



Independent Scientific Review Panel

for the Northwest Power & Conservation Council
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Memorandum (2018-10)

November 2, 2018

To: James Yost, Chair, Northwest Power and Conservation Council

From: Steve Schroder, ISRP Chair

Subject: Follow-up Step Review for the Klickitat River Spring Chinook Master Plan (Project #1988-115-35)

Background

On May 11, 2018, the ISRP completed a review of the Yakama Nation's [Klickitat River Spring Chinook Master Plan](#) (2018 Master Plan) for project #1988-115-35, *Klickitat River Design and Construction-Yakima/Klickitat Fisheries Project (YKFP)* ([ISRP 2018-4](#)). In that review, the ISRP requested responses on five topics:

1. Adaptive management process with “decision tree” contingency planning;
2. Performance standards for early maturation of males (i.e., minijacks);
3. Gene flow proportions between hatchery and natural fish (pHOS, pNOB, and PNI);
4. Effects on project outcomes of annual variability in survival (SARs); and
5. Specific questions regarding habitat capacity, smolt release locations, broodstock selection protocols, in-hatchery operations, and monitoring evaluation of genetic changes and smolt survival and abundance.

In response, the Yakama Nation provided the Northwest Power and Conservation Council a [September 14, 2018 cover letter](#) containing a summary of responses to the ISRP and a supporting document containing [detailed responses](#). On September 17, 2018, the Council requested the ISRP's review of the response documents. This review is part of the Council's Step Review process for artificial production projects. This project's Step Review began in 2004 and has involved numerous iterations (see [ISRP 2018-4](#), [ISRP 2013-1](#), [ISRP 2012-12](#), [ISRP 2008-6](#), and [ISRP 2005-7](#)).

The 2018 Master Plan focuses on spring Chinook production, which differs from earlier master plan drafts (2004, 2008, 2012) that proposed multispecies hatchery reform initiatives for fall Chinook, coho, and steelhead, as well as spring Chinook. As described in Yakama Nation's cover letter, the overall goals of the 2018 Master Plan are to:

- a) Implement a phased-in integrated broodstock spring Chinook production program at the Klickitat Fish Hatchery to replace the current segregated spring Chinook program and thereby increase the biological performance of the spring Chinook produced;
- b) Ensure that returning adults are locally adapted and compatible with restoration goals for the Klickitat River Subbasin;
- c) Improve the overall ecology of the Klickitat River system; and
- d) Support harvestable populations of spring Chinook consistent with regional mitigation obligations and U.S. v Oregon agreements.

Our review comments below are organized around the five items in our response request.

ISRP Recommendation

Meets Scientific Review Criteria (Qualified)

The response we received from Yakama Nation (YN) scientists answered many of the questions from our May 2018 review. We compliment the Yakama Nation on the creation and use of a stochastic model developed to forecast how ocean conditions and subsequent SAR values may impact their program. The implications of the model's predictions on the project were clearly explained. Four qualifications still need to be addressed in the Master Plan. Details related to these qualifications are provided in the ISRP Comments section below. The ISRP looks forward to reviewing how these qualifications are addressed and the status of the project in the upcoming Category Review covering artificial production projects.

1. Provide performance standards to enable assessment of in-hatchery performance, fish health, the proportion tagged, tag retention probability, and the proportion of smolts that mature as mini-jacks. Performance standards are a key component of an adaptive management process.
2. Describe how minijack abundance will be estimated in the three hatchery lines (H1, H2, and N1). The ISRP recommends assaying 11-ketotestosterone in smolts just prior to release to obtain estimates of the proportion of minijacks in each hatchery line. Limiting minijack production may be important to success of the hatchery program.
3. Expand the description of the adaptive management process to include a longer than annual cycle of review (perhaps at 5-year intervals) through which managers will formally consider making **major** changes to the program. Develop contingency plans for additional scenarios. For example, what plans or actions might take place to counteract low survival of hatchery smolts from release site to the Bonneville Dam (currently only 4.8% of PIT tagged smolts are detected at Bonneville Dam, 2007-2015) or for SARs that are much lower than expected?
4. Incorporate clarifications, corrections, and new analyses (Appendices A and B) into the Master Plan.

