The Proportionate Natural Influence (PNI) Concept and its Use in Supplementation Monitoring.

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Integrated hatchery programs involve gene flow from the natural to the hatchery environment and the hatchery to the natural environment. A simple mathematical model for integrated programs developed by Ford suggests that the degree of domestication, expressed as the change in means at equilibrium at one or more traits, depends in absolute terms on heritability, strength of selection, gene flow rates, and trait optima in the two environments. Examination of this model by the Hatchery Scientific Review Group (HSRG) has shown that if a few simple assumptions are made that the change expressed in relative terms depends almost entirely on the gene flow rates between the two environments. PNI is a simple estimate of the relative trait equilibrium, and is expressed mathematically as

$$PNI = \frac{p_{NOB}}{p_{NOB} + p_{HOS}}$$, where p_{NOB} is the proportion pf natural-origin fish in the broodstock and p_{HOS} is the proportion of hatchery-origin fish on the spawning grounds.

Because it is a unifying concept for the understanding of domestication in all programs, the PNI concept has become a key aspect of hatchery reform planning in western Washington. It is also a useful variable for understanding supplementation projects. Comparison of the PNI values for the YKFP spring Chinook program with those for the Tucannon, Wenatchee, and Methow programs shows that the YKFP program has considerably higher PNI values, so (other things being equal) will incur considerably less domestication than the other programs.

Migration behavior and survival of artificially reconditioned kelt steelhead through the lower Columbia River

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A field study was initiated in 2004 to evaluate the migration of artificially reconditioned kelt steelhead through the lower Columbia River with hydro acoustic tags. All natural-origin steelhead populations originating above Bonneville Dam are listed as threatened or endangered under the Endangered Species Act. Post-spawn steelhead (kelts) are numerous in the Snake, Columbia, and Yakima rivers in the spring. In many years 20% of the upstream steelhead migration is collected in juvenile bypass systems as kelt stage steelhead. In this study we evaluate two management strategies for kelt steelhead. The first strategies, termed no-term, collected individuals outfitted them with acoustic tags then trucked them to a release point below Bonneville Dam. The second management strategy termed short-term, involved feeding the kelts for about 6 weeks before transporting and releasing the fish below Bonneville Dam. Detection arrays were placed near RM 90 (River); RM 25 (Estuary) ; and RM2 (Ocean). Survival from release to detection array was not significantly different between no-term and short-term treatments ($p=0.429$). Travel time from release to detection array was significantly faster for short-term verse no-term treatments ($p=0.035$). Survival was negatively correlated with travel time for both no-term ($r^2=0.743$) and short-term ($r^2=0.648$). The highest survival was estimated for a short-term release group in 2006 with a survival estimate of 85.2% to the ocean. Overall, about 50% of the kelts released below Bonneville Dam reached the ocean and the mortality rates appear to be about constant from release to ocean entry. Environmental conditions greatly influence survival to the ocean, higher flows result to higher survival. Utilizing this previously lost resource could lead to novel approaches to restoration.