RRS Project Review

Project ID: 2009-009-00[1]

Title: Basinwide supplementation evaluation

Short Description: The Basinwide Supplementation Evaluation project was submitted by CRITFC as part of the Columbia Basin Fish Accords (2008). The Project was designed to implement a variety of actions in support of the Ad Hoc Supplementation Workgroup (AHSWG) recommendations, each associated with a tribal-managed program. The AHSWG recommended a three-pronged approach: 1) conduct treatment/reference (T/R) comparisons of long-term trends in the abundance and productivity of multiple supplemented (treatment) populations relative to un-supplemented (reference) populations, 2) conduct a series of relative reproductive success (RRS) studies to quantify short-term impacts through comparisons of productivity within brood years of hatchery origin (HO) and natural origin (NO) fish observed in programs to supplement depressed natural populations, and in programs where an extirpated stock has been reintroduced and supplemented with hatchery-reared fish, and 3) develop a request for proposals to fund several intensive small-scale studies designed to elucidate various biological mechanisms by which introduction of hatchery-produced fish may influence natural population productivity.

This project merged projects 2008-523-00, 2008-513-00, and 2008-522-00 effective on 1/5/2009, since all projects support supplementation evaluation.

Sponsor: Columbia River Inter-Tribal Fish Commission (CRITFC)

BiOp association: None are identified in CBfish.org

Is this an Accord project? Yes

Budget (2008 to present):

BPA	Grand Total		$5,154,382
	FY16		$ 929,081
Cost share	Grand Total		$ 91,500
		CTWSRO	$ 16,500 (2011 & 2012 combined)
		YCT	$ 38,500 (2011 & 2012 combined)
		CTUIR	$ 13,500 (2011 & 2012 combined)
		Nez Perce	$ 23,000 (2011 & 2012 combined)
	No cost share has been reported since 2012		

Proposal from last Categorical Review:
https://www.cbfish.org/Proposal.mvc/Summary/RMECAT-2009-009-00

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

Most recent Council recommendation:

https://www.cbfish.org/Assessment.mvc/CouncilRecommendationAssessmentSummary/Assessment/2009-009-00-NPCC-20110127

Date of most recent annual report available on Pisces/cbfish?
Basinwide supplementation evaluation, annual report covering 1/2015 – 12/2015. Submitted April, 2016

https://pisces.bpa.gov/release/documents/DocumentViewer.aspx?doc=P148171

Short summary of project reporting compliance: Sponsors were generally on time with all annual reports.

Summary of the scope of the project as it was reviewed by Council:
When proposed, there were four specific project objectives (with the total number of years projected for each Objective within the period of the Accords indicated in parentheses): 1) to use a Dual-Frequency Identification Sonars (DIDSONs) to obtain an estimate of the annual spawning escapement of the supplemented spring Chinook population upstream of the Castile Falls complex in the upper basin of the Klickitat River (4 years).

2) to complete development of a mark-recapture likelihood model which incorporates tag loss, including the uncertainty of the tag loss estimate, into the inference for population abundance (1 year)

3) to perform a relative reproductive success (RRS) study of NO versus HO salmon in a population associated with an ongoing supplementation monitoring and evaluation (M&E) program for which tissue samples have been collected but for which genetic analysis and estimation of RRS remains unfunded (10 years

4) to perform RRS studies of NO versus HO salmon in four to five different populations which have been reintroduced (following extirpation of the native population) and supported through hatchery supplementation (10 years)

Summary of the scope of the project now:

The contract for Year #8 includes the following Project Objectives:

Project Objective #1: to support RRS studies associated with spring Chinook supplementation programs, including the Nez Perce Tribe (NPT) managed Johnson Creek Artificial Propagation Enhancement Project (JCAPE), and the Yakama Nation and Washington Department of Fisheries co-managed Yakima-Klickitat Fisheries Project.

Project Objective #2: to support RRS studies associated with spring Chinook salmon reintroduction/supplementation programs including the NPT managed program in Newsome Creek (South Fork Clearwater River) and the Confederated Tribes of the Umatilla Reservation (CTUIR) managed

program in Lookingglass Creek (Grande Ronde River). Also, we continue to evaluate possibilities for support of studies in additional tribal reintroduction and supplementation programs.

Project Objective #3: to assess productivity of sockeye salmon that have been reintroduced in the Deschutes River/Lake Billy Chinook/Metolious River/Suttle Lake system as part of a Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) project, and in the Yakima River/Cle Elum Lake system as part of a Yakama Nation (YN) project.

Project Objective #4: to assess the effect of hatchery broodstock parent age on fry length and on proportion of premature maturation of male progeny (minijack production)

Project Objective #5: to assess stock-recruitment relationships associated with tribal supplementation programs

Project Objective #6: to conduct two Introduction to Genetics Analyses in Tribal Fisheries Management training programs.

