

Survival Estimation Using Estimated Daily Detection Probabilities

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Numerous wild and hatchery-reared juvenile chinook salmon and steelhead smolts are PIT-tagged annually in the Snake River Basin above Lower Granite Dam and released to migrate downstream through eight dams and reservoirs (four each on the Snake and Columbia Rivers) to the Pacific Ocean. We developed methods to estimate the survival of these smolts to Lower Granite Dam. This entailed estimation of daily detection probabilities of fish guidance into the dam bypass system and subsequent detection by the PIT-tag detection system. To get each day's estimate, we used the following process: 1) Assign the fish detected on a given day at Little Goose Dam, which had previously been detected at Lower Granite Dam, to their particular detection/passage day at Lower Granite Dam; 2) Assign the fish detected on the same day at Little Goose Dam, which had NOT previously been detected at Lower Granite Dam, to their estimated "non-detection passage day" at Lower Granite Dam in the same proportions as the Lower Granite Dam-detected fish; 3) Repeat this process for all days of detection at Little Goose Dam; 4) Sum all these detected and non-detected fish for a given day at Lower Granite Dam; 5) After making an adjustment for fish transported at Lower Granite Dam, estimate that day's detection probability by calculating the proportion of detected fish to the total of detected and non-detected fish; 6) divide the total detected number at Lower Granite Dam on that day (bypassed and transported) by the estimated detection probability to get an estimated daily total; and finally, 7) divide the seasonal sum of the estimated daily totals by the release number to obtain a Release-Lower Granite Dam survival estimate. Formally, this process is referred to as the Schaeffer method. We modified the method slightly for estimates in the tails of the passage distribution where the above process wasn't applicable (*e.g.*, for days when no detections occurred at Little Goose Dam).