

RRS Project Review

Project ID: 1996-043-00¹

Title: Johnson Creek Artificial Propagation Enhancement

Short Description: The primary goal of the Johnson Creek Artificial Propagation Enhancement (JCAPE) program is to use indigenous stock to provide for the restoration of summer Chinook salmon in Johnson Creek and to mitigate for fish losses occurring as a result of the construction and operation of the four Lower Snake River Dams. The RRS research is intended to inform the demographic risk to ESA-listed summer Chinook salmon in the South Fork of the East Fork Salmon River, while maintaining the genetic diversity of the artificially propagated and natural populations.

Sponsor: Nez Perce Tribe

BiOp association: 2008 FCRPS

RPA 41 Implement Safety-Net Programs to Preserve Genetic Resources and Reduce Extinction Risk
RPA 50.6 Review/modify existing fish pop status monitoring projects,
RPA 50.7 Fund marking of hatchery releases from AA funded facilities,
RPA 51.1 Synthesize fish pop metrics thru Regional Data Repositories,
RPA 51.3 Provide funding support/staff participation in regional forums,
RPA 63.1 Measure effect of safety-net & conservation hatchery programs,
RPA 64.2 Determine if artificial production contributes to recovery,

Is this an Accord project? No

Budget (2008 to present):

BPA	Grand Total	\$10,861,014 (FY08 to FY16)
	FY16	\$ 1,594,842
Cost share	No cost share associated with this project.	

Proposal from last Categorical Review:

<https://www.cbfish.org/Proposal.mvc/Summary/RMECAT-1996-043-00>

Most recent Council recommendation:

<https://www.cbfish.org/Assessment.mvc/CouncilRecommendationAssessmentSummary/Assessment/1996-043-00-NPCC-20110125>

¹ This is not one of the six exclusively RRS projects, but it has RRS linkages.

**Sponsor has addressed Council recommendations in the form of the Idaho Supplementation Study (ISS) final report

Date of most recent annual report available on Pisces/cbfish? M&E Report uploaded into Pisces on May 6, 2016, and covers work performed from March, 2013 to December, 2014.

<https://pisces.bpa.gov/release/documents/DocumentViewer.aspx?doc=P148725>

Short summary of project reporting compliance: Contract management and project performance has been good thus far. Sponsor has been on time with almost all deliverables; sponsor appears to be 'overdue' publishing their monitoring methods in MM.org.

Summary of the scope of the project as it was reviewed by Council: (2011) AP/ Supplementation – The Johnson Creek Artificial Propagation and Enhancement (JCAPE) project is a small-scale supplementation initiative integrated with a monitoring and evaluation program that is designed to increase survival of a weak but recoverable spawning aggregate of summer Chinook salmon. Primary goals of the JCAPE project are to (1) prevent extirpation of the spawning aggregate present in Johnson Creek (2) preserve genetic, ecological, and behavioral attributes of Johnson Creek summer Chinook while minimizing the potential impacts to other stocks, and (3) build a naturally-sustaining summer Chinook population once factors contributing to the initial decline are addressed.

The JCAPE program was identified in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp) (NMFS 2008) as a project that 'slows trends toward extinction' and as one that provides a beneficial effect to the South Fork Salmon River MPG. The project is identified as one that is designed to preserve summer Chinook salmon genetic resources, at least until factors limiting recovery are addressed.

Summary of the scope of the project now: Scope and goals are the same as they were at the time of the last review.

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

Link to ISRP/AB Critical Uncertainties Appendix D review:

<http://www.nwcouncil.org/media/7149871/isabisrp2016-1appendixd.pdf#page=212>

Comments: The JCAPE project results indicate that hatchery-produced Johnson Creek spring/summer Chinook salmon have an RRS of 0.99 compared to natural origin adults. Many more species-specific studies of this type are needed before conclusions can be drawn. The project results also demonstrate the demographic benefit of supplementation using a broodstock that is 100% natural origin fish.

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:

- In the project's estimate of RRS were all hatchery returning adults measured equally? In other words, were spawners that had no successfully returning adults also included in the calculation?
- Your study has drawn strong conclusion about RRS in Johnson Creek, therefore is it necessary to continue studying this any further, and if so how long?

