

The use of PIT tags to evaluate passage of adult Pacific lamprey at Columbia and Snake river dams

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Pacific lamprey are an ecologically and culturally important anadromous fish in the Columbia Basin and returns have declined steeply in recent years. We have used half-duplex PIT tags to monitor adult movements at multiple spatial scales since 2005 at dams on the Columbia and Snake rivers as part of an integrated telemetry program to monitor adult migration behavior at dams, passage rates, and fate during upstream spawning migrations. Over this period, we have expanded the extent of the array and incorporated improved antenna designs. The PIT tag technology has been complementary to simultaneous radio- and acoustic telemetry studies and each method, separately and in combination, has revealed important results. Specific applications of HD-PIT telemetry include the following examples. Evaluations of fishway modifications at local spatial scales (10's of meters) such as at the modified Cascades Island Fishway entrance at Bonneville Dam and within Lamprey Passage Structures (LPSs), revealing movement patterns through individual structures. Estimation of passage metrics at the scale of individual projects have shown low passage ratios at many locations, e.g., 41-53% of tagged adults passed Bonneville Dam after release during 2005-2009. We have observed consistent size-selection at dams, with larger adults more likely to pass than smaller adults. Similarly, the probability of passage has declined later in the season at most projects. Interdam conversion rates and distributions of final records (including radio-tag records) indicate a considerable proportion of adults may not exit reservoirs, may enter tributaries undetected, or may spawn in tailraces. The long-life of HD-PIT tags has confirmed that small proportion of adults overwinter in the hydrosystem and resume upstream migration in spring. Double tagging with HD-PIT tags and active tags has been important for assessing detection probabilities for all three tag types, and for assessing effects of tag burden. The latter has consistently revealed that radio-tagged adults (radio-tag only or double-tagged) are less likely to pass upstream than adults with only a HD-PIT tag. We anticipate HD-PIT tag studies will continue to contribute to our understanding of adult lamprey migration behavior and performance in fishways, play a central role in the evaluation of passage modifications at dams, and eventually will be used to monitor lamprey movements into tributaries.