abundance and assess population health. Fish are externally marked in the Deschutes River, and a subsample of the marked fish is recovered on the spawning grounds to provide data for estimating escapement. Escapement would be overestimated if some of the marked fish exited the Deschutes River prior to spawning (i.e., used this tributary temporarily). We used mark–recapture and radiotelemetry techniques to calculate (1) the proportion of adult fall Chinook salmon that entered the Deschutes River and subsequently exited the river prior to spawning and (2) the effect of such temporary entrances on spawning ground escapement estimates. We used separate criteria to calculate maximum and minimum temporary tributary use rates, which were then used to adjust the escapement estimates made with external-tag data alone. Over the 3 years of study, the adjusted estimates were approximately 4–29% lower than the unadjusted estimates. We conclude that failure to adjust escapement estimates for temporary tributary use might lead to inflated harvest targets. To partially account for temporary tributary use, the lower 95% confidence limit for an escapement estimate could be used to regulate harvest.

Managing ocean fisheries for Pacific salmon is complicated because the migratory ranges of many stocks often cross state, provincial, tribal, and international waters. In this context, fisheries managers are responsible for allocating harvest among different user groups, monitoring interception of fish in international waters, complying with endangered species laws, and forecasting stock abundances. Effective management of ocean fisheries is data intensive and ultimately relies on accurate and precise estimates of spawning ground escapement (Knudsen 1999). Forecasts of stock abundance, fishery impact assessments, and evaluations of fishery management strategies are all improved by accurate spawning ground escapement estimates (Schwarz et al. 1993; Knudsen 1999).

The international Pacific Salmon Commission (PSC) has adopted abundance-based management for Chinook salmon Oncorhynchus tshawytscha, with the goal of restoring and rebuilding production of naturally spawning Chinook salmon (PSC USCTC 1997). A major element of the PSC’s rebuilding strategy is accurate assessment of stock-specific spawner escapement levels. Chinook salmon stock data provided by PSC participants (Canada and U.S. federal, state, and tribal agencies) are incorporated into the PSC Chinook salmon model that generates yearly pre- and postseason cohort abundance estimates. These estimates are used by the PSC to set ocean harvest levels and determine the relative health of Chinook salmon stocks.

Three Columbia River fall Chinook salmon populations are used as escapement indicator stocks by the U.S. Chinook Technical Committee (USCTC) of the PSC; these populations are located in the Hanford Reach of the Columbia River; the Deschutes River, Oregon; and the Lewis River, Washington. Lewis River fall Chinook salmon are commonly referred to as “lower-river brights,” whereas Deschutes River and Hanford Reach stocks are referred to as “upriverbrights” (Dauble and Watson 1997). The upriver bright stocks are a major contributor to southeast Alaska and Canadian fisheries, and the status of these populations is of concern for parties to the Pacific Salmon Treaty.

The Deschutes River fall Chinook salmon stock is considered to be ocean type (Healey 1991) and natural in origin (Myers et al. 1998). Adults enter the river from mid-July through October, and the peak adult migration occurs during late September through mid-October (Howell et al. 1985). Adults return to spawn as 3–5-year-olds in the main-stem Deschutes River from the mouth to the Pelton Reregulating Dam at river kilometer (rkm) 160 (ODFW 2005). Spawning takes place from late October through early January, with a peak in November.

The Deschutes River flows northerly through central Oregon and enters the Columbia River approximately...