

Use of Mark Recapture Models to Inform Habitat Restoration Actions in Toppenish Creek, WA

Abstract:

Survival of out-migrating steelhead smolts in the Columbia River hydropower system is well studied and modelled. However, survival of fish in Columbia River tributaries is not well documented. For example, out-migrating ESA listed Mid-Columbia River steelhead smolts natal to Toppenish Creek, WA, must swim 40 km downstream through heavily altered shrub-steppe floodplain habitat in Toppenish Creek, then travel an additional 100 km in the Yakima River before entering the Columbia River. Identifying survival bottlenecks in natal streams, then removing those bottlenecks through habitat restoration or fish friendly passage solutions could have large impacts on overall survival. Within Toppenish Creek, steelhead smolts must navigate a complex system of irrigation diversions and associated managed wetland units before entering the Yakima River. In coordination with Yakama Nation Fisheries, we designed and implemented a monitoring plan to estimate routing and reach survival of out-migrating steelhead smolts in the Toppenish Creek drainage. Study fish were captured in a screw trap, then marked with PIT tags, and subsequently released. Downstream movements of marked fish were then monitored using 22 PIT antennas located downstream of the release site. A multi-state mark recapture model was fit to detections of marked steelhead smolts to estimate routing and survival. Over the period of 2018 to 2021 we were able to identify low survival reaches within the Toppenish Creek system. Within some of these reaches we were able to implement habitat restoration actions and introduce water management strategies aimed at improving survival of out-migrating steelhead smolts. Here we present routing and survival estimates from 2018 to 2021 within the Toppenish Creek corridor and results of selected habitat improvement projects.