

RRS Project Review

Project ID: 2010-033-00¹

Title: Study Reproductive Success of Hatchery and Natural Origin Steelhead in the Methow

Short Description: This project aims to quantitatively evaluate the relative reproductive success (RRS) of naturally spawning hatchery and natural origin summer steelhead in the Methow River Basin over two generations. Specifically, the objectives are 1) directly measure the relative reproductive success of hatchery and natural-origin steelhead in the natural environment using a DNA pedigree approach, 2) determine the degree to which any differences in reproductive success between hatchery and natural steelhead can be explained by measurable biological characteristics such as run timing, morphology, spawn timing, or spawning location, and 3) estimate the relative fitness of hatchery-lineage steelhead after they have experienced an entire generation in the natural environment.

Sponsor: Washington Department of Fish and Wildlife (WDFW)

BiOp association: 2008 BiOp

RPA 64.2: Determine if artificial production contributes to recovery

RPA 64.3: Fund new RSS study for ESA-listed steelhead in Methow River

Is this an Accord project? No

Budget (2010 to present):

BPA	Total	\$2,299,560
	FY16	\$ 300,196
Cost share	Douglas County PUD	\$ 927,696 (2012-2015)

Proposal from last Categorical Review:

<https://www.cbfish.org/Proposal.mvc/Summary/RMECAT-2010-033-00>

Most recent Council recommendation:

<https://www.cbfish.org/Assessment.mvc/CouncilRecommendationAssessmentSummary/Assessment/2010-033-00-NPCC-20110214>

Date of most recent annual report available on Pisces/cbfish? FY2015 Annual Report: *Monitoring the reproductive success of naturally spawning hatchery and natural origin steelhead in the Twisp River.* Submitted April 2016. <https://pisces.bpa.gov/release/documents/DocumentViewer.aspx?doc=P148542>

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

Short summary of project reporting compliance: The sponsor addressed all Council recommendations since the review, has been timely with all required deliverables and contracting deadlines, and the quality of their work is exemplary.

Summary of the scope of the project as it was reviewed by Council: In 2010, WDFW submitted a project proposal to the Council for the Fast Track proposal review process. The proposal was revised to address Council and ISRP recommendations and funding was approved per Council decision in May 2010. This project is intended to address “high priority research, monitoring and evaluation needs identified in the 2008 Biological Opinion (BiOp) for the Federal Columbia River Power System (FCRPS).” Results from this study have the potential “to provide improved understanding of the demography and viability of upper Columbia ESU steelhead and the relationship between hatchery and natural fish in this region.” Additionally, information gathered from this project may be applicable to steelhead populations with low abundance in other upper Columbia subbasins, i.e., Entiat, Wenatchee, and Okanogan. This project is similar to ongoing RRS investigations in the Hood River, Oregon, that have provided evidence that multi-generation hatchery stocks of steelhead are less productive when spawning naturally than non-captive fish. “The objectives, rationale, and approach are clearly presented and suggest a project that will provide another data set for comparing hatchery and natural steelhead reproductive performance that will complement the Hood River investigations, and will contribute to our understanding of the population status of upper Columbia River steelhead.”

Summary of the scope of the project now: The scope and objectives of the project have not changed.

Has the scope of this project changed significantly since it was reviewed? No

ISRP/AB Critical Uncertainties Appendix D review:

<http://www.nwcouncil.org/media/7149871/isabisrp2016-1appendixd.pdf#page=132>

Comments: This project has a strong link to the 2008 FCRPS BiOp (RPA 64.3), the Methow Subbasin Plan, and Council's Columbia River Research Plan. It was developed in collaboration with Douglas County PUD, and Douglas County PUD is providing funding for the project both indirectly through ongoing monitoring and evaluation activities (e.g., weir operation, smolt trap operation, and spawning ground surveys) as well as direct funding for the project (e.g., genotyping and analysis of adult steelhead samples). This project still has four more years to run.

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:

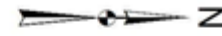
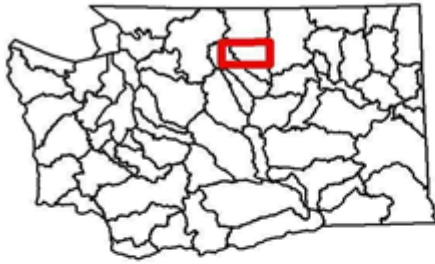
- Is there any expectation that the completion year (2020) will change?
- Has the second generation of steelhead been present in sufficient numbers to provide statistically significant results by 2010?
- How has the shift in genetic makeup or natural origin fish in the Twisp River affected the study design or the potential applicability to other areas in the basin?

