Independent Scientific Review Panel
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Memorandum (ISRP 2009-19) **May 22, 2009**

To: W. Bill Booth, Council Chair

From: Eric Loudenslager, ISRP Chair

Subject: Review of Accord proposal, Basinwide Supplementation Evaluation – Phase I (2009-009-00)

Background

At the Council's March 26, 2009 request, the ISRP reviewed the Columbia River Inter-Tribal Fish Commission's (CRITFC) Accord proposal, Basinwide Supplementation Evaluation – Phase I (2009-009-00). Some of the project tasks include actions that support recommendations from the Ad Hoc Supplementation Workgroup (AHSWG) for implementation of a basinwide evaluation of the long term effects of supplementation on productivity of natural anadromous salmonid populations in the Columbia River Basin.

For the first year (Phase I) of the 10-year project, four specific project objectives are identified:

1. use a pair of Dual-Frequency Identification Sonar (DIDSON) to obtain an estimate of the 2009 natural spawning escapement of spring Chinook in the upper basin of the Klickitat River,
2. complete development of a mark-recapture likelihood model which incorporates tag loss into the inference for population abundance,
3. initiate a relative reproductive success study in a project chosen from among supplementation monitoring and evaluation (M&E) programs for which tissue samples have been collected but for which genetic analysis and estimation of relative reproductive success remains unfunded, and
4. initiate studies to obtain estimates of relative reproductive success of natural-origin versus hatchery-origin salmon which naturally spawn for four to five different populations which have been reintroduced (following extirpation of the native population) and supported through hatchery supplementation.

On an administrative note, the integrated project combines three projects previously identified separately under the Columbia Basin Fish Accords (Accords 2008), whose tasks are found within one or more of the integrated Project Objectives:

Original Accord Title	Original Project Objectives	Tasks within 200900900
Improved Escapement Estimation	2008-513-00	Objectives 1 and 2
Basinwide Evaluation of Supplementation Benefits and Risks	2008-522-00	Objectives 3 and 4
Supplementation Monitoring	2008-523-00	Objective 4

In November 2008, we reviewed the supplementation monitoring proposal, 2008-523-00, and requested a response on a few issues. Our review of CRITFC's response to those issues is incorporated into our review of the combined proposal, under comments on Objective 4.

ISRP Recommendation

Objective 1. Use Dual-Frequency Identification Sonar (DIDSON) to estimate natural escapement of spring Chinook salmon above Castile Falls, Klickitat River – RESPONSE REQUESTED

Objective 2. Complete development of mark-recapture likelihood model which incorporates tag loss – MEETS SCIENTIFIC REVIEW CRITERIA (QUALIFIED)

Objective 3. Perform relative reproductive success study of NO versus HO salmon in population associated with an ongoing supplementation project – MEETS SCIENTIFIC REVIEW CRITERIA (QUALIFIED)

Objective 4. Perform relative reproductive success studies of NO versus HO salmon in four to five reintroduced salmon populations [Phase I] – MEETS SCIENTIFIC REVIEW CRITERIA (QUALIFIED)

Review Summary

Objective 1. The installation and use of DIDSON to estimate salmon escapement at Castile Falls is not adequately linked to the specific monitoring of salmon supplementation in the Klickitat river (as identified in the Klickitat Anadromous Fisheries Master Plan, Klickitat subbasin plan, or in YKFP-Klickitat Subbasin Monitoring and Evaluation Project 199506335) or to the general monitoring of supplementation in the basin (AHSWG 2008) to be justified within this proposal.

The project proposes to install two DIDSON at Castile Falls in 2009 for testing, and contingent upon the results, employ them in 2010 and 2011 to gather data on adult spring Chinook escapement into the upper portion of the Klickitat subbasin. Preliminary work with DIDSON in the Klickitat River just above the Klickitat Hatchery was not encouraging. More important, however, is that an unspecified monitoring system will be in place at Castile Falls for the 2011 salmon migration season. The proposal did not suggest that DIDSON was being considered and that this was a test to evaluate its suitability. In fact, the plan is that in 2011 both the DIDSON

and this yet to be decided system would both be operated as a method to validate the new system. There is no description of the spring Chinook supplementation program in the Klickitat and identification of how this data is needed to monitor it. According to the recently approved Klickitat Anadromous Fisheries Master Plan, hatchery-origin adult spring Chinook will be captured at Lyle Falls, the Klickitat Hatchery, and Castile Falls and transported and released for natural spawning in the upper subbasin. How the DIDSON data will contribute to monitoring this program is not mentioned. The figure on page 6 is confusing because it identifies three proposed acclimation sites above Castile Falls. At this time spring Chinook adults are planned to be direct released, and steelhead are going to be permitted to naturally colonize the upper subbasin following passage improvements at Castile Falls.

