

RRS Project Review

Project ID: 2003-039-00¹

Title: Monitor and Evaluate (M&E) Reproductive Success and Survival in Wenatchee River

Short Description: This project aims to quantitatively evaluate the relative reproductive success (RRS) of naturally spawning hatchery and natural origin spring Chinook salmon in the Wenatchee River using a DNA-based pedigree approach, and to evaluate the causal mechanisms for differences in reproductive success.² Specifically, the project objectives are 1) directly measure the RRS of hatchery and natural origin spring Chinook salmon in both natural and hatchery settings 2) determine the degree that differences in RRS can be explained by measurable biological characteristics (run timing, size), and 3) estimate the relative fitness of hatchery lineage spring Chinook salmon after one generation in the natural environment. This project is a collaboration between NOAA-Fisheries (Northwest Fish Science Center) and WDFW, and is an extension of the Chinook salmon supplementation and monitoring program in the Wenatchee River operated by WDFW and funded by Chelan County PUD.

Sponsor: Washington Department of Fish and Wildlife (WDFW) & NOAA

BiOp association:

- RPA 62.5 Investigate feasibility of genetic stock id techniques
- RPA 64.1 Estimate relative reproductive success (RSS) of hatchery
- RPA 64.2 Determine if artificial production contributes to recovery

Is this an Accord project? No

Budget (2008 to present):

BPA	Grand Total	\$4,358,784
	FY16	\$ 496,743
Cost Share	Chelan County PUD	\$1,341,662 (2008 to 2015)
	Grant County PUD	\$ 439,319 (2008 to 2015)

Proposal from last Categorical Review:

<https://www.cbfish.org/Proposal.mvc/Summary/RMECAT-2003-039-00>

Most recent Council recommendation:

<https://www.cbfish.org/Assessment.mvc/CouncilRecommendationAssessmentSummary/Assessment/2003-039-00-NPCC-20110125>

**As reviewed and recommended by the Council, the study needs to continue through 2018.

¹ This is one of the six exclusively RRS projects in the program.

² First versus second generation.

Date of most recent annual report available on Pisces/cbfish? FY15 Annual report: *Monitoring the reproductive success of naturally spawning hatchery and natural spring Chinook salmon in the Wenatchee River*. Submitted April 2016.

<https://pisces.bpa.gov/release/documents/DocumentViewer.aspx?doc=P142990>

Short summary of project reporting compliance: This project involves two agencies, each with their own contract, working collaboratively. A single, joint authored annual report is generated for the contract period. Contract management and project performance for each agency has been excellent. To date, 5 peer-reviewed scientific papers have been published from this project.

Summary of the scope of the project as it was reviewed by Council: The project achieved its initial objective of evaluating the RRS of hatchery versus natural spring Chinook in the Wenatchee River subbasin. The hatchery fish have about 50% of the fitness of natural fish. During the 2010 RM&E categorical review, the sponsors (WDFW & NOAA) proposed to continue “quantitative evaluation of the relative reproductive success and survival of naturally spawning hatchery and natural origin spring Chinook salmon in the Wenatchee River. The next phase of the project focuses on i) evaluating the relative reproductive success of naturally produced spring Chinook with different levels of hatchery ancestry (first versus second generation), and ii) refining our understanding of the mechanisms causing differences in fitness.”

Summary of the scope of the project now: This project continues to address key uncertainties regarding the impacts of artificial production programs on listed salmon populations. “Specifically, what is the relative reproductive success of naturally spawning hatchery fish and what are the causes of poor reproductive success of hatchery fish.” The Sponsors are addressing these questions by focusing on the spring Chinook salmon in the Wenatchee River, part of the endangered Upper Columbia River spring Chinook salmon ESU. “Work continues on quantifying differences in traits between hatchery and natural produced fish through 2015. In addition, comparisons of the reproductive success of naturally produced fish with various degrees of hatchery parentage (i.e., second generation) will continue through the end of the study in 2020.”

Has the scope of this project changed significantly since it was reviewed? No, the scope of the project has not changed significantly since it was reviewed by Council in 2010.

ISRP/AB Critical Uncertainties Appendix D review:

<http://www.nwcouncil.org/media/7149871/isabisrp2016-1appendixd.pdf#page=122>

Comments: Chelan and Grant County PUDs provide cost sharing for this project as part of their requirement to implement monitoring and evaluation activities associated with their hatchery programs in the Wenatchee subbasin. The results derived from this project have contributed to the development of hatchery fish exclusion at Tumwater Dam, a revised HGMP reflecting limits on the genotype of fish passed upstream to spawn, and ongoing efforts to develop Parental Based Tagging (PBT) to reduce or eliminate the need for broodstock collection weirs in tributaries.

Questions to all project sponsors with RRS studies:

- How does this project inform (1) the Council's Research Plan and (2) the Council's Fish and Wildlife Program objectives?
- Can any results from this study be extrapolated to other geographic locations or other populations?
- How does the Idaho Supplementation Study inform this project?
- Does this project have any of the following elements:
 - (a) A scientific question
 - (b) A hypothesis
 - (c) A specific time frame within which to answer the question posed
- How was it determined which species or geographic area to study?
- How does this effort work or collaborate with other RRS projects on aspects of the study (methodology, data and conclusions)?
- How does **density dependence** factor in to this study moving forward?