ISRP Comments on the Five Response Requests

1. Adaptive management process with “decision tree” contingency planning

The YN acknowledges that key assumptions and circumstances may change. Consequently, they have adopted an Adaptive Management (AM) process formulated by DJ Warren & Associates (2009) which is used throughout Yakima-Klickitat Fisheries projects. In Appendix A, the YN provides a brief overview of the AM process including the use of a pre-season workshop where status and trend data, key assumptions, and decision rules are reviewed and updated as needed. The process appears to be well established, and minor adjustments to operations, based on status and trend data, will be made on a yearly basis. It is not clear, however, how progress towards objectives would be evaluated over the longer terms of 5 to 10 years to enable **major** adjustments to objectives and decision rules if warranted.

The project includes some contingency planning for collecting broodstock when returning adult abundance is low. However, to further guide the AM process, additional performance standards are needed for in-hatchery performance, fish health assessments, the proportion of fish tagged, tag retention probability, and the proportion of smolts that mature as minijacks. Contingency actions for these performance standards should be identified.

2. Performance standards for early maturation of males (i.e., minijacks)

The proponents hypothesize that the Klickitat Hatchery program will have low proportions of precocious maturation in yearling hatchery smolts. This supposition is based on several factors. First, yearling smolts produced by the hatchery are relatively small. Second, cool spring water is used for rearing. Third, relatively low numbers of minijacks have recently returned to the Klickitat Hatchery. Additionally, the YN’s analysis of PIT tag detections for spring Chinook passing Bonneville Dam from 2007–2015 suggests that the current Klickitat Hatchery program produces a lower proportion of age-2 minijacks than the Carson and Levi George (Cle Elum) hatcheries.

The percentage of age-2 minijacks among all tagged and maturing Klickitat Hatchery Chinook salmon at Bonneville Dam averaged 22.1% during 2007-2015, according to YN Table 3. This value might seem low at first glance, but it suggests that approximately 44% of returning male Chinook salmon were minijacks, assuming 50% of the returning fish were males and all age-2 salmon were males. In comparison, approximately 80% and 40% of tagged males counted at Bonneville Dam and returning to Carson National Fish Hatchery and Levi George Hatchery, respectively, were minijacks. High minijack values for all three hatcheries highlight the importance of minijacks when estimating SARs and contributions of hatchery salmon to salmon fisheries.

Although interesting, the descriptions of hatchery rearing conditions and the results of the PIT tag study do not accurately estimate minijack production at the hatchery. It is true that relatively small release sizes and rearing in cool water may help reduce early maturation. However, recent studies by Don Larsen (NOAA) and colleagues (BPA project 2002-031-00; Growth Modulation in Chinook salmon supplementation) demonstrate that both environmental (fish size, cool water, low growth in the fall, low lipid diets) and genetic factors (stock origin and exposure to hatchery conditions) affect rates of early maturation in spring Chinook. For example, precocious maturation rates in Chinook produced from

segregated hatcheries were found to be substantially less than in integrated programs. This finding identifies an important potential constraint when transitioning from a segregated to an integrated hatchery program. Additional actions may be needed to control minijack production in an integrated hatchery.

The Klickitat Hatchery program is moving from a segregated program (H1) line to an integrated one (e.g., N1 and H2 lines).¹ Based on results produced by the NOAA Growth Modulation study, we might expect to see low proportions of minijacks in the H1 line and possibly much higher proportions in the N1 and H2 lines. Minijacks can affect SAR, R/S, and SAS statistics, reduce the occurrence of harvestable anadromous fish, compete with other juvenile salmonids for food and other resources, and spawn with older females. It is important that their abundance be directly estimated at the smolt stage.

The ISRP recommends that smolts from each of the Klickitat Hatchery lines be sampled (~400 fish/line) just prior to release in the spring. The best method for such an appraisal is the blood plasma 11-ketotestosterone assay. Results from this sampling will provide the proponents with accurate estimates of the proportion of early maturation in each of their lines. Such samples could be collected from fish that are being used in health evaluations. A number of hatcheries in the Basin are using the 11-ketotestosterone assay. We suggest the proponents contact Don Larsen (NOAA), Peter Galbreath (CRITFC), or Confederated Tribes of the Umatilla Indian Reservation (CTUIR) staff involved with the Walla Walla spring Chinook program for more information on the 11-ketotestosterone assay.