Johnson Creek Artificial Propagation Enhancement

A Review of the JCAPE
Relative Reproductive Success Program

Project Scope

- Operations & Maintenance
- Monitoring & Evaluation
- Status & Trends Assessments

Robust Monitoring and Evaluation Program

- NPCC 3-Step Process

Adaptive Management Commitment

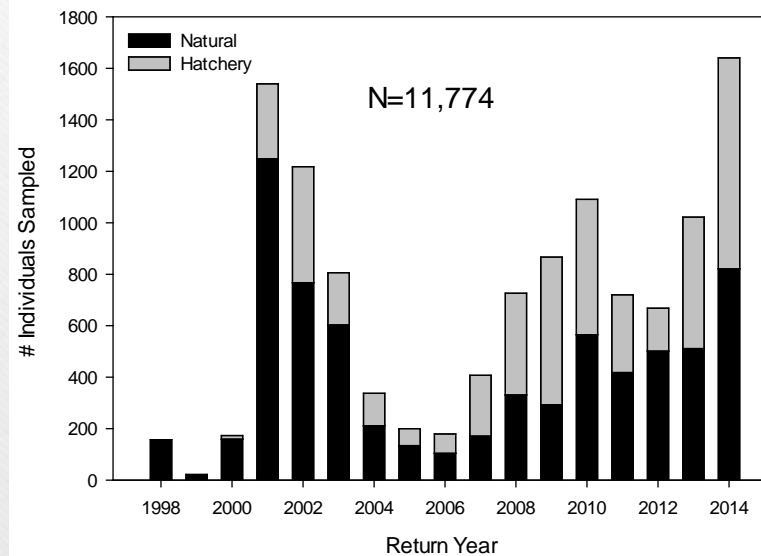
- Symposiums
- Regional Forums

Overview

The RRS component of the JCAPE M&E Project

- Highly efficient weir (mean = 92%)
- 11,774 Johnson Creek adult Chinook have been genotyped (to date)
- 17 years (7 complete parent/progeny cycles)

Number of Individuals by Return Year and Origin



How does this project [RRS] inform the Council's Research Plan?

- 'Hatcheries/Artificial Production' Theme:
 - RRS has informed us that we can use the hatchery supplementation tool to achieve programmatic objectives without genetically affecting the natural population
- 'Population Structure and Diversity' Theme:
 - Demographic Analyses
 - Adaptive Management

How does this project [RRS] inform the Council's Fish and Wildlife Program objectives?

- Theme Two: Ensure Species Survival by Promoting Abundance, Diversity, and Adaptability
 - We've recently updated findings presented in Hess et al. (2012)

MOLECULAR ECOLOGY

Molecular Ecology (2012) 21, 5236–5250

doi: 10.1111/mec.12046

Supportive breeding boosts natural population abundance with minimal negative impacts on fitness of a wild population of Chinook salmon

MAUREEN A. HESS,* CRAIG D. RABE,† JASON L. VOGEL,‡ JEFF J. STEPHENSON,* DOUG D. NELSON† and SHAWN R. NARUM*

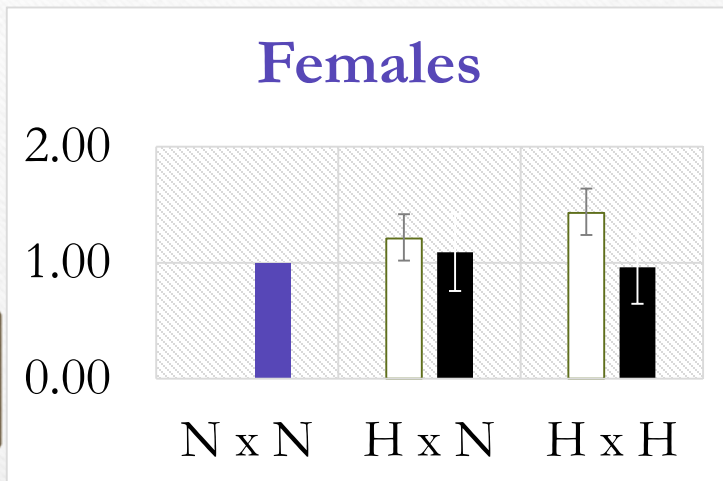
*Columbia River Inter-Tribal Fish Commission, Hagerman Fish Culture Experiment Station, 3059F National Fish Hatchery Road, Hagerman, ID 83332, USA, †Department of Fisheries Resources Management, Nez Perce Tribe, PO Box 1942, McCall, ID 83638, USA, ‡Department of Fisheries Resources Management, Nez Perce Tribe, PO Box 365, Lapwai, ID 83540, USA

1.) *Demographic boost provided by the hatchery over two generations?*



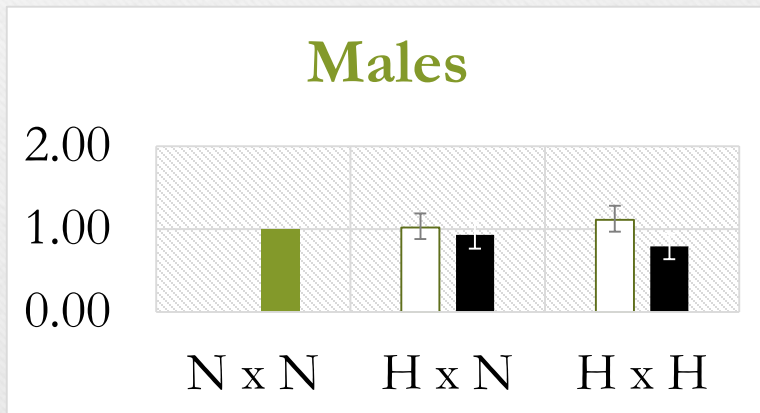
On average, fish taken into the hatchery produced 4.5 times more adult offspring, and 2.6 times more adult grand-offspring than naturally reproducing fish.

