



Independent Scientific Review Panel

for the Northwest Power & Conservation Council
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Memorandum (ISRP 2016-12)

September 27, 2016

To: Henry Lorenzen, Chair, Northwest Power and Conservation Council

From: Steve Schroder, ISRP Chair

Subject: Step One Response Review of Snake River Basin Steelhead Kelt Reconditioning Facility Master Plan (Project #2007-401-00)

Background

In response to the Northwest Power and Conservation Council's request of July 18, 2016, the Independent Scientific Review Panel (ISRP) reviewed a [revised Snake River Basin Steelhead Kelt Reconditioning Facility Master Plan](#) prepared by the Columbia River Inter-Tribal Fish Commission (CRITFC) and the Nez Perce Tribe (hereafter "project proponents"). In the preliminary review dated May 13, 2016, the ISRP found the original Master Plan to be well written, containing an excellent summary of the extensive steelhead reconditioning work that has occurred in the Basin, but needing clarification on nine issues ([ISRP 2016-8](#)). The project proponents revised the Master Plan and included an appendix in response to the ISRP's preliminary review.

This evaluation is part of the Council's Three Step Review Process for artificial production programs. The Master Plan is a component of Project #2007-401-00, *Kelt Reconditioning and Reproductive Success Evaluation Research*. The proponents are proposing to modify the Nez Perce Tribal Hatchery (NPTH) and install six 20-foot and four 15-foot circular tanks to support the long-term reconditioning of up to 750 Snake River Basin steelhead kelts. This infrastructure would support the annual release of 180 reconditioned kelts – "the equivalent of a 6% increase in B-run adult steelhead escapement relative to the base period considered in the Supplemental Comprehensive Analysis Steelhead Kelt Appendix (Bellerud et al. 2008)."

The proponents acknowledge that the submitted Master Plan does not yet have all the necessary components for a Step 1 review. It currently lacks a Hatchery Genetic Management Plan (HGMP), and work is needed on the program's Research, Monitoring and Evaluation (M&E) Plan, Comprehensive Environmental Assessment, Value Engineering review, and final design. Before producing these elements of the Master Plan, the proponents requested that the ISRP determine if the program's preferred location for a long-term reconditioning facility for Snake River B-run steelhead is appropriate. The ISRP agrees that the NPTH provides the best location,

among those considered, for the proposed kelt conditioning facility. The proponents now need to complete the components of their Master Plan that were delayed until this assessment was made.

The ISRP's review comments below are organized by the nine issues raised in the preliminary review, as addressed by the project proponents in Appendix 2 of the revised Master Plan.

ISRP Recommendation

Meets Scientific Review Criteria (Qualified)

The proponents provided good detailed responses to the issues that were raised in the last ISRP review. A lingering issue, however, is the possibility that B-run steelhead abundance might be constrained by density dependent factors during the spawner to smolt stage rather than by low numbers of spawning adults. Monitoring studies to assess density dependent effects will be challenging to implement because of the remote locations of some of the populations. Moreover, collecting biological information is difficult due to high flows and turbidity during the spring when adults are returning to spawn and smolts are emigrating. Even so, Idaho Department of Fish and Game (IDFG) researchers (Copeland et al. 2013) developed recruits per spawner (R/S) relationships in two Snake River steelhead streams (Fish Creek, 15 broodyears, Lochsa River, Clearwater subbasin; Rapid River, 4 broodyears, Little Salmon River, Salmon subbasin). In both cases, density-dependent effects were detected.