Objective 2. The project proposes to complete development of a mark-recapture likelihood model for estimating tag loss rate and spawning escapement. The model incorporates uncertainty associated with tag loss estimates into the subsequent estimation of abundance and the variance of the abundance estimate. The purpose is to provide a better estimate of the uncertainty associated with abundance estimation attributable to tag loss prior to fish recapture. The proposed objectives are to create a more user-friendly version of the current model and to present the model in oral and written formats.

It is not clear from the proposal how beneficial the binomial-hypergeometric model is compared to commonly used methods although initial results look promising (CRITFC Technical Report #08-07). It is also not clear how different the results from this approach are compared to other work that considers tagging failures in estimation (e.g., Townsend et al., JABES, Volume 11, 2006). The ISRP qualifies its recommendation for objective 2 concluding that the model development should include an evaluation of the benefits of the binomial-hypergeometric likelihood model using real or realistic data. In addition, the written and oral presentations of the model should evaluate how different the approach and results are compared to other work that incorporates tagging failures. In addition, a briefing to the ISRP by the sponsors would be welcome.

Objective 3. During the planning for ISRP review of MOA proposals, there was agreement that proposals that were reviewed and received affirmative ISRP recommendations (Fundable, Fundable (In Part), Fundable (Qualified), etc) during the FY 2007-09 solicitation, but not funded did not need to be reviewed before being initiated. Consequently, any of the technically adequate proposals that included tasks to evaluate relative reproductive success are eligible for initiation contingent upon satisfaction of any “In Part” and “Qualified” modification of the proposals.

For example, the proposal identifies the following proposals or projects where the relative reproductive study for ongoing supplementation projects may be accomplished:

- Project No. 200303900 - Monitor Reproduction In Wenatchee/Tucannon//Kalama (ISRP FY 2007-09 recommendation: fundable)
- Project No. 200729900 - Investigation of the Relative Reproductive Success of Stray Hatchery and Wild Steelhead and the Influence of Hatchery Strays on Natural Productivity in the Deschutes River Subbasin (ISRP FY 2007-09 recommendation: fundable (qualified))
- Project Proposal No. 200725000 - Genetic Evaluation of Chinook Salmon Supplementation in Idaho Rivers (ISRP FY 2007-09 recommendation: fundable)

- Project No. 199604300 - Johnson Creek Artificial Propagation Enhancement Project (ISRP FY 2007-09 recommendation: Fundable in part)

The sponsors of any of these projects or other ongoing Fish and Wildlife Program project should confirm willingness to cooperate as part of the objective's implementation.

If a stream or other task not covered by a reviewed proposal is under consideration to implement Objective 3, then full review by ISRP is needed.

Objective 4. The proposal to initiate relative reproductive success studies of spring Chinook and coho salmon reintroduced into watersheds where these species have been extirpated was reviewed by the ISRP, in December 2008, as a stand-alone proposal (200852300: Relative reproductive success of reintroduced Columbia River salmon populations – Phase I). The ISRP concludes that relative reproductive success investigation of reintroduced salmon has the potential to contribute to our understanding of the demography of the reintroduced populations and potentially the evaluation of re-adaptation to natural environments. In the December 2008 review, we raised four concerns with the proposal, two that we thought should be dealt with before the investigation begins, and two that could be addressed while the project was underway.

The first ISRP concern was whether the computational approach, together with the experimental setting (number of adults of different genetic backgrounds spawning and the total number of recruits they produce) were sufficiently sensitive or powerful (in a statistical or analytical sense) to measure a differential fitness signal among the primary treatment groups (HORs and NORs). The sponsor addressed this concern by briefly summarizing a GLM approach that would evaluate the number of adult progeny as a response variable with origin (HO, NO), sex, size, and run timing of the adults as explanatory variables. The additional information provided is not entirely satisfactory.

