



**Independent Scientific Review Panel**  
for the Northwest Power & Conservation Council  
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**Memorandum (ISRP 2008-15A Update)**

**August 3, 2009**

**To:** Tony Grover, Director, Fish and Wildlife Division Director, Northwest Power and Conservation Council

**From:** Eric J. Loudenslager, Chair ISRP

**Subject:** Steelhead Kelt Reconditioning Experimental Designs

This memo responds to the Yakama Nation's June 22, 2009 letter from Steve Parker requesting ISRP input on the design of steelhead kelt reconditioning experiments to be included in a revised proposal for MOA project 2008-45800 *Upper Columbia Kelt Reconditioning Program*. In brief, the Yakama Nation requested advice from the ISRP on how best to divide up the anticipated kelts among treatment(s) and control groups given their limited availability (n~200), variable tank survival rate during reconditioning through time of release (40-80% dependent on long v. short term treatment), and low return rates to Bonneville in subsequent migrations (2-4% also dependent on treatment). The design preference stated in the Yakama Nation's letter is to focus solely on the "long-term" treatment – dispensing with both the "short-term" treatment and the "control" group to maximize returning sample sizes.

For context, the November 2008 MOA proposal reviewed by the ISRP emphasized an objective of increasing iteroparity in steelhead by reconditioning kelts. In our December review and May 2009 discussion, the ISRP raised the question of whether the purpose of kelt reconditioning was primarily evolutionary/genetic (to increase the fraction iteroparous individuals and perhaps genes for iteroparity) or demographic (to produce additional smolts and adults from the increased adult abundance attributable to spawning by reconditioned kelts).

At the May meeting, but not in the June letter, the Yakama Nation indicated the primary benefit from the proposed Upper Columbia River (UCR) steelhead kelt reconditioning project which they wished to explore was to improve the demographic status of the natural UCR steelhead population. This demographic benefit would accrue from an increase in the survival and return rate of potentially iteroparous individuals contributing to the reproductive pool above the current 21-year average of 1.6% (1986-2006 range ~ 0 to 9%) and thus to increase the production and relative reproductive success of offspring from these treated fish.

Regarding the primary question of control and treatments; in the June letter, the Yakama Nation states: "The panel had expressed a concern in its comments that the project design

did not include a control group of kelts against which to measure treatment effectiveness. The Panel also commented that sample sizes likely would be too small to allow for a robust evaluation of project performance even without including a control group.”

The ISRP believes the reference to a control or reference is drawn from the following comment in our review:

*Also, there is no internal control or reference built into the design. Sponsors compare the two treatments, but not to a “non-reconditioned” population. This will be important to establish whether reconditioning truly increases the rate of return or accepts credit for increases when they would have occurred anyway (variation, etc).*

The need to include a control (or a suitable reference) group is vital to any experimental approach that includes some kind of treatment simply to exclude extraneous causes or variable(s) for any observed result. The specific attributes of the reference will be determined by the endpoint being evaluated and the nature of the treatment.

The letter implies (but does not explicitly state) that the control would be some number of individual kelts that were permitted to out-migrate naturally after being handled and tagged similar to individuals brought into the reconditioning program. Presumably the experiment would be a comparison of the number of kelts from control, and long- and short-term reconditioning returning to some specific geographic region. The Yakama Nation letter indicated that meeting these experimental design criteria and sample sizes was not possible. The ISRP concurs.

There are alternative experimental approaches to the question of demographic affects to steelhead VSP parameters. The statistical framework for executing this work (the scale and duration required) and feasibility remains to be determined. One would be to use one (or more) watershed or subbasin that is not reconditioning kelts as a reference (control) and compare the juvenile and adult abundance and productivity VSP parameters from those locations to one (or more) watershed or subbasin that is reconditioning kelts. This avoids the problem of sub-dividing a limited pool of individuals into treatment and reference groups. It does require compromises (trade-offs) in collection locations for kelts. For example if kelt reconditioning was implemented in the Wenatchee and Methow subbasins and the Entiat was set aside as the reference, then kelt collection might need to be restricted to within subbasin trapping locations. Collecting kelts at mainstem Columbia River dams might capture fish destined for the Entiat and remove them from the repeat spawning population in the reference location.

Even with this proposed design there may not be enough fish to compare short- and long-term reconditioning simultaneously. Moreover, natural variability and other restoration actions that cannot be controlled will make comparison challenging.

In summary, the first step is to establish the purpose of the project and from that purpose establish the appropriate endpoints that will serve as the data for comparison between treatments and reference sites. Once that is decided then power analysis of the expected

range of benefit from kelt reconditioning can be used to establish whether a single treatment versus reference is reasonable. At this point, the Yakama Nation may wish to consult a qualified statistician or biometrician to consider alternatives approaches. The potential benefits should be estimated from a model of stock/recruitment. One example is the approach used by NOAA in the 2008 BiOp summarized in an April 21, 2008 NOAA memorandum from Blane Bellerud, Ritchie Graves, and Gary Fredricks to Bruce Suzumoto - *Assessment of likely survival improvement resulting from enhancement strategies for steelhead kelts (b-run kelts in particular)* (appended electronically to this memo). Another is a model of steelhead recruitment that incorporates repeat spawning developed for the NOAA TRT analysis: See [http://www.nwfsc.noaa.gov/trt/wlc\\_viabrpt/appendix\\_h.pdf](http://www.nwfsc.noaa.gov/trt/wlc_viabrpt/appendix_h.pdf) (page 2). This modeling approach would provide some indication of the amount of difference a reconditioned kelt strategy might make in demographic VSP parameters. From this estimate of benefit the feasibility of a particular experimental design can then be judged.