The proponents are convinced (the ISRP less so) that increasing adult escapement will augment B-run population abundance. They hypothesize that reconditioned kelts from their program will increase the abundance and productivity of B-run steelhead populations located above Lower Granite Dam (LGR). The ISRP acknowledges that even if density dependence is currently limiting abundance, ongoing habitat and fish passage restoration work may help alleviate some population bottlenecks and lead to increased productivity. Also, reconditioned adults are buffered from environmental conditions that affect survival rates in mainstem and ocean habitats. Thus, these fish may become an important conservation resource when the survival of maiden steelhead is impacted by poor marine and river conditions. The project also directly addresses the issue of declining iteroparity in Snake River steelhead. Additionally, it provides an opportunity to assess the viability of using reconditioned kelts in population recovery. Consequently, the program offers a "spread-the-risk" strategy that can provide potential benefits not possible through any other existing or proposed action. The Council may wish, however, to weigh these potential benefits against those that might be obtained by alternative actions which improve B-run steelhead survival in tributary and mainstem habitats.

Qualification - The ISRP recommends that the proponents address the following four issues during the next phase of project development:

- 1) Of the proposed locations for the kelt reconditioning facility, the NPTH appears to be the best option. The existing HGMP and Environmental Assessment for the NPTH will need to be modified to account for the reconditioning program.
- 2) A comprehensive M&E Plan with an adaptive management component is needed. The M&E plan should describe quantitative objectives, sampling designs, data collection, and an assessment methodology that will be used to evaluate density dependence in B-run steelhead populations.
- 3) Biologically based escapement goals that consider density dependence should also be included in the M&E Plan. Such goals will help the proponents assess the contributions that reconditioned kelts are making toward B-run recovery on a population-specific basis.
- 4) The M&E plan should also provide more information on the level of effort that will be expended on collecting natural origin B-run kelts and on how they will be identified. How, for example, will the inadvertent inclusion of unclipped B-run hatchery kelts in the program be avoided?

ISRP Comments

Review of responses to the ISRP's nine questions

1. *The biological and ecological rationale for annually increasing B-run steelhead escapement by 180 reconditioned female kelts needs to be explained in the Master Plan.*

The proponents adequately describe the biological and ecological rationale behind their goal of annually increasing B-run steelhead escapement by 180 reconditioned females. Escapement targets (threshold values) for A/B- (Lolo Creek-Clearwater River) and B-run steelhead were presented in NOAA-Fisheries' Draft Snake River Recovery Plan (NMFS 2015). These values along with escapement goals for these same populations in the Nez Perce Tribe's Management Plan (NPT 2013) are shown in Table 1 of Appendix II. Long-term Tribal escapement goals are at least an order of magnitude greater than the threshold values in the NMFS plan. At present, however, the proponents state that the values provided by the NMFS plan could be used as escapement objectives in the near term as a first step to evaluate project effectiveness.

In their response, the proponents also provide recent (2010-2015) adult abundance estimates for four B-run steelhead populations. In three cases, Lolo Creek (Clearwater River), South Fork Clearwater, and South Fork Salmon, adult abundance values appear to be 82% to 98% of those

proposed by NMFS. Conversely, adult abundance in the Secesh population (Salmon River) is about a third of the NMFS proposed threshold value (166 vs 500). Adult abundance estimates for the other four populations are not available. Based on historical abundance data and current information, which shows no increasing trends in abundance, the proponents state it is their professional opinion that Snake River B-run steelhead are substantially under escaped.

A similar hypothesis of under escapement for spring/summer Chinook salmon in the Clearwater and Salmon river subbasins, however, was found to be incorrect (Venditti et al. 2015) as density dependent effects were observed (Walters et al. 2013). Additionally, Copeland et al. (2013) discovered that density dependent forces were constraining steelhead smolt production in Fish Creek. Further, Bowersox et al. (2011), as cited by Copeland et al. (2013), established that steelhead smolt production in Potlatch Creek was affected by density dependence. Thus, an important part of the project's M&E Plan should be to evaluate the degree of density dependence in the populations receiving reconditioned kelts. This information should help the proponents determine whether current conditions can support additional spawners leading up to and beyond the NMFS spawning threshold or whether existing conditions and density dependence will limit population growth gained by the kelt reconditioning program. If current conditions and density dependence restrict population growth, then the benefits of adding kelts to the spawning population will be less than if population growth is inhibited by the lack of spawners, as currently assumed by the proponents.

