



**Independent Scientific Review Panel**  
for the Northwest Power & Conservation Council  
851 SW 6<sup>th</sup> Avenue, Suite 1100  
Portland, Oregon 97204  
[www.nwcouncil.org/fw/isrp](http://www.nwcouncil.org/fw/isrp)

**Memorandum (ISRP 2009-39)**

**September 28, 2009**

**To:** W. Bill Booth, Council Chair

**From:** Eric Loudenslager, ISRP Chair

**Subject:** Final review of the Yakama Nation's Upper Columbia Kelt Reconditioning Program, #2008-458-00, an Accord Proposal

## **Background**

This memo is the ISRP's final review of the Yakama Nation's proposal, Upper Columbia Kelt Reconditioning Program, #2008-458-00. This project is called for in the Columbia River Fish Accords. This project proposes "to take advantage of iteroparity in natural-origin (NOR) steelhead populations to increase the abundance of NOR spawners by enhancing the survival of post-spawning females (kelts) intercepted at various locations in the UCR [Upper Columbia River] at seaward migration... This project will initiate a kelt reconditioning program in the UCR to collect kelts, recondition them in captivity under two treatment protocols, monitor a set of variables related to condition and reproductive state, and track their post-release contribution to natural spawner abundance."

On December 15, 2008, the ISRP completed its initial review of the original proposal and sent a memo to the project sponsor requesting additional information that would allow us to complete our scientific review. In that review, we recommended that:

Based on the results-to-date from kelt reconditioning efforts, the ISRP questions whether this recovery strategy is efficacious and whether the fundamental assumptions of a benefit from kelt reconditioning are adequately reasoned. In any case, the experiments outlined in this proposal are insufficient to generally address the primary uncertainties underlying kelt reconditioning as a restoration tool, or specifically to provide a benefit in the proposed setting. Although kelt reconditioning is an inherently attractive proposition even to the reviewers, it may be time to reevaluate the effort being dedicated to this strategy. If there is empirical evidence in support of kelt reconditioning as a restoration tool that was not presented in this proposal it should be brought to the attention of the ISRP in a revision.

On May 8, 2009, we met with the Yakama Nation to primarily discuss their Mid-Columbia Coho project, but we also discussed the Accord kelt project. This discussion led to correspondence between the Yakama Nation and the ISRP on the project's purpose and potential approaches to pursue in the proposal revision process, including an examination of alternative study designs.

The Yakama Nation revised their initial proposal in response to our December 2008 review and our discussions and correspondence in 2009. On August 24, 2009, the Council requested our review of the revised proposal. Our review of the revised proposal follows below.

## **ISRP Recommendation**

### *Does Not Meet Scientific Review Criteria*

The proposal does not meet review criteria because the overall assumed benefits to steelhead NOR abundance (or other VSP criteria) has not been established, the specific objectives in the proposal are inconsistently described, and the evaluation methods are not sufficiently detailed to determine the ability to measure any benefit that might occur.

The ISRP believes that if further consideration is given to kelt reconditioning as a recovery strategy the appropriate beginning point is a review of iteroparity in UCR steelhead leading to simulation and recruitment analysis that includes historical and current rates of iteroparity, potential benefits of using reconditioned kelts, and the effect of altering the rates of iteroparity on steelhead life-history. This would serve the important function of identifying the potential benefit to steelhead VSP metrics that would need to be produced using kelt reconditioning as a recovery strategy and quantified during implementation. This background effort has not yet been completed.

## **Review Summary**

The proposed work appears to be based on the supposition that the kelt reconditioning completed by the Yakama Nation at the Prosser facility on the Yakima River has worked and can be replicated on the Upper Columbia. Evidence that kelt reconditioning works (i.e., contributes to NOR productivity) remains to be demonstrated. The proposal includes a more comprehensive summary of Yakama Nation results to date than was previously provided. In the view of the ISRP these results are discouraging. It was frustrating that the proposal focused on the observation that survival to release was high but then largely ignored that return to Bonneville of those in the short-term program was 0 in each of the last three years. (Table 4 on page 8 says zero fish returned to Bonneville, but also gives a 1% return to Bonneville in 2005.) In addition, it is not apparent from the presentation in the proposal that fish from the long-term program reached the spawning grounds or successfully spawned.

