Genetic Monitoring of National Fish Hatcheries and Natural Populations in the Pacific Region

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Hatchery Scientific Review

Welcome to Hatchery Reform

Welcome to the website for the Pacific Northwest Hatchery Reform Project. The US Congress established the project in 2000 because it recognized that while hatcheries play a legitimate role in meeting harvest and conservation goals for Pacific Northwest salmon and steelhead, the hatchery system was in need of comprehensive reform.

The project's independent scientific review panel, the Hatchery Scientific Review Group (HSRG), has reviewed all state, tribal and federal hatchery programs in Puget Sound and Coastal Washington, and in the Columbia River Basin.

Hatchery Reform in Washington State: Principles and Emerging Issues

Hatcheries support nearly all major fisheries for Pacific salmon (Oncorhynchus spp.) and steelhead (anadromous O. mykiss) in the Pacific Northwest. However, hatcheries have been a major source of controversy for over 30 years. The Hatchery Scientific Review Group (HSRG) was tasked by Congress to identify solutions to well-known problems so that hatcheries could support sustainable fisheries and assisting with the conservation. We reviewed over 100 facilities and 200 programs and identified a primary goal: (1) goals for each program must be explicitly stated in terms of purposes; (2) programs must be scientifically defensible and must respond adaptively to new information. We also identified several specific to the success of hatcheries. We concluded that hatcheries must with increased scientific oversight and that they cannot meet their needs and self-sustaining, naturally-spawning populations.
Examples of questions raised during the hatchery reviews:

• Which individuals (based on age, return time, etc...) should be included in broodstock?

• What is the present relationship between hatchery stock and adjacent wild stocks?

• How can we monitor the impacts of changes made based on hatchery scientific review?
Objective:

Develop standardized genetic profiles for National Fish Hatchery stocks

1. Use genetic data to address questions raised by Hatchery Scientific Review

2. Make data for all NFH stocks and adjacent wild populations readily available for internal evaluation and to our partners
Review of genetic divergence

Genetic drift and different selective pressures in hatchery and wild environment will cause stocks to diverge

Gene flow will cause stocks to become similar
(pHOS, pNOB, pNI)
Example 1: Quilcene NFH

• Propagating coho for ~100 years
• Earliest returning fish used for broodstock
• Jacks excluded from broodstock prior to 1992
Divergence in return time among three return years

Proportion of run arrived

Late (2003, 2006, 2009, …)
Genetic divergence measured by neutral markers

Can we detect genetic divergence corresponding to phenotypic divergence?

Has increasing proportion of jacks in recent years made a detectable impact on population structure?
Temporal structure >> geographic structure

Quilcene broodstock
Other population
Genetic diversity in Quilcene NFH coho salmon

Allelic Richness

Early  Middle  Late

2001  2007  2009
2002  2008  2010
2000
Example 2: Warm Springs NFH

Jointly operated by USFWS and CTWSRO

Integrated spring Chinook salmon program since 1978
Genetic divergence measured by neutral markers

Has lack of NOB resulted in detectable divergence between hatchery and wild stocks?

How similar are Warm springs NFH and Round Butte H stocks to wild (unclipped) Deschutes R. Chinook salmon?
Correspondence analysis of upper Columbia River Chinook salmon
Genetic Diversity in Columbia River Chinook salmon populations

Allelic Richness

Round Butte
Warm Springs
spring
fall

Round Butte
Warm Springs
spring
fall
Genetic Profiles for Pacific Region and Pacific Southwest Region National Fish Hatchery Broodstocks

Stocks are listed by species, and Chinook salmon stocks are further divided among five recognized runs (spring, summer, fall, late-fall, and winter). Available reports are indicated by "pdf" which link to the actual report. Expected completion deadlines are given for stocks for which no reports are currently available. Reports will be updated periodically as additional data become available. A general description of methods used to generate reports is provided here as a pdf file.

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<th>National Fish Hatchery</th>
<th>Chinook Salmon</th>
<th>Coho Salmon</th>
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<th>Chum Salmon</th>
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Acknowledgements

Samples and data were collected in cooperation with our partners and with the assistance of hatchery staff. Genotyping was conducted by the laboratory staff at AFTC.

The findings and conclusions presented here are those of the author and do not necessarily represent the views of the U.S. Fish and Wildlife Service.