There is an immediate need for accurate estimates of the proportion of minijacks released for each hatchery line (H1, H2, N1) at the Klickitat Hatchery. If minijack proportions seem excessive, based on performance standards, then the program may wish to consider alternative rearing procedures (e.g., low lipid diets, low rations during the fall, etc.) to reduce their occurrence. Furthermore, the Master Plan needs to establish performance standards for the production of minijacks and for other within-hatchery performance measures (i.e., values that could be used to guide adaptive management decisions).

3. Gene flow proportions between hatchery and natural fish (pHOS, pNOB, and PNI)

The YN is forthright about the issues in the Klickitat subbasin that may prevent achievement of their desired PNI goal of 0.67. For instance, efficiency at the Lyle Falls trap (RM 2.4) is only ~25%. Consequently, this trap cannot be relied on to adequately control the proportion of hatchery fish on the spawning grounds (pHOS). Instead, the proponents are considering in-river sport fisheries directed toward fin-clipped hatchery fish and using 100% NOR broodstock to achieve annual PNI values close to project targets. This approach, however, implies the need to improve productivity of natural origin salmon so that sufficient NORs are available for both the hatchery broodstock and for the spawning grounds. It is clear that the proponents recognize the importance of regulating pHOS and in achieving PNI values >0.5.

¹ H1 refers to the initial segregated broodstock during Phase 1 that consists of hatchery origin salmon; it will be phased out. The H2 line will be developed from adults returning from the N1 line, which is produced by natural origin adults brought into the hatchery.

In our May 2018 review, the ISRP requested that the YN correct errors in PNI values that were present in the Master Plan. The YN noted that the errors stem from use of different datasets. PNI values should be corrected in the Master Plan.

4. Effects on outcomes of annual variability in survival (SARs)

The YN gave careful thought to how annual variation in juvenile survival and SAR values would affect their ability to meet broodstock and natural spawning goals. They built a stochastic model that was used to simulate adult returns to the Klickitat subbasin of both NORs and HORs. Their model used NOAA's "stoplight" indicators to define years with ocean conditions that were good, neutral, and poor for juveniles. Three scenarios were simulated and were referred to as baseline, degraded, and very degraded scenarios. The baseline scenario reflected ocean conditions over the past 20 years comprising 30% good, 40% neutral, and 30% poor years. The degraded scenario comprised 20% good, 30 neutral and 50% poor years. The very degraded scenario comprised 10% good, 20% neutral and 70% poor years.

The effects of the three model scenarios on broodstock availability and the program's capacity to progress from Phase I to Phase III were simulated over a 50-year period. Under baseline conditions the model forecast that the program will have the ability to collect desired broodstock and move from Phase I up to Phase III. However, the probability of collecting sufficient numbers of fish (i.e., 205-240) for the hatchery broodstock decreased in the degraded and very degraded scenarios. Transitioning from Phase III to Phase IV under baseline ocean conditions will likely require an increase in natural production as previously indicated in Appendix C of the Master Plan.

These results have encouraged the YN to consider how trapping efficiency at Lyle Falls (~25%) and volunteer returns to the Klickitat Hatchery (~27%) might be enhanced. Alternative approaches to collecting broodstock are also being considered. These included establishing temporary weirs at strategic points in the subbasin, collecting fish at Castile Falls, and possibly using hook and line methods. The model results also confirmed an original speculation that SARs would need to be at least 0.5% for the project to proceed from one phase to the next. When SARs fall below this level, the project will likely have difficulties in collecting broodstock and in meeting targeted release numbers of smolts. As noted above, additional reduction in the production of minijacks at the hatchery would improve SARs based on age-3 and older Chinook salmon. Also, as noted below, improved survival of smolts from the Klickitat River to Bonneville Dam would contribute to higher SARs since only ~4.8% of PIT-tagged smolts were detected at Bonneville Dam, 2007-2015. The Master Plan should identify potential actions needed to improve SARs, especially when ocean conditions are less favorable. Also, we recommend that the YN estimate smolt survival from the Klickitat River to Bonneville Dam after accounting for PIT tag detection efficiencies at the dam and potential tag loss.

