

The Paradox of Faster Growing Wild Fish Maturing at Older Ages Than Slower Growing Hatchery Fish: Probability-of-Maturation Reaction Norms to the Rescue

CURTIS M. KNUDSEN; *Oncorh Consulting*

Life history theory predicts that faster growing fish will mature at a younger age and larger size-at-maturity than from slower growing population. However, in the upper Yakima spring chinook we have observed just the opposite: slower growing hatchery fish return at a smaller size-at-maturity and mature at a younger mean age, producing about twice as many age 3 jacks within a cohort as natural origin fish. Why is this so, and what processes are in play that result in predictions contrary to those one would make via life history theory?

In the hatchery environment natural selection is relaxed. Beginning with the trapping and transport of adults to CESRF, continuing during their holding in the protected environment until spawning, adults no longer have to find thermal refugia, migrate up-river past barriers and predators, find and defend mates and spawning sites, successfully deposit fertilized gametes, and finally protect their redds from superimposition from other females. Within the hatchery, eggs and juveniles are protected during incubation through emergence from thermal and hydrologic shocks, predation, and disease again relaxing the effects of natural selection. Thus, there is no longer a fitness penalty to be paid if an individual fish has not allocated sufficient energy reserves for mate competition or has allocated insufficient yolk reserves to eggs to guard against starvation during post-emergence fry rearing. In the hatchery environment, fish do not experience mate competition nor have to experience periods of starvation post-emergence. Relaxation of natural selection and imposition of new hatchery selection forces results in the development of new genotypic norms of reaction for hatchery fish.

Data from the Spring Chinook Domestication Study will be used to illustrate how Hatchery Control, and to a lesser degree, the Supplementation Production fish have demonstrated adaptation to the hatchery environment and a descriptive model of Probability of Maturation Reaction Norms will be presented that resolves the paradox of faster growing natural origin fish maturing at older ages than slower growing hatchery origin fish.