2.) Do hatchery-reared fish reduce the fitness of wild-origin fish?



➤ No detectable difference in fitness relative to natural-origin females (overall $RRS=1.03$, $p=0.55$)

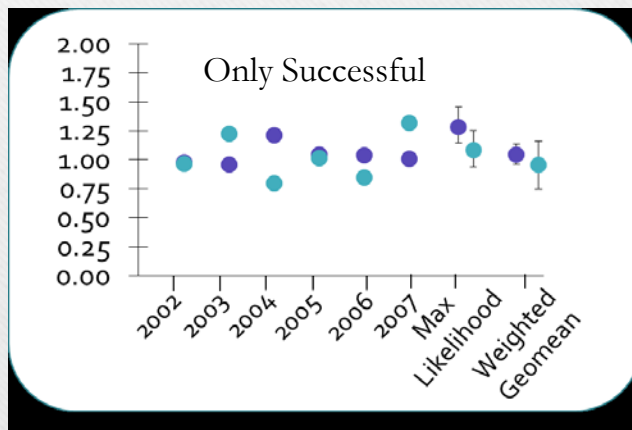
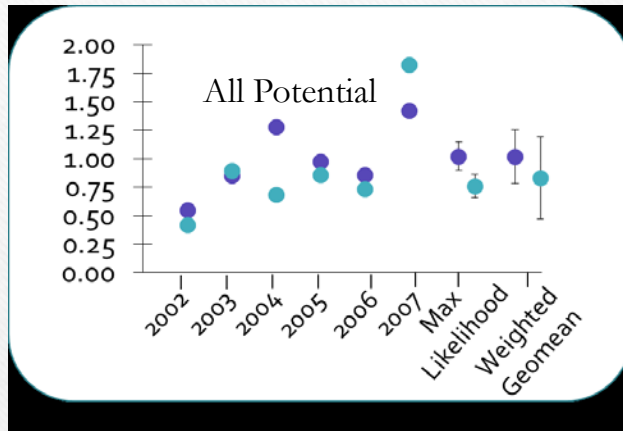
➤ Limited evidence of reduction in fitness of natural fish when they mate with hatchery fish



□ Maximum likelihood
■ Weighted geometric mean

3.) Differences in reproductive success between hatchery-reared and wild-origin fish spawning naturally?

Relative reproductive success (HAT/NAT)



- Hatchery rearing yielded fewer males that reproduced (possible sexual selection in action)
- Many hatchery jacks present, likely poor spawn success
- RRS estimates similar between hatchery and natural fish, no statistical differences (recognize some years with low power due to sample size; average annual 95% CI's ranged between 0.65 and 1.5)

- Females
- Males, age 4+

Can any results from this study be extrapolated to other geographic locations or other populations?

- Yes, provided similar study design, weir efficiency, and key production area

How does the Idaho Supplementation Study inform this project?

Similarity to ISS	Contrast to ISS
Extensive M&E component	Studies were initiated/funded for different objectives
Johnson Creek was initially a control stream for ISS study	ISS has the statistical design and power to evaluate the use of supplementation as tool for recovery – JCAPE doesn't
Johnson Creek data was used by ISS for their evaluation	An independent study utilizing Johnson Creek and one to two control streams would have little or no power to detect an effect and could not be incorporated into the ISS study because of different study designs
	Creating an independent stand alone study would provide limited information toward supplementation as compared to extensive ISS study
	ISS cannot replicate the information that JCAPE currently collects, which means they can't address many JCAPE supplementation objectives

Does this project have: (a) a scientific question, (b) a hypothesis, or (c) time frame?

a) Monitoring and Evaluation Objective 1b: Genetic parentage analysis to determine and compare relative reproductive success of hatchery and naturally produced Chinook salmon (Vogel et al. 2006)

b) Ho: Reproductive success of natural spawning hatchery fish is not significantly different than that of naturally produced fish.

Ha: Reproductive success of natural spawning hatchery fish is significantly different than that of naturally produced fish.