Questions relative to this project:

- This study determined that hatchery fish have about 50% of the fitness of natural fish and that spawning location play a key factor in that. What additional information is expected to be derived from this study?
- With the caveat that the project is recommended to continue through 2018, where does the project stand regarding the three objectives mentioned in the Short Description section?

Reproductive success of spring Chinook salmon in the Wenatchee River

BPA Project # 2003-039-00

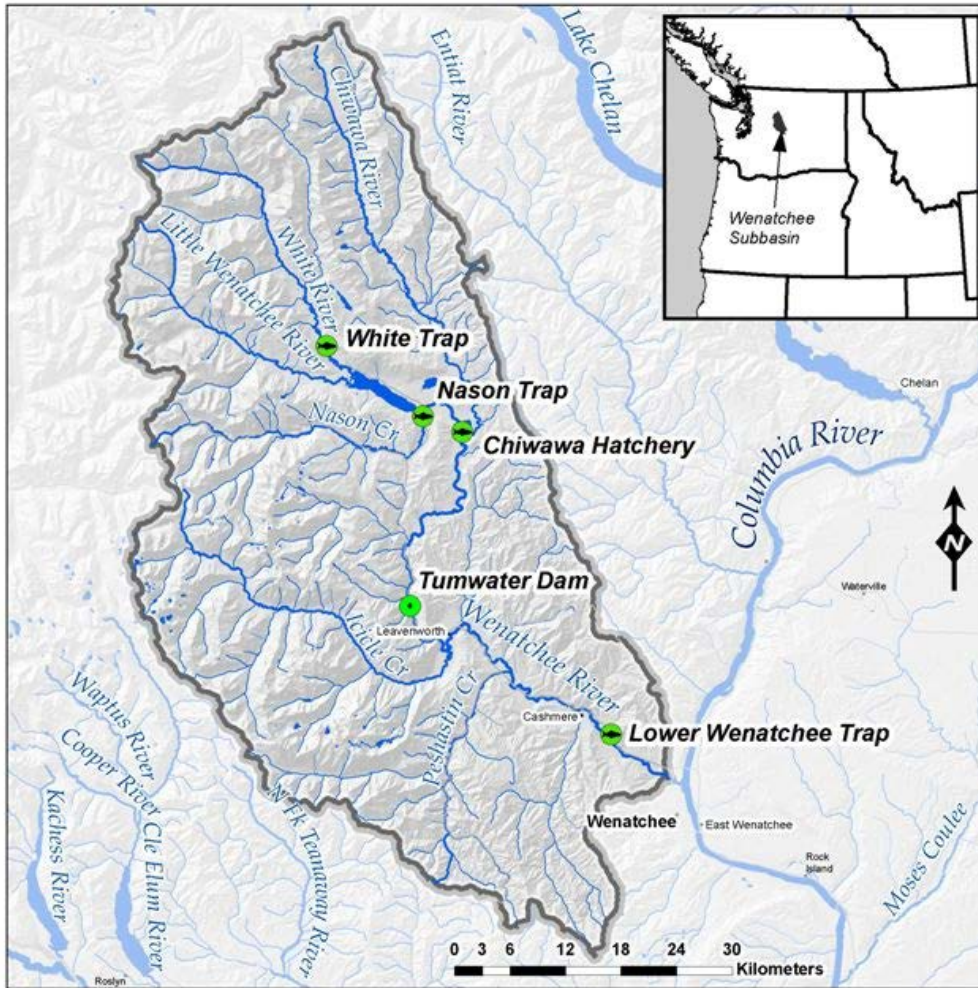
Andrew Murdoch (WDFW)

Michael Ford (NWFSC)

Project goals

- Provide information needed to maximize benefits and minimize risks of hatchery supplementation
 - Estimate relative reproductive success (RRS) of hatchery fish from supplementation program
 - Identify biological causes of any reduction in RRS
 - Evaluate if reduced RRS of hatchery fish persists after a generation of natural spawning
- Spring Chinook
 - Lots hatchery propagation but little information on RRS
 - Direct management application throughout basin

