MIGRATION BEHAVIORS AND DISTRIBUTION OF ADULT SPRING CHINOOK SALMON RADIO-TAGGED AT WILLAMETTE FALLS IN 2011-2014

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The primary objectives of this four-year study were to describe the migration behaviors, main stem migration survival, and likely spawning distribution of adult spring Chinook salmon radio-tagged at Willamette Falls Dam. Over the four years, 1,249 spring salmon were tagged, with annual samples of 150 (2011), 500 (2012), 299 (2013), and 300 (2014). The combined samples included 754 fin-clipped and 495 unclipped (presumed wild-origin) salmon; 477 were tagged using a fish-restraint device and 722 were tagged using AQUI-S 20E anesthetic, including all of the salmon in 2013 and 2014.

Escapement to tributaries, (i.e., survival from Willamette Falls through the Willamette River main stem) varied among years and among origin groups. In the anesthetized handling group, escapement estimates were: 88% (2011), 82% (2012), 79% (2013), and 89% (2014). Estimates were lower for the non-anesthetized restrained salmon in 2011 and 2012. In the anesthetized handling group, presumed wild-origin salmon had slightly higher escapement (84%) than hatchery-origin fish (83%) with all years combined, but results were mixed within years. Among-year differences in main stem survival estimates were associated with river environment and with some fish traits. Results from multi-year survival models will be presented.

Salmon were last detected in eleven sub-basins over the four years. In the anesthetized group, the largest percentage returned to the McKenzie River, at 25% of those released, on average (annual *range* = 14-37%). Other sub-basins with relatively high returns included the Middle Fork Willamette (*average* = 17%, *range* = 10-28%), South Santiam (16%, 11-19%), and North Santiam (13%, 5-23%). The remaining tributary fish returned to the Clackamas (5%, on average), Molalla (2%), Fall Creek (2%), and the Coast Fork, Luckiamute, and Yamhill rivers (<1% each). Fish that did not successfully return to tributaries were last detected at a variety of main stem sites both upstream and downstream from Willamette Falls.

Tagged salmon typically spent 1-3 weeks in the main stem Willamette River after release and prior to tributary entry. Transit times from Willamette Falls to tributary entry varied among years, and times were associated with function of river environment, with slower passage in cooler years with higher river flow. As expected, fish that returned to lower tributaries (e.g., Santiam River) had shorter main stem transit times than those that returned to upper basin tributaries (e.g., McKenzie and Middle Fork). Salmon consistently migrated most rapidly in lower main stem reaches, with slower ground speeds in upper reaches. A sub-sample of the radio-tagged salmon was also tagged with internal temperature loggers. Data from the recovered loggers indicated that a small number of salmon had thermoregulatory behaviors in the main stem Willamette River. Almost all logger-tagged fish encountered their warmest temperatures in the main stem and some salmon accumulated very high numbers of degree days (>1,200 DD per fish), which may be a useful indicator of increased disease susceptibility and a predictor of prespawn mortality risk.