Red Bluff Technical Report Abstract

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  Craig D. Martin, C.D., Gaines, P.D., and R.R. Johnson, 2001. Estimating the Abundance of Sacramento River Juvenile Winter Chinook Salmon with Comparisons to Adult Escapement. Red Bluff Research Pumping Plant Report Series, Volume 5, United States Department of the Interior, Fish and Wildlife Service and Bureau of Reclamation, Red Bluff, California. 55 pp.

We developed in-river quantitative methodologies for indexing juvenile winter chinook production (JPI) in the upper Sacramento River using data collected by rotary-screw traps at Red Bluff Diversion Dam. These indices were used in conjunction with and in support of adult escapement and for evaluating year-class strengths in winter-run abundance. Estimates of juvenile winter chinook production derived from escapement estimates based on ladder counts at Red Bluff Diversion Dam, winter chinook carcass surveys and the National Marine Fisheries Service's (NMFS) juvenile production estimate (JPE) were compared to the JPI to identify possible sources of bias and determine whether these surveys were correlated in magnitude and trend. Five complete brood-year (BY) periods - July through June the following year - were monitored to index winter-run production for 1995, 1996, 1997, 1998 and 1999. Emergence and dispersal of winter-run fry (≤ 45mm FL) started in July for all brood years evaluated with peak dispersal occurring in September. Pre-smolt/smolt (> 45mm, FL) emigration started in September with 100 percent of production passing Red Bluff Diversion Dam two to three months prior to the onset of the next brood year. Between 81 percent (BY98) and 44 percent (BY99) of winter-run production used areas below RBDD for nursery habitat, and the relative utilization above and below RBDD appeared to be influenced by river discharge during fry emergence (P=0.029, r2=0.838, N=5). This relationship may be a useful tool for managing fry distributions in the upper river to compensate for and address dwindling habitat during dry years. The JPI was also useful for providing supportive evidence of estimated escapement. We concluded that escapement estimates from winter chinook carcass surveys and ladder counts were relative predictors for evaluating year-class strengths (r2 ≤ 0.566); however, no correlation was found between ladder escapement estimates and JPI's, although readers are cautioned that one data point had a large influence on this conclusion (P=0.555; r2=0.128; N=5). Paired comparisons with JPI and JPE, a production estimate that uses female escapement as the primary variate, did not significantly differ (carcass survey JPE, paired t-test, P=0.903, df=3; ladder count JPE, paired t-test, P=0.097, df=4), yet evidence suggested that ladder count JPE underestimated inriver abundance of juvenile winter run. First, ladder count JPE fell below the 50 percent confidence interval of JPI in 4 of 5 brood years evaluated (probability of occurrence = 0.01). Secondly, egg-to-fry survival based on ladder count data averaged 118 percent (± 80 SD), indicating that fry production exceeded estimated egg deposition. Egg-to-fry survival from carcass survey data, on the other hand, averaged 29 percent (± 9 SD), a value similar to that which has been estimated for winter-run in the upper Sacramento River. We concluded that NMFS's JPE model, based on estimates of escapement using ladder count data, underestimated juvenile winter-run production, while carcass survey escapement estimates were found to be a satisfactory replacement for RBDD ladder counts.