2. Clarification on why male kelts are not included in the proposed reconditioning program is needed.

The ISRP appreciates the informative and comprehensive response. The proponents give four reasons for excluding male kelts: (1) their scarcity, (2) lower probability of survival to re-maturation, (3) suitable male abundance on spawning grounds (freshwater and anadromous life histories combined), and (4) the greater demographic boost provided by females. They also suggest that the potential of inbreeding depression caused by matings among near relatives is reduced if only females are reconditioned. They acknowledge that there may be a slight reduction in genetic diversity by not reconditioning males, but they feel that cost would be offset by the increased efficiency of a program that targets female kelts because females are more likely to survive reconditioning and would provide a greater demographic boost given that population productivity is currently more limited by the number of females than males. This practice would need to be re-evaluated if reconditioned kelts were to be used as captive broodstock.

3. The biological escapement goals for B-run steelhead populations in the Snake River subbasin should be in the Master Plan along with a description of what project "success" entails. To what extent, for example, are reconditioned kelts expected to contribute to the rebuilding of natural steelhead populations and eventually to fisheries?

As mentioned above, threshold escapement values in the NOAA-Fisheries' draft Snake River recovery plan along with "sustainable" and "ecological" escapement values for A/B (Lolo Creek) and B-run steelhead in the Nez Perce Tribal Management Plan are shown in Table 1 of Appendix II. The proponents state that, for the immediate future, comparison of escapement estimates to NMFS's threshold values will provide a useful way to track the contributions that the reconditioning program may be making to B-run recovery. This is a reasonable first step in the evaluation of steelhead recovery, but the key issue is whether the larger spawning population in response to kelt reconditioning can be sustained by the environment.

The proponents also provide an estimate of the number of adult progeny the reconditioning program is expected to produce. They use information from Copeland et al. (2013) collected at Fish Creek to estimate a Recruit/Spawner (R/S) ratio for reconditioned kelts. The Copeland et al. report presents R/S ratios for 15 broodyears (1992-2006). These values were highly variable, ranging from a high of 10.39 to a low of 0.34 and averaged 2.23. The proponents used this average R/S value and estimated that 180 reconditioned kelts would produce approximately 400 adult progeny ($180 \times 2.23 = 401$). Additionally, these fish are expected to contribute adults proportionally to B-run populations in the Clearwater and Snake subbasins. However, this approach for estimating the contribution of kelts to future returns is potentially misleading because Copeland et al. (2013) show that steelhead recruitment is strongly influenced by density dependence and the relationship between recruitment and spawners is curvilinear. In the Fish Creek population, the R/S from the median parent spawning population during broodyears 1992-2006 is only 0.9 recruits per spawner. Recruitment data for Fish Creek shows that R/S declines from 2.5 at 50 spawners to 1.3 at 100 spawners to 0.7 at 200 spawners to 0.5 at 300 spawners (i.e., the range in observed spawners). This example shows why consideration of density dependence is important.

The M&E plan for the project will need to include components that can evaluate the validity of the assumptions behind the projected adult contributions made by reconditioned fish. For example, the plan might consider estimating the survival of reconditioned fish from release to spawning areas and assessing R/S ratios in populations supplemented by reconditioned kelts compared to untreated populations. The M&E plan should also contain empirically based biological escapement goals for each B-run population expected to be supplemented by reconditioned kelts. Such goals reflect how many steelhead spawners are needed to potentially maximize harvest, to reach equilibrium where adult returns equal parent spawner abundance, or to achieve a minimum viability threshold. This type of information is needed to determine the extent to which kelt reconditioning may contribute to the re-building of B-run populations, which is the ultimate goal of the program. If extant habitat is fully utilized by existing wild and hatchery steelhead, then adding a few more reconditioned kelts may provide relatively little benefit. Thus, pivotal questions that the M&E Plan will need to address are how many steelhead in total can each stream support and to what extent will the kelt program contribute to these targets?

