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# Step Two Review of the Yakama Nation's July 2012 Klickitat Anadromous Fisheries Master Plan

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# ISRP Step Two Review of the Yakama Nation's July 2012 Klickitat Anadromous Fisheries Master Plan

## Contents

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## Background

At the Northwest Power and Conservation Council's July 24, 2012 request, the ISRP conducted a Step Two review of the Yakama Nation's *Klickitat River Anadromous Fisheries Master Plan* (project 1988-115-35) and supporting documents. The Yakama Nation proposes to improve the existing Klickitat Hatchery near Glenwood, Washington and build a hatchery and acclimation facility at Wahkiacus at river mile 17. These proposed actions are intended to build upon completed project activities including improvements made to the Lyle Falls Fishway and broodstock collection facility as well as the Castile Falls Fishway and escapement monitoring facility. The facilities are intended to support programs for spring Chinook, fall Chinook, steelhead, and coho. The Yakama Nation believes that the location of the Wahkiacus facility will allow release of hatchery coho and fall Chinook to the lower river and thus limit adverse impacts to native fish species. In addition, a potential acclimation site for summer steelhead has been identified for McCreedy Creek, but the Yakama Nation states that these facilities will be built only if steelhead are unable to naturally re-colonize stream habitat above Castile Falls. In addition, the Master Plan explains that habitat improvements occurring in conjunction with the proposed project are expected to benefit bull trout and Pacific lamprey as well as steelhead and spring Chinook.

The ISRP completed its Step One review of the Klickitat Master Plan in 2008 (ISRP 2008-6; also see ISRP 2005-7). Overall, the ISRP found that the 2008 Master Plan was a well-balanced, relatively thorough plan that included a number of progressive and positive attributes. The ISRP recommended that the master plan met ISRP scientific review and Three-Step review criteria with a qualification that elements of the steelhead and spring Chinook natural and artificial production plans need a more detailed explanation.

In the Council's decision memo on Step One (Letter from Tony Grover, Council, to Bill Maslen, BPA, August 15, 2008), the Council identified the following items from the ISRP's review that needed to be addressed in Step Two:

1. A decision tree that would function as a tool to guide management actions based on monitored results and actions
2. Detail regarding steelhead recruit analysis and harvest
3. Detail regarding the determination of spring Chinook release sizes, recruits-per-spawner, and harvest
4. Information regarding balancing broodstock collection, hatchery smolt yield, and anticipated SAR with the harvest and stock conservation
5. Summary and synthesis of ecological benefits

6. Confirmation of study design and statistical validation of tagging rates and tag recovery
7. Information addressing the conditions of termination of supplementation above Castile Falls should also be outlined in the requested "decision tree"

The ISRP's 2012 review below is organized by these points.

## Recommendation

Response Requested: Qualifications identified in the 2008 Step 1 review were not sufficiently addressed. In order to complete Step 2, the ISRP recommends that responses are needed to further address the 2008 qualifications and to provide specific information related to three production components in the Master Plan. These production components are (1) Segregated Steelhead Harvest Program, (2) Integrated Steelhead Supplementation/Conservation Program, and (3) Integrated Spring Chinook Harvest Program.

Explanation of recommended responses follows:

<u>(1) Segregated Steelhead Harvest Program</u>
There are two primary deficiencies in the current draft of the Master Plan. First, the 2012 Master Plan proposes a segregated harvest program for steelhead whereas the 2008 Master Plan proposed an integrated harvest program. The 2009 Klickitat Steelhead Recovery Plan includes implementing the 2008 integrated hatchery program to replace the segregated program as a recovery plan element. The 2012 Klickitat Master Plan does not reconcile differences between the 2008 and 2012 plans or describe the consistency with the Klickitat Steelhead Recovery Plan. Consistency with the recovery plan needs to be incorporated in Section 4.2.2 (page 37).

Second, the decision narrative for guiding the anticipated segregated harvest program is incomplete. The primary guidepost is the proportion of smolts with hatchery parentage (< 5%). At a minimum, performance standards are needed for abundance and recruits per spawner (R/S) for natural-origin steelhead and for the proportion of hatchery-origin steelhead on the spawning grounds. Further, a timeframe and protocol needs to be established to transition from scatter planting steelhead from out-of-basin to releases of within-basin segregated hatchery steelhead from the Klickitat Hatchery.

Overall, based on the information in the Master Plan, appendices, and 2009 Klickitat Steelhead Recovery Plan, the ISRP concludes there is inadequate information on the effect of the proposed (or existing) program on natural population stock/recruitment of ESA-listed steelhead to make a scientific conclusion about the size of the proposed program.

