**Using physiological indices to forecast life history in hatchery reared winter-run steelhead trout, *Oncorhychus mykiss* in the Hood River, Oregon**

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Steelhead trout (*Oncorhynchus mykiss*) exhibit a high degree of life history plasticity including variation in age of smoltification and maturation, freshwater residence time, and seasonality of adult upstream migration and spawning.  While stock specific life history patterns have a genetic basis, the proportion of fish expressing various life-history phenotypes in the same stock can vary year to year due to environmental factors (e.g. temperature, food availability) that influence early development, emergence timing, growth and body energy stores.  Hatchery steelhead that either fail to reach minimum size thresholds for smolting or exceed size thresholds for maturation may forgo migration and remain resident in fresh water (‘residualize’) where they may pose genetic and ecological risks to native salmonids.  In this investigation we quantified the proportions of fish expressing various life-history pathways in winter-run hatchery steelhead from the Hood River, Oregon, USA. Using a combination of physiological indices related to smolting (body silvering and gill Na+/K+-ATPase activity) and reproductive development (sex, gonad histology, GSI, plasma hormone levels and gene expression in both the pituitary gland and testis) we identified several phenotypes: 1) immature male and female parr, 2) precociously mature male parr, 3) male smolts with testes in early to mid-spermatogenesis with elevated expression of reproductive factors that are likely to spawn after < 1year in the ocean, 4) male fish that attempted maturation, but failed, 5) immature male and female smolts that are likely to mature after >1 year in the ocean.  The Parkdale Hatchery releases approximately 50,000 S1 (smolt at age-1) steelhead annually in to the Hood River basin.  A survey of 300 fish prior to release from the facility showed relatively similar results over three brood years.  Sex ratios (M:F) were 52:48, 55:45, and 51:49 M:F over brood years 2011-2013, respectively.  We calculated that approximately 3-4% of the population (1,500-2000 fish) could potentially residualize, 3-12% (1,500-6,000 fish) could mature after  < 1 year in the ocean (1-salt males) and 84-95% (42,500-47,500 fish) could mature after >1 year in the ocean (2-3 salt males and females).