Project design and duration



Year

2004

2005

2006

2007

2008

2009

2010

2011

2012

2013

2014

2015

2016

2017

2018

2019

2020

First generation

Second generation

Third generation

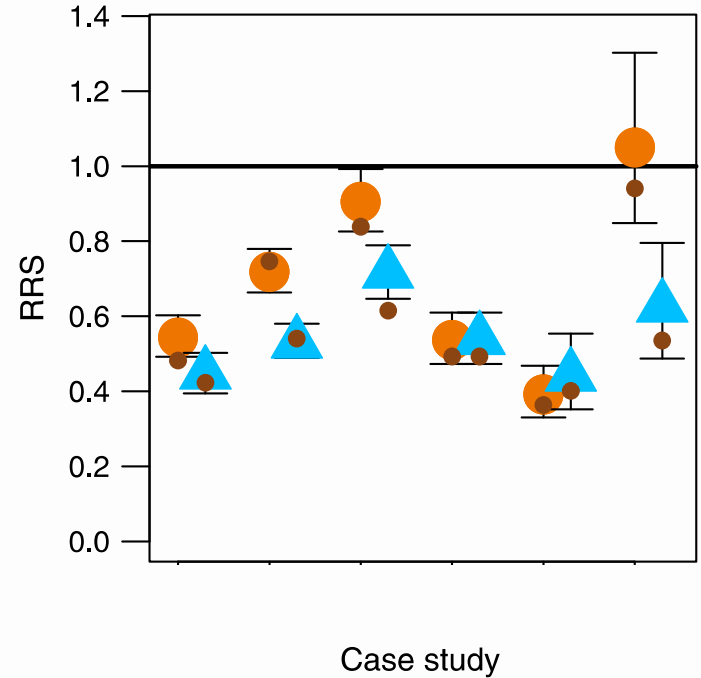
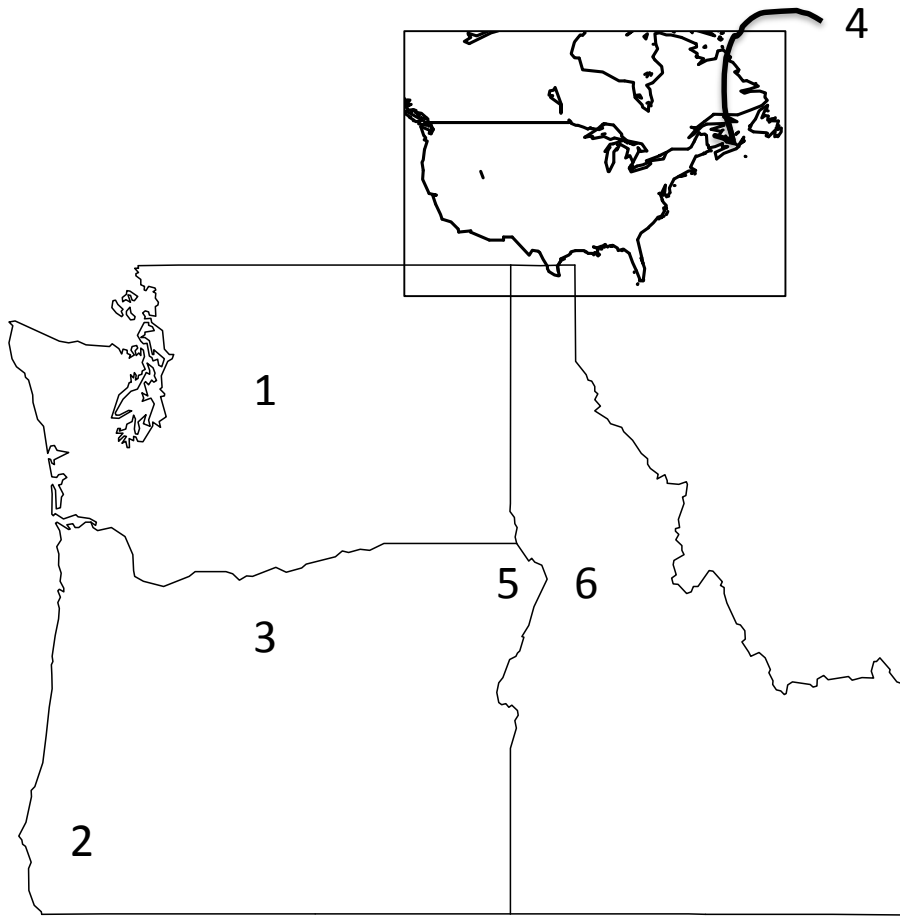
Project characteristics

- Sampled and genotyped > 50,000 fish
- Adult run sizes to Tumwater range from 2000 – 6000
- pHOS ranges from 40% to 60% (less in recent and future years)
- Spawning occurs and is monitored in multiple tributaries
- Detailed information on habitat and density information is collected
- Concurrent study of steelhead RRS in same watershed

Key results to date

- RRS of hatchery fish is about 50%
 - Consistent over multiple years
- Hatchery N_e < natural N_e
- RRS of male hatchery fish < female hatchery fish
- Spawning location influences RRS
 - Within tributaries
 - Among tributaries
- Broodstock history not a detectable factor influencing RRS
- Hatchery fish and their natural progeny stray \gg natural fish
- Hatchery broodstock produce lots of early maturing males with low RRS

Comparison to other studies?



Ongoing and future tasks

- Complete remaining broodyears
 - Contrast in pHOS
 - RRS of natural progeny of hatchery fish
- Evaluate effects of density
 - Wenatchee scale, local scales
- Evaluate effects of habitat quality
- Continue to investigate broodstock effects and genetic basis of RRS
- RRS of fish that stray or home
- Evaluate in context of basin wide data

Wenatchee steelhead RRS

- Chelan PUD, NMFS and WDFW funded
- Published today in PLOS ONE
- Four years of adult parents and juvenile offspring
- >10,000 fish genotyped
- Replicates a key result of the Hood River steelhead broodstock study: $H_{HH} < H_{HW} < H_{WW}$