The Master Plan concludes that this program may pose unacceptable risks to steelhead conservation goals from interbreeding, direct juvenile competition, and predation. The ISRP concurs. These risks require performance standards and evaluation, and the status of the natural steelhead population needs to be integrated into decisions on program size, design, and harvest.

The brief “decision tree” for steelhead on page 61 should be refined to provide greater clarity and information. For example, how will collection of broodstock at Lyle Falls improve the segregated hatchery? Is there an intention to reduce hatchery fish spawning in the river as a means to reduce the impacts of the segregated hatchery? Clarification is needed.

Consistent with Fish and Wildlife Program Artificial Production Review principles and guidelines, an experimental approach is required that will establish the effects of the hatchery strategy on the natural population. Such an adaptive management experiment may facilitate proceeding with a program that will refine the scale in terms of release numbers and harvest objectives.

The Master Plan would also benefit from the development of a recruitment curve, using existing data for natural steelhead and Chinook salmon, as a means to evaluate the existing capacity of the system to support steelhead and Chinook salmon.

(2) Integrated Steelhead Supplementation/Conservation Program

The 2008 Master Plan included the intention of beginning a supplementation program to increase the rate of colonization above Castile Falls if after 9 years of natural colonization abundance had not achieved a threshold of 150 adult natural-origin steelhead. In the 2012 Master Plan, the criteria for beginning this integrated supplementation/conservation program has been altered slightly. The time period has been shifted to 2020 (2 to 3 generations after the 2005 passage improvements at Castile Falls) and a mean threshold of 120 fish average over the 2012 to 2019 run years has been added.

The ISRP concludes that active management of colonization rates above Castile Falls requires a thorough evaluation of adult abundance and spawning distribution above and below the falls and an adequate understanding of recruitment dynamics of the steelhead population. Additionally, before initiating an integrated supplementation program, consideration should be given to alternative active management, for example, translocation of adults and egg plants to gain an understanding of spawning areas, smolt production potential, and migration behavior of returning adults from smolts produced above Castile Falls. The ISRP acknowledges that the Master Plan anticipates that a decision to proceed with supplementation would involve consultations with the National Marine Fisheries Service (NMFS) and Washington Department of Fish and Wildlife (WDFW). The ISRP believes that a better understanding of the population is required before an informed decision can be reached. Step 2 of the Master Plan should develop details of the monitoring and evaluation that is taking place that can guide evaluation of the capacity of the reaches above Castile Falls and fish counting at Castile Falls. Step 2 should also provide a time-frame for conducting preliminary stock recruitment analysis to determine capacity and colonization rates and provide details on the opportunities for alternative active management of colonization rates.

(3) Integrated spring Chinook Harvest Program

The current spring Chinook hatchery program in the Klickitat River is not providing the harvest benefits desired by the Yakama Nation, U.S. v. Oregon, and other co-managers. Adult recruits per spawner for the hatchery is less than adult recruits per spawner for the natural population; the hatchery produces mini-jacks that do not contribute to harvest; and the program has had bacterial kidney disease (BKD) infections. The program is functionally segregated; broodstock for spawning are selected from volunteers to the Klickitat Hatchery and most are hatchery returns from previous production. Approximately 800,000 juveniles are released annually and the program requires 722 adults for spawning (HGMP for Klickitat spring Chinook).

The Yakama Nation proposes to transition the existing spring Chinook program to an integrated harvest format with the hope that this improves overall harvest benefits while reducing risks to the natural population. This proposal is consistent with HSRG (2009) recommendations for the Klickitat spring Chinook population and currently accepted best management practices. The ISRP notes that it is unknown whether implementing these alternative strategies will improve harvest performance or provide natural population conservation benefits. Consequently such programs need to be operated in an experimental framework that provides for sufficient evaluation.

The proposal to transition from a segregated to an integrated harvest program meets scientific review criteria. However, the details of the actual transition in the Master Plan and Appendix C are not specific enough.

The information of primary interest to the ISRP includes:

- a more detailed presentation on how the long-term PNI of >0.67 is to be achieved (various choices of pHOS and pNOB will provide an equivalent PNI)
- justification for the rate of broodstock mining from the natural population
- a succinct statement of the life stage survivals needed for natural and hatchery spring Chinook to achieve the program design
- an assessment of the needed improvement from current conditions

Finally, a well-defined schedule for the transition is needed. On page 80, the Master Plan states that the conversion will involve increasing the proportion of NORs into the broodstock over time, and that the pace of the conversion will depend on the size of the natural population. The ISRP believes additional modeling of the transition and breeding alternatives is needed to provide guidance on whether the overall spring Chinook program (natural production and harvest) is more likely achieved by maintaining a program of 800,000 hatchery smolts, but delaying the transition, or by reducing the program scale and harvest in the near term with the anticipation of improved performance after transition to an integrated program with a large PNI (>0.67).