DRAFT

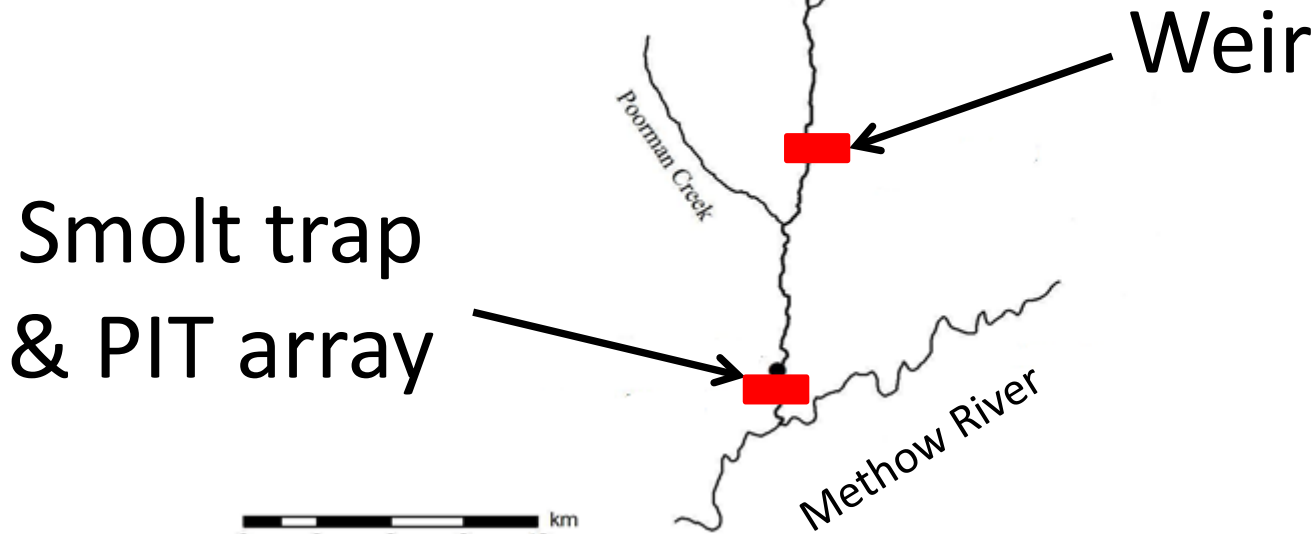
Reproductive success of hatchery and natural-origin steelhead in the Methow

