Assessment of Habitat Use and Habitat-Specific Survival and Travel Time of Acoustic-Tagged Salmonid Smolts in the Lower Columbia River Estuary

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In 2009, over 10,000 juvenile salmonids (yearling and subyearling Chinook salmon and steelhead) were implanted with JSATS acoustic transmitters and released into the forebay of John Day Dam. Nearly 100 acoustic telemetry receivers were deployed downstream of Bonneville Dam, with most (76) receivers deployed in the lower 50 km at Three Tree Point (rkm 50), Harrington Point (rkm 37), in Grays Bay (rkm 29-34), at the Astoria Bridge (rkm 22), and near the mouth of the river (rkms 8 and 3). Detections of acoustic-tagged fish at these receivers allowed us to determine the primary migration pathways used by juvenile salmonids to migrate through the estuary and how use of different pathways influenced survival and travel time. Although most (57% - 74%) yearling and subyearling Chinook salmon and steelhead were detected migrating downstream in the main navigation channel at Harrington Point, the majority (79%) of fish detected at the Astoria Bridge were detected in the north (Washington) channel, suggesting that many fish migrated through small tidal channels or across shallow tidal shoals and bars between Rice Island and the Astoria Bridge. Our results also indicated that a relatively large percentage (26%) of the subyearling Chinook salmon detected at Harrington Point migrated through Grays Bay compared to 9% of yearling Chinook salmon and 6% of steelhead. Yearling and subyearling Chinook salmon that migrated through Grays Bay took, on average, 7 to 22 h longer to travel from Harrington Point to the Astoria Bridge than fish that migrated, at least part of the way, in the navigation channel. The probability of survival from Harrington Point to the Astoria Bridge was 0.74 (SE = 0.06) for steelhead and 0.82 (0.04) for subyearling Chinook salmon that migrated through Grays Bay, which was lower than the survival of fish that migrated, at least part of the way, in the navigation channel (0.88 – 0.99). Survival of steelhead and subyearling Chinook salmon from Grays Bay to the Astoria Bridge was 0.90 (0.05) and 0.93 (0.02), respectively. The large difference in survival to the Astoria Bridge from Harrington Point versus Grays Bay indicates that survival was particularly low through the 4 km-long shallow water area that separates Harrington Point from the deeper channels of Grays Bay. Although not the objective of the study described above, our results suggest that JSATS may be a useful tool for identifying habitats in need of restoration and for evaluating restoration efforts on both site-specific and population-level scales. Strategic placement of JSATS acoustic telemetry receivers can reveal the proportion of the tagged population using a particular habitat and the residence times and survival estimates for implanted fish migrating through or rearing in the habitat, which can be compared to the tagged population as a whole.