## Specific Comments

1. **A decision tree that would function as a management tool to guide management actions based on monitored results and actions**

Response: Chapter 6 (6.1.5) page 61 for steelhead and (6.2.5) for spring Chinook

The Master Plan submitted by the Yakama Nation (YN) for the Klickitat Subbasin presents well-considered proposals for how treaty harvest obligations for steelhead, spring Chinook, coho, and fall Chinook salmon can be achieved. Harvest opportunity, however, is not the only goal presented in the master plan. Habitat improvements along with efforts to protect and enhance natural populations of steelhead, spring Chinook, lamprey, and bull trout in the Klickitat Subbasin are also included. A major objective is to create local hatchery broodstocks that can be used in hatchery programs within the Klickitat basin. Converting the current situation where eyed eggs or smolts originating from hatchery populations outside the basin are imported for future or immediate release into the Klickitat to the desired state where only local origin fish are used in segregated or possibly integrated hatchery programs requires multiple steps and choices. Work completed in 2005 in the Klickitat River reopened upriver habitat that had been unavailable to anadromous salmonids for forty years. The Master Plan also presents approaches for how this area above Castile Falls can be colonized by steelhead and spring Chinook. In both cases, conversion of hatchery broodstock sources and colonization above Castile Falls, the proponents use iterative processes that have a number of "if and then" actions.

In its review of the 2008 Klickitat Master Plan, the ISRP recommended that decision trees be developed for the steelhead and spring Chinook programs. Decision trees will help the proponents formally present the steps and "if then" decisions that each program has. Such trees also help emphasize where monitoring and evaluation efforts need to be directed, how often such tasks need to be performed, and the questions and analytical procedures that need to be implemented. Results of these efforts will indicate the status of the resource and what should occur next.

Information in the 2012 Master Plan, the HGMPs for steelhead, spring Chinook, fall Chinook, and coho, plus details in the Klickitat Hatchery renovation and Wahkiacus Hatchery construction plans lay out the options considered and how the proponents plan to proceed. In its current state, however, the Master Plan does not possess formal decision trees for steelhead or spring Chinook. Instead, the Master Plan describes the steps and "if-then" decision points in both of these programs. In some cases, however, the Master Plan lacks important details that were present in the HGMPs. For instance, the Master Plan for spring Chinook indicates that hatchery origin (HOR) and natural origin (NOR) adults captured in the Klickitat Subbasin will be used as broodstock. At spawning, HORs will be crossed with HORs and NORs with NORs with the goal of producing 200 K NOR and 600 K HOR progeny. Juveniles originating from each type of cross will be differentially marked; HOR progeny will be ad clipped while NOR progeny will only receive elastomer marks. Why this was being done was not explained. The spring Chinook HGMP clarifies why this strategy is being pursued. It states that genetic differences were found in Klickitat NOR and HOR spring Chinook. And it reveals that spring Chinook adults produced from NOR parents would be used to colonize habitat above Castile Falls. Further, the reason that fish originating from NOR parents would not be ad clipped and instead receive elastomer tags was to enhance their survival through selective fisheries and therefore increase the number of adults that could be released into the upper Klickitat River. And finally, the HGMP discloses that the proponents have assumed genetic differences found between HORs and NORs make progeny from NORs better adapted to local conditions and therefore preferred colonizers. Details such as these expose the thought and rationale the proponents have given their plan. These details need to be incorporated into the Master Plan.

The ISRP recognizes that Master Plans and HGMPs are living documents, subject to change as new information or strategies are developed. Nonetheless, we encourage the proponents to incorporate materials present in their HGMPs to enrich the Master Plan and therefore provide additional rationale for planned steps. In some cases too, the HGMPs should be modified to account for new thinking as expressed in the Master Plan. We suggest that the HGMPs and Master Plan be carefully examined and updated by the proponents so that consistent information and background information is present in all project documents. Furthermore, the ISRP urges the proponents to develop detailed decision trees for all four Klickitat hatchery programs. With four major programs simultaneously occurring in the same subbasin, these decision trees will provide each project with a series of easily seen formal bench marks and decision points that will help guide the proponents as they manage these projects through time. If necessary, decision trees and if-then triggers can be modified as new information becomes available.