Project Objective #7: to participate in regional forums for review of hatchery effects on natural populations

Project Objective #8: to prepare manuscripts for submission to peer-reviewed scientific journals

Has the scope of this project changed significantly since it was reviewed? The scope has evolved and is more defined, but has not changed significantly.

Link to ISRP/AB Critical Uncertainties Appendix D review:

http://www.nwcouncil.org/media/7149871/isabisrp2016-1appendixd.pdf#page=138

Comments: This project supports the genetics portion of the RRS studies that are already included in the existing list (1996-043-00 Johnson Creek , 1995-063-25 Yakima River), as well as three other populations: Hood River spring Chinook, Lookingglass Creek spring Chinook, and Newsome Creek spring Chinook. It also includes the assessment of re-introduced Sockeye populations to the Yakima and Deschutes rivers. The work has lead to several peer-reviewed publications and are likely to produce several more in the near future.

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:

- Where does the project stand regarding the original four objectives mentioned in *Summary as Reviewed by Council* section?
- This is year eight of a ten year study. Is the project on track to finish in 2 years and what products are anticipated to summarize the insights or outcomes for each of the currently envisioned eight objectives?

Basinwide Supplementation Evaluation

BPA Project # 2009-009-00

Peter F. Galbreath
Columbia River Inter-Tribal Fish Commission

I - Project Objectives

Use assessments of escapement, genetic stock identification (GSI), productivity and relative reproductive success (RRS) to supplement evaluations of Columbia River treaty tribe programs for reintroduction and/or supplementation of anadromous fish populations

- tissue sampling and collection of biodata already occurring as part of tribal program M&E
- project supports equipment and laboratory costs, and salary costs for analyses conducted by CRITFC personnel with expertise in biometrics, modeling and genetics

NPCC Fish & Wildlife Program (2014)

- Three.4.B - Fish Propagation Including Hatchery Programs (p.76)

  Use hatchery programs *(segregated and integrated)* as tools to help meet the mitigation requirements of the Northwest Power Act

- Three.4.C.2 - The use of hatcheries for reintroduction (p.82)

  The purpose of reintroduction is to return lost salmon and steelhead into blocked areas or to re-establish populations in watersheds accessible for anadromy but where the native population had been extirpated or the risk of extirpation is very high.

- Three.4.C.6 – Lamprey (p.94)

  Implement actions that result in increased abundance and survival for lamprey, including habitat actions, dam operations and passage, monitoring populations, and research to improve understanding of how the development and operation of the Federal Columbia River Power System affect migration success, survival and growth of lamprey.

Critical Uncertainties – ISAB/ISRP Report 2016-1

1. What is the relationship between basinwide hatchery production and the survival, fitness, and growth of naturally produced fish in freshwater, estuarine, and ocean habitats?

2. What is the magnitude of any demographic benefit to the production of natural origin juveniles and adults from natural spawning of hatchery origin supplementation adults?

3. What is the potential role of lamprey propagation and translocation as a way to mitigate for lost lamprey production when passage and habitat improvements alone are insufficient to restore lamprey populations? Specifically, can artificial propagation be used to supplement and restore depressed populations of Pacific lamprey?

5. What are the range, magnitude, and rates of change of natural spawning fitness of integrated (supplemented) populations, and how are these related to management rules, including the proportion of hatchery fish permitted on the spawning grounds *(pHOS)*, the broodstock mining rate, and the proportion of natural origin adults in the hatchery broodstock *(pNOB)*?

II - Abundance estimation studies

1. Use of a Dual-Frequency Identification Sonar (DIDSON)

- Spring Chinook to the upper Klickitat River watershed - upstream of Castile Falls fishway

2. Development of a full likelihood model for abundance estimation with mark-recapture data

- Kokanee escapement from Lake Billy Chinook to Metolius River

III - Introduction to Genetics in Tribal Fisheries Management

- 2-day workshops at the CRITFC molecular genetics laboratory, Hagerman Fish Culture Experiment Station, Hagerman ID
- Review vocabulary and principles of genetics and inheritance, and of basic analytical techniques.
- 2012 to 2016: 9 workshops, 86 tribal fisheries technicians, biologists and managers

IV - Precocial male maturation

1. Effect of parent age on minijack rate

- A 3 broodyear (2014 to 2016) study underway - factorial matings of NOR broodfish: females age 4 and 5 X males ages 1 (precocial parr), 3 (jacks) 4 and 5
- Progeny reared to smolt stage
- Blood samples assayed for 11-ketotestosterone to assess maturation status; genetic parentage to identify groups of full-male siblings
- Results for initial broodyear in 2017

2. Effect of parent age on age at maturity

- Analyze data from RRS studies to assess age of parents with age of progeny

V - RRS of Supplemented Populations

- Two RRS studies of spring Chinook supplementation programs ongoing – Johnson Creek and upper Yakima River
- Programs unique - broodstock are both in-basin origin and fully integrated - 100% NOR
- Many reports of RRS have involved programs using out-of-basin source stock, and typically only partially integrated

1. Johnson Creek (South Fork Salmon River)

- Initiated juvenile-to-adult RRS study (BY2007 to BY2011) in parallel with ongoing adult-to-adult RRS study
  - Are juvenile-to-adult RRS results similar to adult-to-adult RRS?
  - Does increased sample size for juveniles permit improved analysis for effects of sex, age/size, return time, etc., in addition to effect of origin?