The sponsor has focused the proposal on "fitness" effects and re-adaptation of reintroduced salmon. The proposal argues that the comparison is among three treatment groups: (a) out-of-basin HO: (b) versus in-basin HO: versus (c) NO fish (page 33). The explanation provided does not address how the analysis will sort out the confounding genetic and environmental effects (and their potential interaction) using this design. Any difference in relative reproductive success or performance between HO and NO fish will include both genetic effects and juvenile rearing environmental effects. The terms "fitness" and "adaptation" imply that these can be teased out to permit robust assessment of these as treatment effects. If the out-of-basin HO and in-basin HO fish are not reared in a common environment then there will be additional environmental effects that need to be sorted out. The genetic differences between in-basin HO and NO fish in each generation (brood year) will reflect the combined environmental and genetic effects of single generation of selection in the natural versus hatchery environment in the reintroduction site. Interpreting the difference in relative reproductive success between these two groups as adaptation following reintroduction is not correct. The in-basin hatchery line (in-basin HO) and in-basin natural line (NO fish) will be a single population with two rearing phases, and the two phases will be approximately one generation apart relative to the extent of natural versus hatchery rearing in the introduced environment. For the question of adaptation, the contrast would be a comparison of the reintroduced fish with the original founding population, not a comparison of in-basin HO versus NO fish as the program evolves.

Furthermore, the ISRP is requesting clarification on "what difference in fitness is this experimental design capable of detecting?" The sponsor identifies that the statistical sensitivity will be determined by the sample size (limited by run size and capture efficiency), parentage assignment rate, and the magnitude of productivity differences between the parental types. The ISRP had hoped the sponsor would provide the productivity differences that could be detected under a range of likely return and assignment rate assumptions (based on previous run sizes and return rates or good v. bad ocean years, and so on). A power analysis using a reasoned range of sample sizes should be performed. Even without an experimental design sensitive enough to detect fitness differences, it is likely that much could be learned about the demography of the reintroduced population.

Because the ISRP anticipates there could be logistical challenges in completing an analysis of relative reproductive success that would provide for a robust interpretation of the fitness differences between fish with different pedigrees, we qualified the earlier review with the suggestion that the Hood River spring Chinook reintroduction effort be used as a "proof-of-concept" trial to genotype fish, and conduct the analysis. We really were not criticizing whether the approach "would not" work, but rather whether the approach "could" work for this circumstance – therefore a small step in generating real data that show the entirety of the method will lead to data that can answer the question. This incremental first step is viewed to be critical for establishing whether the approach is actually feasible in this case.

The ISRP also requested a summary of the stocking and return history for spring Chinook in the Hood River and a description of the analysis before beginning. The sponsor provided a summary of the total escapement and recruits by brood year (page 32), and the NO and HO escapement are identified. The HO escapement may consist of both in-basin and out-of-basin individuals, and specific identification of the progeny from these groups are needed to test the hypothesis: out-of-basin HO < local HO < local NO (page 33). The summary did not, however, confirm that the HO escapement was identified as to in-basin and out-of-basin, so we are unable to evaluate whether the proposed contrast is possible.

The table on page 32 reinforces the ISRP concerns. The NO recruits for many brood years are quite small, and the spawning escapement much greater. In relative reproductive success studies the proportion of fish that are not assigned to any parents can be 20 – 30%. If this is the case in this investigation, the sample size of the recruits to be assigned is potentially limiting the sensitivity of the assessment.

Consequently, the ISRP continues to believe the Hood River spring Chinook samples should be used as a "proof-of-concept" before expanding the laboratory analysis to other reintroduced populations. Collecting tissues in other locations is appropriate. The ISRP also qualifies the recommendation for this objective with the recommendation that a more complete summary of the potential analysis be completed before beginning the genotyping.

A component of this objective is to hold a workshop/symposium on the efforts to reintroduce salmon into extirpated watersheds in the Columbia River basin. The ISRP recommended that this symposium be co-sponsored by an independent fisheries or conservation organization (perhaps the American Fisheries Society), and that it should follow the "proof-of-concept" Hood River evaluation. The sponsor concurred with the ISRP suggestion to co-sponsor a larger-scale symposium but wished to proceed with a tribal workshop to determine likely candidate populations first. The sponsor's reply is reasonable.