

AFSC/ABL: 1996 Brood year Steelhead growth and early life-history transitions

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Heritabilities of growth, precocious maturation and smolting were measured in 75 families of juvenile steelhead or rainbow trout *Oncorhynchus mykiss*, progeny of within and between line matings (crosses) of wild, anadromous steelhead and wild, resident (lake) rainbow trout originally derived from the same anadromous stock 70 years earlier. The tagged yearling progeny were combined by line in common freshwater rearing containers and graded into three categories: mature, smolt or rearing (undifferentiated) at age 2 years. Heritabilities of precocious male maturity, smolting and growth were moderate to high, and the genetic correlation between growth and smolting was low. Smolting and precocious male maturity were highly variable among families within lines and significantly different between lines. Each of the four lines produced significant numbers of smolts at age two. Smolting and maturation were negatively genetically correlated, which may explain the persistence of smolting in the lake population despite strong selection against lake smolts; balancing selection on male maturation age may help to maintain variation for smolting. The high heritability of smolting, coupled with the inability of smolts that leave the lake to return to it indicates that the genetic potential for smolting can lie dormant or be maintained through a dynamic interaction between smolting and early maturation for decades despite complete selection against the phenotype. The results have significant implications for the preservation of threatened anadromous stocks in fresh water and the inclusion of resident fish of formerly anadromous populations, currently trapped behind long-standing barriers to migration, as one component of the same population.