Alternative smolt rearing enables use of local natural-origin steelhead broodstock.

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Hatchery programs for ESA-listed steelhead are designed to support natural populations, as such, broodstock are derived from the local natural population to minimize potential genetic effects of hatchery fish interbreeding with wild fish and to maintain natural spawn timing. Incorporating natural-origin steelhead into hatchery broodstock can present challenges as natural-origin steelhead often spawn later than traditional hatchery stocks. Late spawn timing and cool rearing temperatures at some hatcheries can make it difficult for juvenile steelhead grow rapidly enough to achieve smoltification thresholds in one year. Under such circumstances, adopting a two-year rearing cycle allows fish additional time to grow sufficiently large to smolt. We compared the performance (survival, migration, maturation, and residualism) of yearling smolts (S1) from non-local broodstock and two-year smolts (S2) from local broodstock released from the Winthrop National Fish Hatchery over six release years. Apparent survival was positively correlated with body size at release in both treatments. S1s had higher apparent survival than S2s for fish between 180 and 220 mm FL at the time of release. Nevertheless, S2 smolts were larger than S1 smolts at release and consequently had apparent survival rates greater or equal to S1 groups in all 6 release years. Outmigration travel times were faster for S2 steelhead in 5 of 6 release years. The majority (75-97%) of S1 and S2 males were immature; however, in two release years there was a significantly higher proportion of S2 males that had either matured or initiated maturation for the following year. Residualism was similar in both programs and appeared to result from small size at release (mainly S1) and precocious male maturation (mainly S2).

Volitional release practices assisted in retaining steelhead that were less likely to migrate and more likely to residualize, and therefore reduced the potential for negative ecological and genetic interactions. S1 and S2 steelhead that remained in the hatchery after the one-month volitional release period had significantly lower apparent survival when forced from the hatchery compared to fish that left the hatchery on their own. Fifteen years of hatchery records for the S1 program show that S1 steelhead were smaller and more variable in size at release than the six release years of S2 steelhead evaluated in this study. This result suggests that in many years the S1 program produced greater numbers of smaller smolts with lower survival, slower travel times, and higher potential for residualism than an S2 program. The S2 program minimizes genetic risks of nonlocal broodstock and ecological risks associated with reduced S1 smolt performance characteristics.

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