Before another study is undertaken to establish this same result, it should be adequately designed to provide evidence that reconditioned kelps can successfully spawn and produce viable offspring and yield an increase in NOR steelhead in the following generation. Based on the empirical results to date and the uncertainty associated with the strategy, it makes more sense (perhaps) to repeat the Prosser study downriver, where higher return rates have been observed or are expected. That would enable the adaptive adjustments needed to design an effective reconditioning program (or its abandonment as a viable approach). Instead, the proposed effort, upriver above additional dams, would be expected to show lower rates of return as a background

baseline than that for Prosser. This expectation along with the absence of analytical power from low sample sizes creates a substantial level of intractability – that is, the ISRP is not convinced the project proponents will be able to adequately judge whether the projects objective(s) have been met.

Because available data demonstrate a trend toward decreasing iteroparity rates upriver, the UCR steelhead population may have low rates of iteroparity. As a life-history trait, iteroparity varies among and within the basin's steelhead populations for reasons that are not well understood. It is doubtful this work as designed would shed light on this uncertainty or assist with recruitment. Simply putting more adult steelhead on the spawning grounds does not ensure enhanced natural recruitment and, in fact, may do the opposite. Artificial reconditioning may alter maturity and spawning dates (as seen when smolts, parr, or sub-adults have been used for supplementation) thus adding little, or negatively, to recruitment.

As currently prepared, the proposal does not adequately discuss what technical, biological, and environmental uncertainties may preclude completing implementation, or the challenge in evaluating potential benefits to the abundance of the natural population. To the ISRP it appears that in the UCR there is uncertainty about obtaining kelts, uncertainty about the reproductive functioning of reconditioned kelts, and uncertainty about recovering data on the fate of reconditioned kelts that are released. Implementing kelt reconditioning as a recovery strategy and attempting to evaluate the recovery by comparing the return rate, spawning distribution, and spawn timing of reconditioned versus un-reconditioned NOR kelts require some additional proof of concept, feasibility investigations, and pilot trials to demonstrate that broader implementation and evaluation is justified.

For the current proposal, it is not clear how many NOR kelts may actually be available (and the critical issue is the number of females). On page 17, the proponents state that they expect that most of the kelts would be Wenatchee and Methow NOR steelhead obtained at Wells Fish Hatchery after live-spawning. However, some number of fish that are spawned will need to be killed for virology testing, and the sampling program has yet to be designed. The number of Wenatchee NOR steelhead females (Table 6 page 17) averages 40 fish, and the number of Methow NOR steelhead females (Table 6 page 17) averages only 20 fish. Table 7 on pages 17 and 18 provides numbers of steelhead kelts encountered at Rocky Reach and Rock Island Dam bypass systems, but the numbers of NOR kelts are not given. The number of kelts ranges from 14 to 77. The text states that these numbers of kelts are not representative of the current operations at the bypass facilities, but no indication of the likely numbers of NOR kelts (by sex) is provided. Obtaining kelts from rotary-screw traps is mentioned, but no estimates of numbers are given. And the proponents indicate that logistical problems make this option the last choice. It seems that the one task is to await a decision on the virology sampling and begin a realistic assessment of the fish that are available from alternate sources.

From the current proposal, it is also unclear what the likelihood is of detecting reconditioned kelts once they are released. The primary effort is to detect PIT tagged kelts, and there is an extensive array of detectors at passage facilities and tributary streams. No information is provided on the detection rates at these locations for adult salmon and steelhead. Either existing data or feasibility investigations using adults of any migrating species are required to establish

the detection capabilities of the system of arrays. This information is needed to design any future kelt release program that would be considered.

The potential benefit to steelhead adult abundance from releasing re-conditioned kelts depends on the quality of the gametes produced by kelts. Only two studies of gamete quality, with one comparing reconditioned individuals and anadromous individuals are provided in the proposal. In both studies the results raise concerns. Given the history of rearing rainbow trout in captive culture and the Abernathy Fish Technology Center experience raising adult steelhead from wild-caught fry, there is no reason to believe reproductively competent adults are unlikely. Nonetheless, it is important at this stage of the development of kelt reconditioning to establish the viability of gametes from the parents. This quality control/quality assurance documentation should be incorporated into the experimental design.