2. Upper Yakima River

- See presentation by Bill Bosch - Yakama Nation/YKFP
- Initiated collaborative (WDFW, CRITFC) adult-to-adult RRS study for 5 broodyears 2007 to 2011 – will require approx. 50,000 samples
- Results for BY 2007 in 2017

VI - Evaluation of Reintroduction Programs

- Tribal programs to reintroduce where indigenous populations extirpated, generally via stocking of juveniles from out-of-basin hatchery stocks
- Expectation - fish will adapt to new environment over successive generations, as might be inferred by observation of:
  - return and natural spawning of HOR fish
  - increase in escapement, redd count, range of spawning area
  - increase in ad NOR juvenile abundance, and in %NOR in adult escapement
  - greater productivity of NOR fish (produced from natural spawning of reintroduced fish): $(RS_{NOR})/(RS_{HOR}) > 1$
- If adaptation via natural selection apparent, to what extent does this allay fears of deleterious domestication effects associated with supplementation programs?

1. Reintroduction of coho salmon

- Tribal programs reintroduced out-of-basin HOR coho in Yakima, Wenatchee, Methow, Umatilla and Clearwater rivers
- HOR + NOR returning, spawning naturally, expanding range
- Broodstock now 100% in-basin returns; initiated inclusion of NOR
- Galbreath, P. F. M. A. Bisbee Jr., D. W. Dompier, C. M. Kamphaus, and T. H. Newsome. 2014. Extirpation and Tribal Reintroduction of Coho Salmon to the Interior Columbia River Basin. Fisheries 39(2):77-87.

2. RRS of reintroduced spring Chinook salmon in Newsome Creek (South Fork Clearwater River)

- Samples from adults and juveniles collected for RRS study of NOR and HOR began 2008
- To present, changes in management approach and limited adult return numbers preclude clear RRS evaluation;

3. RRS of reintroduced spring Chinook in Hood River

- Adult-to-adult RRS for broodyears 1992 through 2005
- Reintroduced stock of interior stream-type genetic lineage (IST), but lower Columbia (LC) genetic lineage fish also observed – apparently natural colonizers
- NOR fish demonstrate higher productivity than HOR within both males and females, and within both the reintroduced IST fish and LC fish; LC fish demonstrated higher productivity than the IST fish
- Larger size and later return time (within both NOR and HOR) associated with higher fitness
- Higher productivity of NOR conforms with expectation that introduced HOR stock likely adapting to the new habitat

4. RRS of reintroduced spring Chinook salmon in Lookingglass Creek (LKG; Grande Ronde River)

- Indigenous population extirpated; out-of-basin stock (Rapid River) introduced and propagated at LKG hatchery
- 1998 initial spawning of new in-basin Catherine Creek stock at LKG Hatchery
- Out-of-basin adults culled at LKG weir 2001-2003
- Beginning 2004 adults passed upstream
- First 4 year old NOR LKG returns in 2008
- Tissue sampling of juvenile out-migrants and returning adults
- Juvenile-to-adult RRS study (BY 2008 to 2014) in progress - results in 2017; adult-to-adult RRS to follow

5. Cle Elum Lake-Cle Elum/Yakima rivers

- 2009 Yakama Nation initiated reintroduction via translocation of adults captured at PRD
- Adults a mix of 25% Wenatchee and 75% Okanogan stock
- 2011 initiate tissue sampling of post-spawn carcasses, juvenile out-migrants, and returning adults
- Genetics analyses show:
  - temporal segregation for spawn timing: early = Wenatchee, late = Okanogan
  - essentially zero inter-stock "hybrids" among juveniles
  - stock ratio of juveniles approx. 50%-50%
  - insufficient data yet to asses adult return proportions
- Results will inform approach to reintroduction into other Yakima Basin lakes (Bumping, Keechelus, Kachess) and Rimrock Res.

VII – Evaluation of tribal programs for restoration of Pacific lamprey

- Project has initiated support to expand genetic studies associated with tribal programs for monitoring, artificial propagation and translocation of Pacific lamprey
- Estimate effective population size of natural populations based on genetics analysis of juvenile sample sets
- Use parentage analysis to monitor stage-specific productivity in artificially spawned progeny groups
- Use parentage analysis to monitor spawning patterns and relative productivity of translocated adults, and to monitor juvenile growth and age within broodyears