**Genetic Estimation of Stock Abundance and Run-timing of Interior Columbia River Steelhead Passing Bonneville Dam**

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The Columbia River Basin supports ESA listed stocks of wild steelhead as well as hatchery supplemented populations. Accurate estimates of hatchery and wild stock abundance are critical for population viability assessment and are particularly useful information for steelhead fisheries managers when combined with stock run-timing trends. In this study, we used a set of 188 single nucleotide polymorphism (SNP) genetic markers and determined that genetic stock identification (GSI) analysis could accurately distinguish 17 reporting groups (stocks) of steelhead within the Columbia River Basin. Further, we genotyped unknown stock-of-origin wild and hatchery adult summer-run steelhead sampled at Bonneville Dam during each of three years between 2009 to 2011 (n=2468, 1760, and 1394 respectively) and performed GSI on these mixtures to obtain estimates of run-timing and abundance for each stock. Stock abundance was calculated by first pooling mixture samples into 10 biweekly strata (mean n = 88, range 6 - 288 per strata) representing >98% of the total summer-run from April to October, and then multiplying GSI-estimated stock proportions for each stratum with the total abundance of steelhead tallied at the Bonneville Dam fish counting window. Aside from improving spatial resolution of GSI applications, SNP markers also provide an efficient way to perform large-scale parentage based tagging (PBT) analyses, which are used to identify an individual’s parents. A large-scale PBT baseline has been completed for all 2008-2011 Snake River steelhead hatchery broodstock, and we demonstrate the utility of this PBT baseline by using it to assign 4-year-old spawn age steelhead from the 2011 Bonneville Dam mixture back to their hatchery parents. The benefit of these two genetic tools, PBT and GSI, is maximized when the tools are applied in concert. This is because PBT provides highly accurate hatchery-level assignments and age information for Snake River hatchery steelhead, and GSI provides stock-level information for wild steelhead as well as for hatchery fish that were not assigned with PBT.

Comparison of wild and hatchery estimates of stock abundance showed large differences in relative stock proportions (e.g. middle Columbia R. versus Upper Salmon R. had highest abundance for wild and hatchery steelhead, respectively) and showed hatchery stocks with the severest declines across years. Run-timing distributions of wild and hatchery stocks could be divided into three categories: early (Skamania summer-run), intermediate (most reporting groups), and late (SF/Upper Clearwater R. and SF Salmon R.). PBT analyses were able to assign 208 steelhead to six Snake River source hatcheries, and the majority (75%) was found to originate from Dworshak Hatchery. This study demonstrates great potential for the application of two genetic tools, GSI and PBT, in the management of Columbia River steelhead fisheries evidenced by high accuracy of stock-/parent- assignments and the ability to estimate hatchery and wild components of stock abundance, and to characterize stocks by life-history traits (e.g. ocean-age, length, and run-timing).