It seems premature to evaluate some of the finer points of kelt reconditioning before it has been established that the procedure succeeds in bringing more fish back to the spawning grounds.

The technical aspects of the presentation related to fish culture and tests of such culture options appear well organized with sufficient detail.

In any revised proposal, objectives and tasks should be focused on feasibility investigations. Broad implementation of the kelt reconditioning strategy and new facility construction are not warranted until completion of the feasibility studies and peer review of evaluations.

The ISRP understands that the ISAB is scoping a potential review of the management and research implications of kelt and other salmonid life-histories. This ISAB review should inform kelt reconditioning strategies in the Basin, including this project. The ISRP thinks completion of this type of a comprehensive review of kelt management strategies, whether by the ISAB or others, is needed before extensive kelt programs are implemented in the Basin.

## **ISRP Comments**

### *1. Technical Justification, Program Significance and Consistency, and Project Relationships (sections B-D)*

This project proposes to enhance the survival of post-spawning steelhead (kelts) intercepted at various locations in the UCR at seaward migration. The strategy is take advantage of iteroparity in natural-origin (NOR) steelhead populations to increase the abundance of NOR spawners by reconditioning post-spawned fish in a captive environment by reinitiating feeding, rehabilitating muscle tissue, and redeveloping mature gonads.

The proposal states, “This project will initiate a kelt reconditioning program in the UCR to collect kelts, recondition them in captivity under two treatment protocols, monitor a set of variables related to condition and reproductive state, and track their post-release contribution to natural spawner abundance.” There actually is only one active treatment protocol, long-term reconditioning. A control group has been defined in this proposal. References made to short-term

reconditioning in the proposal confuse the issue. For example, “**Evaluation 1:** Quantify the relative rate of repeat spawning by UCR steelhead in each reconditioning treatment relative to rates for non-reconditioned kelts.”

The project proponents note that, “Several related projects within the Columbia Basin have shown that kelt survival and contribution to naturally-spawning populations can be increased by “reconditioning” in captivity.” If this is the case, why is this study necessary? Were the other studies flawed? If so how will this study avoid the flaws present in previous studies?

The proponents claim that this project could add up to 250 NOR adults should be justified in the proposal by describing under what circumstances this number is attainable. The proponents should also justify why the addition of 250 NOR adults is an adequate goal.

The bottom line is whether kelt reconditioning can or will increase natural abundance of the endangered UCR steelhead ESU. The proponents will need to demonstrate first that this method has the capacity to add NOSs to the spawning grounds and increase overall production before undertaking this on a broad scale. While the proponents should be acknowledged for trying to increase NOR and NOS and capture life-history diversity, it is unclear that the general method and approach can achieve the deeper desired outcomes.

Also, the proposal implies that iteroparity has a genetic component and that decreases in the contemporary rate of iteroparity, attributed to greater than historic mortality owing to the hydropower system, could be leading to a loss of genetic and life-history diversity. An alternative interpretation of the reduction in the contemporary rate is that iteroparity is a facultative response of surviving an energetically expensive activity such as spawning. Moreover, even if there is a genetic component, are the appropriate individuals in the population being selected? If the adults selected are not genetically predisposed to iteroparity and would not normally be iteroparous this might lead to selection against it.

Questions to be considered by the proponents:

- Does an increase in iteroparity address or overcome one or more of the critical limitations to the populations in question?
- Does iteroparity affect mean life time fecundity and effective population size?
- Does reconditioning increase number/rate of iteroparous adults returning to spawn, and do these adults contribute additively to natural productivity?
- Under multiple “success” scenarios for reconditioned kelts surviving and returning, what will be the NOR productivity benefit (percentage of current or baseline productivity)?

## *2. Objectives, Work Elements, and Methods (section F)*

The stated objectives are:

Objective 1: Implement a kelt reconditioning program in the UCR to increase NOR spawner abundance relative to current conditions.