To help answer those questions, the proponents may wish to contact Yakama Nation scientists who have been working with a private firm to evaluate a prototype vertical PIT tag detection

array. The array has the potential to recognize PIT tags throughout the entire water volume of a river under a wide array of flow and debris conditions. This new detection tool might be useful in identifying project fish as they enter spawning locations. The proponents are also clearly aware of IDFG's steelhead monitoring and evaluation studies taking place in the Clearwater and Salmon subbasins. If they have not already done so, they may wish to collaborate with IDFG researchers and combine resources and expertise to evaluate juvenile production and possible density dependent effects in B-run steelhead populations.

4. *If available, information on the abundance and status and trends of B-run steelhead populations in the Clearwater and Salmon River subbasins should be provided in the Master Plan. Current spawning levels of B-run steelhead in the Snake River Basin should also be described with reference to numerical objectives for natural spawning steelhead. Additionally, a brief overview of the factors limiting each of these populations should be added to the Plan.*

Appendix II provides some of the requested abundance, status, and trend information on B-run steelhead. Table 1 of Appendix II includes recent spawning abundance estimates that are available for the A/B and B-run populations in the Clearwater and Salmon subbasins. An overview of the factors limiting Snake River B-run steelhead is also presented. Factors that limit specific populations, however, are not identified. Determining their importance and identifying the factors limiting individual populations may help the proponents plan habitat restoration and other efforts that promote B-run recovery. The effects of competition and predation among both B-run and A-run steelhead, including hatchery origin fish, were not mentioned as potential limiting factors. As alluded to earlier, assessing the importance of these factors is of particular importance since they are associated with density dependent regulation on population abundance.

5. *Substantial hatchery and habitat restoration actions affecting B-run steelhead are occurring in the Snake River subbasin. The Master Plan should briefly describe these programs and indicate how the proponent's goal of annually releasing 180 reconditioned kelts will be coordinated with ongoing habitat restoration and existing hatchery programs.*

The proponents provide a comprehensive overview of the hatchery and habitat actions taking place in the Clearwater and Salmon subbasins. The ISRP appreciates this informative response. Such information may help the program become more selective about the fish targeted for reconditioning. B-run steelhead kelts originating from watersheds undergoing substantial restoration could, for example, become preferred fish for reconditioning. Not much detail, however, is provided on how the reconditioning program will be coordinated with other programs occurring in the Snake subbasin. This is not too surprising given all the parties involved, and it appears that coordination will occur as the proponents stated, "Coordination for the kelt reconditioning program occurs in various forums: hatchery AOP reviews, US v Oregon policy advisory committee (PAC) meetings, technical advisory committee (TAC)

meetings, Endangered Species Act consultations, and state agency collection, transport and release permitting processes.”

6. As it is currently designed, the kelt reconditioning program will recondition female B-run steelhead kelts without targeting specific populations. It would seem that capturing, reconditioning, and releasing kelts from populations that have the potential to accommodate additional spawners would be a more efficient and productive way of directing this strategy. The Master Plan should explain why a more focused program was not considered.

Appendix II provides explanations for why a smaller and more focused kelt program has not been considered. The proponents examine two possible approaches to create population-specific reconditioning efforts. In one of these, genetic methods to select kelts from specific reporting groups collected at mainstem dams (e.g., Lower Granite and Little Goose) will be employed. In this scenario, collected kelts will be held until genetic determinations are made. Fish from desired populations will then undergo long-term reconditioning. It is stated that the time needed to make genetic identifications is great enough that the holding and rearing infrastructure originally proposed would still be required. Hence, it is argued that a smaller effort would be just as expensive and require the same infrastructure as their preferred option of collecting a broader array of B-run kelts for reconditioning. This rationale becomes a little clearer when it is recognized that about 18% of the kelts leaving the Snake River are B-run fish. Hence, numerous kelts will likely need to be held while genetic affiliations are determined, thus requiring suitable infrastructure to accommodate them.