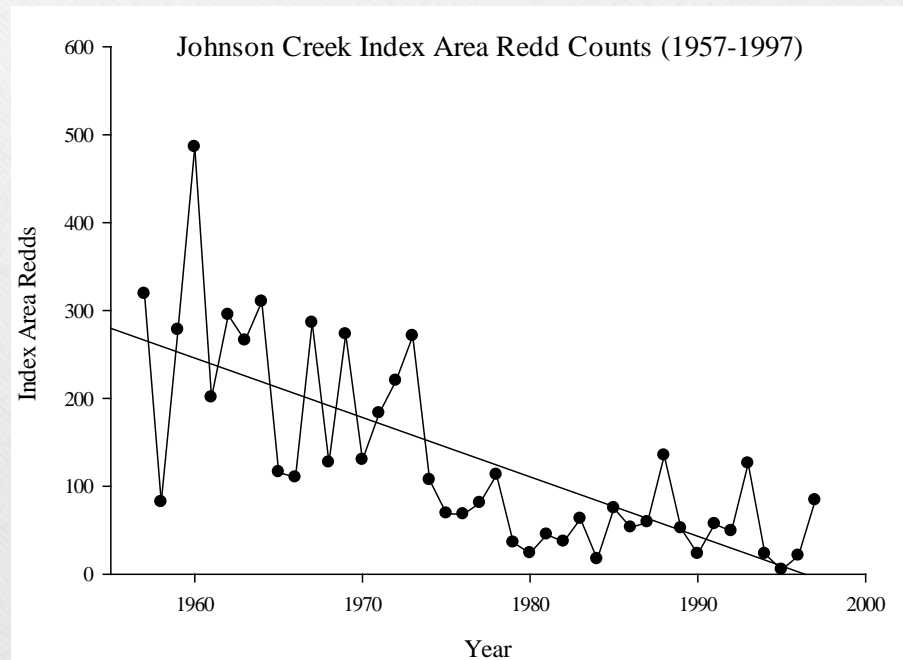
Ho: Naturally spawning progeny of hatchery fish and natural fish produce an equal number of returning adults in the F_2 and F_3 generations.

Ha: Naturally spawning progeny of hatchery fish and natural fish produce significantly different numbers of returning adults in future generations (F_5)

c) Time Frame: A minimum of 5 generations of brood collection

How was it determined which species or geographic area to study?

- Johnson Creek represented the primary spawning aggregate of the EFSFSR population
- Spring/summer Chinook represented the species in Johnson Creek requiring hatchery intervention



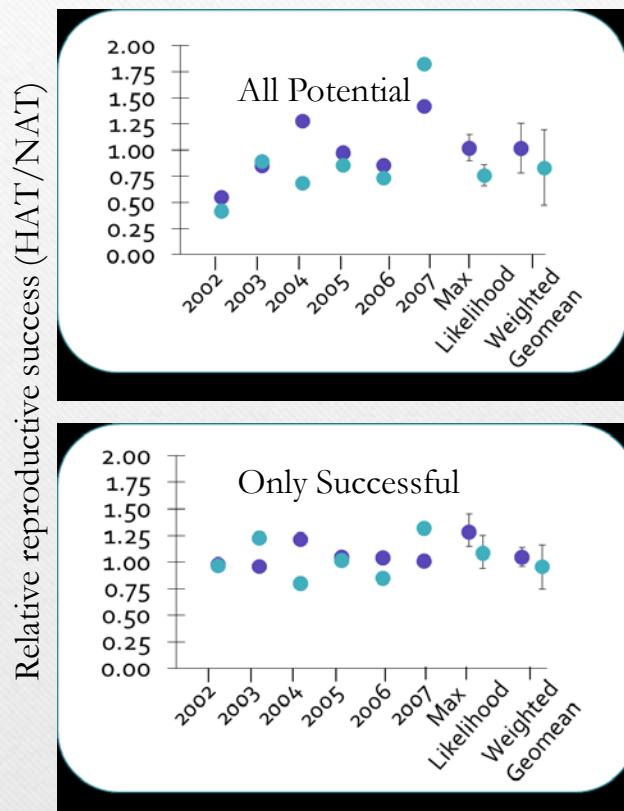
How does this effort work or collaborate with other RRS projects on aspects of the study (methodology, data and conclusions)?

- Collaboration between CRITFC geneticists and regional geneticists (e.g., IDFG)

How does density dependence factor in to this study moving forward?

- Density dependence does not have a bearing on this study moving forward

Were all hatchery returning adults measured equally?



- Hatchery rearing yielded fewer males that reproduced (possible sexual selection in action)
- Many hatchery jacks present, likely poor spawn success
- RRS estimates similar between hatchery and natural fish, no statistical differences (recognize some years with low power due to sample size; average annual 95% CI's ranged between 0.65 and 1.5)

● Females
● Males, age 4+

Is it necessary to continue studying this any further, and if so how long?

- Yes, based on the merits of this program
 - Cost, relative to benefit
 - JCAPE, a truly integrated program; others not so much