Objective 2: Evaluate kelt survival and program effectiveness.

Objective 3: Collaborate with ongoing M&E studies to document the reproductive success of kelts released from the reconditioning program

There seems to be some confusion about what is being proposed in this revised submission. The proponents claim that the primary aim of this kelt reconditioning program is to evaluate the survival of kelts under alternative reconditioning treatments. Project performance measures will focus on the relationship between reconditioning protocols and post-release survival of reconditioned kelts. Do these reconditioning protocols include the control group with no reconditioning? It is not clear if short-term reconditioning is still being considered despite the statement made in this proposal, “At this point in time we are not including a short-term reconditioning program within this proposal.”

In the Columbia River Basin, workers observing the hundreds to thousands of kelts passing mainstem hydroelectric facilities each spring have come to the sensible conclusion that these fish represent a significant opportunity to aid the recovery of steelhead populations.

A study by the Yakama Nation indicates that the survival of long-term reconditioned kelts ranged from 19.6% to 61.8%, with an average survival to release of 35.7% (Branstetter et al. 2006). These survival rates are more than five times greater than the return rates for short-term kelts and over 20 times the rate of repeat spawning for UCR kelts not taken into captivity.

The proponents acknowledged that increasing spawner abundance does little to promote recovery if reconditioned spawners do not produce viable offspring and that the successful production of viable offspring by reconditioned female kelts remains undocumented.

The meaning of the statement that, “few would argue that kelt reconditioning represents a valuable opportunity to avoid the uncertainties of hatchery intervention in the enhancement of NOR populations” is not clear but seems to argue against kelt reconditioning.

There are genetic concerns despite the statement that, “Because reconditioned kelts will spawn in natural conditions, we do not expect any genetic divergence of their progeny.” One concern is raised by the explanation that, “Based on empirical data of kelt survival within the program, the fish condition score may eventually be used to determine which fish are suitable for inclusion into the reconditioning program and control group, or to evaluate potential reasons why one group may have had a higher or lower survival rate.” If the strongest fish are selected for reconditioning then there is no valid control group because the control group is biased toward those in poor condition.

*3. M&E (section G, and F)*

Generally inadequate. The evaluation of success is stated as a comparison of the relative proportions of reconditioned kelts and non-reconditioned kelts that return to the point of collection. But elsewhere the successful endpoint is different. Specifically, the proponents identify hypotheses and measured variables that are inconsistent with the limitation of the proposed study.

## **Hypothesis:**

**Ho<sub>1</sub>:** Repeat spawner rate<sub>reconditioned kelts</sub> > Repeat spawner rate<sub>control group</sub>

## **Measured Variables:**

- The number of kelts entering the reconditioning program
- The number of non-reconditioned PIT tagged kelts sampled and released.
- The number of long-term reconditioned kelts released and subsequently detected ascending upstream to spawning grounds
- The number of non-reconditioned PIT tagged kelts returning and subsequently detected ascending upstream to spawning grounds.

## **Derived Variables:**

- The estimated proportion of steelhead entering the long term reconditioning program that return survived to repeat spawn.
- The estimated proportion of non-reconditioned steelhead kelts that return a second year to repeat spawn.

A second purpose is to determine if reconditioned kelts have similar run timing, spawn timing, and spawning distribution as the target population. Because of sample size limitations it seems that there will be insufficient data to detect meaningful differences. That is, a power analysis is necessary to justify pursuit of this question.

A third purpose stated in the proposal is to determine "...relationships between reconditioning protocols, kelt condition, gamete maturity, kelt survival in captivity, and contribution to NOR." The proponents intend to quantify relationships between those variables and response variables such as probability of survival to release or the probability of successful spawning. This raises the question of how the probability of successful spawning can be estimated if spawning is not observed. In addition, given the limited data the quantification of relationships would be quite suspect and metrics for evaluation question 3 are not defined, so we cannot evaluate the evaluation. That is, how are you going to define and estimate "survival to spawning", "gamete regeneration", and "spawn distribution and timing." Some effort needs to be put into discussing how to measure these traits and whether it is likely that sufficient data will be generated to conduct an evaluation that will support adaptive management.