BPA Project # 2010-033-00

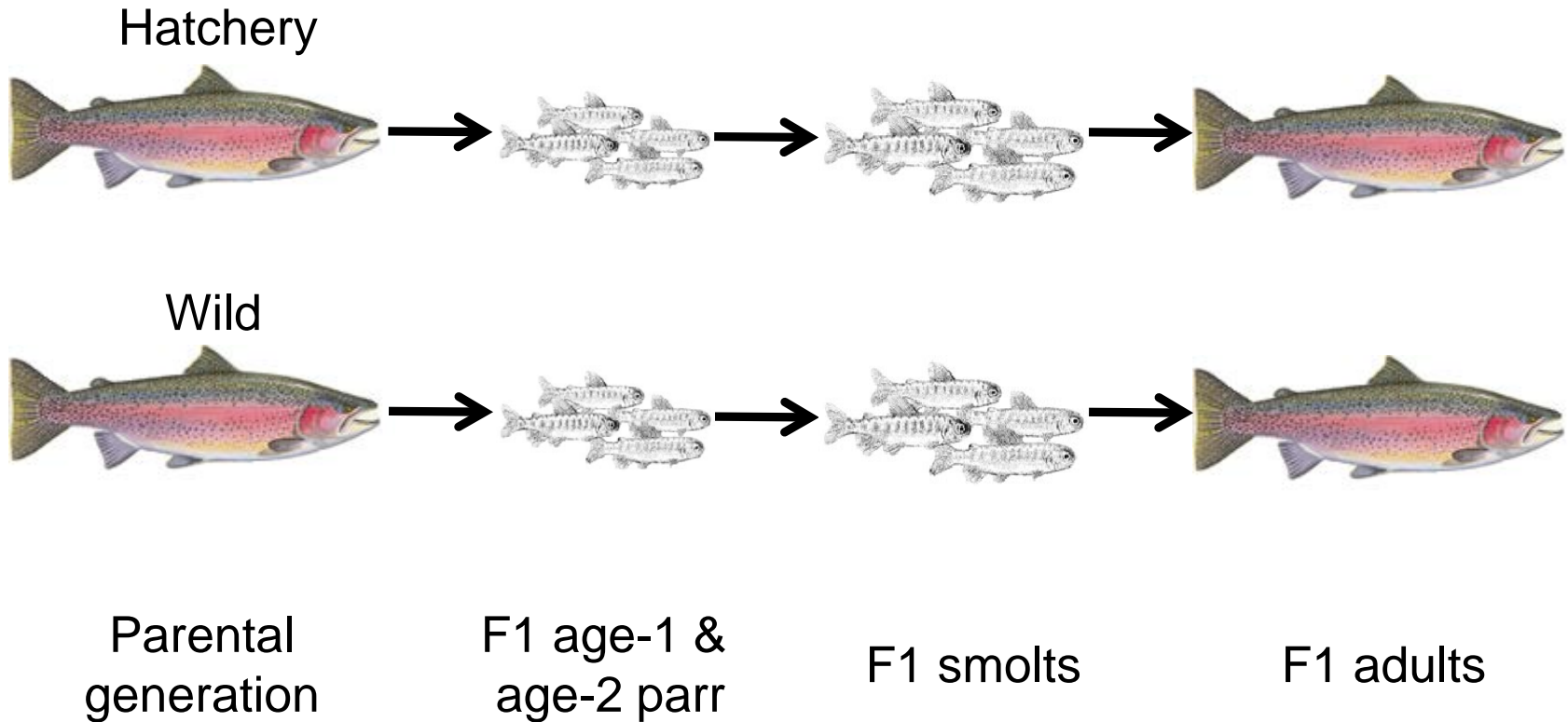




Study Area



OBJECTIVE 1: Estimate RRS of hatchery and wild steelhead spawning in the natural environment



OBJECTIVE 2: Determine which measurable physical and behavioral traits affect reproductive success



Spawner Demographics

- length, weight, sex, lipid, age

Spawning Behavior

- spawning surveys (3-4 d)
- spawning timing/location
 - Floy, PIT
- Measure redd morphology

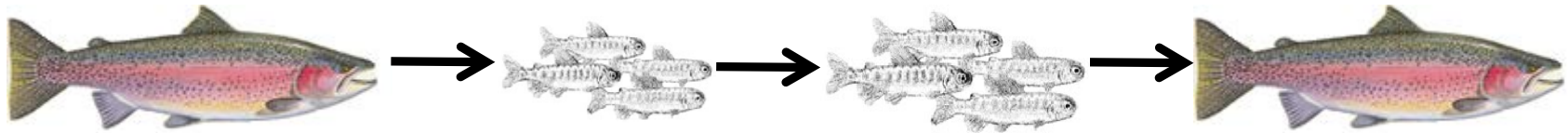
Run timing

- PIT tag arrays, arrival at weir

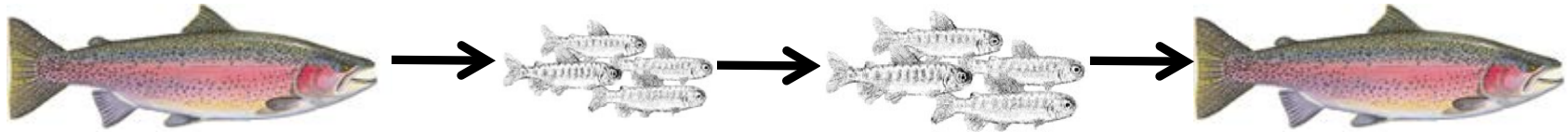
Generalized Linear Models

OBJECTIVE 3: Estimate RRS of hatchery-lineage steelhead after a generation in the natural environment.

Wild (H parents)



Wild (W parents)



F1 adults

F2 age-1 &
age-2 parr

F2 smolts

F2 Adults

Preliminary Results

(1) RRS of hatchery (HxW) fish < 1.00 at all life stages

Comparison	RRS by Life stage		
	Parr (N=4)	Smolt (N=2)	Adult (N=1)
H male: W male	0.53	0.63	0.47
H female: W female	0.67	0.56	0.64

(2) GLMs of RRS as function of traits

parr offspring ~ origin, year, length, arrival date

(3) No results to date for RRS of F1s

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Future work

- Continue to evaluate RRS of Wells broodstock (HxW, HxH) and their progeny
- Evaluate effects of density and pHOS on RRS
- Evaluate RRS of local, WxW broodstock program started in 2011
 - Adult returns 2014-2018
 - F1 juveniles (2015-2022) and adults (2018-2025)
 - F2 juveniles (2019-2026) and adults (2022-2025)