The other method would require collecting kelts from their natal streams. The proponents indicate that this approach would most likely require the installation and maintenance of weirs. Weirs are an expensive and problematic proposition due to high water flows and debris conditions when kelts are available. Besides being difficult to maintain, weirs may also disrupt migration timing and adult spawning distribution patterns. Additionally, the proponents suggest that the distances among B-run populations are great enough that transporting kelts to a common reconditioning site may lead to inadvertent mortality. If this method were used, the proponents believe that several reconditioning locations would be required to prevent unintended kelt mortalities during the collection period.

Given the above considerations, the proponents conclude that “The cost and infrastructure associated with targeted kelt collections would likely exceed that of our preferred alternative. Additionally the operational costs would be substantially elevated relative to the program described in the Master Plan.” It is likely, however, that genetic stock identification methods will become more efficient and rapid in the future. When that occurs, the proponents may wish to refine their kelt reconditioning efforts to one that could focus on specific B-run populations.

- 7. The Master Plan should discuss the infrastructural needs of a more focused and integrated reconditioning program. If the project, for instance, were to narrow its focus on B-run populations that could benefit from the addition of reconditioned kelts, would facilities at Dworshak National Fish Hatchery be adequate to meet these new escapement objectives?*

The proponents indicate that kelt reconditioning facilities located at Dworshak National Fish Hatchery are temporary and not suitable for a reconditioning program at the desired scale. Perhaps, more importantly, this facility does not have space that can be devoted to reconditioning skip spawners, or individuals that will require 20 months of care before re-maturation. Since 66% of B-run females are skip spawners, it is important that the program has the capacity to include these fish in the reconditioning program.

- 8. The Master Plan should compare the benefits and drawbacks of increasing B-run steelhead escapements by modifying harvest regulations, by long-term reconditioning for adult release, and long-term reconditioning for captive breeding and smolt release.*

The proponents reasonably point out that “Kelt reconditioning has not been developed as an alternative to any other activity affecting natural steelhead populations, but rather to work in concert with all other activities designed to facilitate the rebuilding and restoration of wild steelhead.” They explain why reducing harvest as a way to increase escapement is not as effective or straightforward as it might seem due to mortality during upstream migration and treaty reserved rights to the fishery resource. They remind us that “Further reductions in B-run steelhead fishery impacts would mean diminished access especially by treaty fishers to many other abundant harvestable groups of fish.” We note that run size of B-run steelhead at Lower Granite Dam during the past 10 years has averaged 4,685 wild and 24,225 hatchery B-run steelhead (Joint Columbia River Management Staff 2016); for completeness, the Master Plan should discuss the disposition of these fish beyond Lower Granite Dam.

Regarding captive breeding, the proponents agree that the use of reconditioned kelts should be evaluated as a way to offset the collection of maiden natural or hatchery-origin steelhead for broodstock. However, their calculations indicate that the resources required to carry out a captive breeding program would be greater than those needed for the project currently being proposed.

- 9. Some discussion of the genetic risks that may accompany reconditioning (e.g., heritable epigenetic effects and domestication selection) needs to be added to the Master Plan or incorporated into the Plan’s HGMP.*

A thorough discussion of how epigenetic effects may be transmitted is provided. Reconditioning is thought to present a low risk of creating and transmitting epigenetic changes due to the early timing of epigenetic effects during development. The possibility of inadvertent domestication caused by reconditioning is also thoroughly explored and discussed. The proponents contend that their program is best described as a refuge from unnatural selection as opposed to a

source of artificial selection or agent for relaxation of natural selection. Although they acknowledge that some risk from unnatural selection exists, they conclude that such risks are “minimal relative to standard hatchery programs, and pale in comparison to the strength of artificial selection imposed by anthropogenic modifications within the Columbia River Basin.” They also point out that “this program would have a slight, but beneficial impact on net proportionate natural influence within the Snake River Basin, owing to an increase in the number of natural-origin B-run spawners.”

Literature Cited

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