5. Specific questions regarding habitat capacity, smolt release locations, broodstock selection protocols, in-hatchery operations, and monitoring evaluation of genetic changes and smolt survival and abundance

Measuring Adult-to-Smolt Productivity and Juvenile Capacity: The YN provide a brief response on how habitat capacity and productivity may be estimated in the subbasin above Castile Falls. They state that

PIT tags, parentage-based-tagging (PBT), and smolt trapping will be used to estimate these parameters. How these methods of identifying fish origin and estimating NOR smolt abundance might be used to make such estimates are not discussed. It is likely that adult counts at Castile Falls will be coupled with smolt abundance estimates at the falls to estimate both of these parameters. Details of the monitoring activities need to be described, including anticipated sample sizes. Monitoring of naturally produced smolts (e.g., size and survival in relation to abundance) is needed to verify the initial estimates of capacity and productivity, and to test assumptions about increased capacity and productivity following continued habitat restoration. This information could help the program evaluate the extent to which habitat improvements and freshwater survival might help offset the periods of low SAR discussed above.

Smolt release locations: The YN clarified that possible acclimation sites in the upper subbasin (above Castile Falls) will not be used. All project fish will be released from the Klickitat Hatchery.

Broodstock selection protocols: A coded wire tag (CWT) placed in different body locations will be used to identify fish from the various lines and brood years. Some tag loss will undoubtedly occur. However, inserting CWTs in various body locations has been successfully used in other hatcheries. The YN should add the new information and clarifications to the existing Master Plan so that the document is complete.

In-hatchery operations: Information on the number of smolts released and their mean size were presented in Table 1. However, the proportion of those fish that were tagged and estimates of tag retention proportions were not presented. Minijack proportions were not reported, but this is not unexpected since no effort has been made to evaluate their presence at the hatchery. The ISRP recommends use of the 11-ketotestosterone assay to obtain estimates of proportions of minijacks, as discussed above. In the Master Plan, the YN should describe health surveys that will be conducted by USFWS health specialists. The ISRP had requested this information to determine if fish being used in these appraisals could also be used in the 11-ketotestosterone assays.

Ultrasound equipment will be used to identify gender of prospective broodstock. MS222 will be used to anesthetize broodstock. Fish designated for human consumption will undergo a 21-day clearance period prior to being dispersed to Tribal members. Fish set aside for Tribal members will not receive antibiotics.

The ISRP previously suggested that the YN consider using isobuckets to prevent the possible horizontal transmission of Bacterial Kidney Disease (BKD). Egg lots from individual females would be sequestered in each isobucket until BKD titers were evaluated. Individuals with high titers could then be culled. Tribal biologists contacted USFWS health experts to ask if their existing procedure of treating recently fertilized eggs would also reduce the risk of horizontal transmission. These experts agreed that the current practice of holding the eggs of a single female in a vertical stack tray for one hour in a solution of 600 ppm of iodophor prior to running water throughout the entire stack was a suitable approach. As in other hatchery programs in the Basin, egg lots with high BKD titers will be culled.

Monitoring of genetic changes: The proponents state that several hundred DNA samples will be collected from Chinook salmon each year. Samples will be obtained from all brood fish and the fish handled at Lyle Falls. Samples from juvenile fish will be obtained from individuals captured at the lower Klickitat smolt trap. The samples will be used for two purposes: (1) to determine if the program's breeding procedures will reduce the presence of ocean-type Chinook (fall Chinook) genes in the Klickitat's spring Chinook population, and (2) to evaluate the reproductive success of hatchery

broodstock. The Master Plan should identify if DNA samples will also be collected from adults passing over Castile Falls to obtain productivity estimates of individuals.

Smolt survival and abundance: The YN agrees with the ISRP that there is a need to continue to evaluate the exceptionally high mortality of smolts from release to Bonneville Dam (avg. 95.2% of release detected, 2007-2015; Table 3 of YN response). While the ISRP agrees that more habitat restoration in the Basin is needed to improve survival, the relatively high mortality from release in the Klickitat River to detection at Bonneville Dam suggests predation might be important as well. Predation should be investigated as a potential source of mortality that could be addressed to improve smolt survival to Bonneville Dam, and overall SAR.

The ISRP remains concerned about the proportion of age-2 minijacks in Klickitat spring Chinook salmon passing Bonneville Dam (22% = 30/136 in Table 3; or ~44% of male salmon). Although this proportion is lower than for some other hatcheries, it still warrants attention given that many minijacks likely remain upstream of Bonneville Dam where they are not counted, an effort was already made to reduce smolt size, and integrated hatcheries tend to produce more minijacks than segregated hatcheries. We emphasize the need to monitor minijack production when smolts are released from the hatchery, as discussed above.

Future reporting by the YN should include a table showing estimates of NOR smolts leaving the subbasin and estimates of SAR values for these fish.