The specific points for the individual programs are included above in the recommendation section.

2. **Detail regarding steelhead recruit analysis and harvest**
   Response: Chapter 6.1 and Appendix C

In the review of the 2008 Master Plan, the ISRP recommended a steelhead recruitment analysis that incorporates variability in productivity and capacity to estimate allowable harvest of wild fish, and modeling of harvest potential, natural abundance, and productivity under a scenario without artificial production to provide a comparative standard for evaluating alternative options in the Master Plan. This modeling would provide the basis for scientific justification for specific elements of the integrated harvest program (deleted from the 2012 Master Plan) and the supplementation/conservation components in the 2008 plan.

The 2012 Master Plan, the steelhead HGMP, and Appendix C (Model Analysis and Supporting Data) reports additional information on steelhead vital statistics, but a recruitment analysis that serves to justify the proposed program is not yet provided. The longest data set is a series of redd counts for a combination of summer and winter steelhead, hatchery and wild combined (Table 6-1, page 53). The Klickitat Steelhead Recovery Plan (2009) concludes that adequate data are not available to perform a thorough steelhead viability analysis. The recovery plan also concludes that improved data collection is now in place. Consequently, the ISRP concludes that the steelhead program needs to be implemented in an experimental format so the vital population parameters can be estimated and subsequently used to design the program. At this time there is no scientific justification for the program design.

In 2008, the ISRP asked why a nine-year natural colonization period was chosen as opposed to some other time period. Additionally, an explanation of the reasons behind the fish numbers chosen to trigger an integrated steelhead hatchery program at McCreedy Creek was requested. The McCreedy Creek project would require the construction of a new facility and the release of 70,000 steelhead smolts per year into the Klickitat River above Castile Falls. These two questions remain unanswered in the current Master Plan.

The 2008 and 2012 Master Plans indicated that resident rainbow trout will be incorporated into the fish placed at the McCreedy Creek acclimation site, if this facility is built. The ISRP questioned why resident trout would be included in the McCreedy broodstock. The 2012 Master Plan largely addresses this issue by indicating that four separate breeding lines, consisting of pure anadromous steelhead, pure resident trout, anadromous females by anadromous males and resident females by anadromous males will be used at the McCreedy facility. The plan cites a study performed by Thrower et al. (2004) that showed smolting juveniles were produced when anadromous males were crossed with resident females. The HGMP for steelhead does not mention the use of these lines nor does the Master Plan include information in the coho HGMP where it is suggested that mainstem resident trout are likely produced by anadromous x resident crosses. This implies a genetic potential for resident trout to produce anadromous offspring (see e.g. Nichols et al. 2008) and infers that resident females represent a potentially important source of eggs that could be used when anadromous females are scarce. All of this information should be included in the Master Plan as it provides the rationale for potentially using resident rainbow in the McCreedy Creek broodstock program.

The ISRP cautions the proponents about using PIT tagged fish to estimate SAR values. Knudsen et al. (2009), for example, found that SARs of PIT tagged spring Chinook were, on average 25% lower than those calculated on non-PIT tagged cohorts. This impact was due to tag loss and tag induced mortality. We suggest that parallel SAR estimates be made on non-PIT tagged project steelhead to provide potentially less biased values. In addition, estimates of SAR values from previous Klickitat steelhead smolt releases should be calculated and presented in the Master Plan, as requested in 2008, to see if the program is adequately sized to reach its harvest goal of 2000 fish.

An SAR of 2% has been listed as the standard for the steelhead project which is scheduled to release 90,000 smolts. If this SAR is realized the project would produce 1,800 adults that would be available for harvest and broodstock in a segregated program. This means that approximately 200 NOR steelhead would need to be included in the harvest to achieve the project's harvest goal. How often a SAR of 2% or greater will be realized is unknown. However, knowing the range, median, average, and coefficient of variation of past SARs will help define the likelihood of that event and also help the proponents evaluate the impact of potential harvest of NORs on their efforts to conserve Klickitat steelhead under likely future SARs.

The short-term and long-term productivity conservation objectives (return per spawner of 4.5 to 5.3) for steelhead shown in Table 6-4 seem unrealistically high and should be further justified. If these are intrinsic productivity estimates, the table should state so. Moreover, the table should show R/S objectives at the targeted steelhead escapement level, not the hypothetical intrinsic level where there is no density dependence. Based on average values from Table 6-1, an approximate R/S of wild steelhead at present is only 1.17, assuming all spawners are natural origin. Ideally, a brood table for natural steelhead and a recruitment curve for the natural anadromous population could be developed and the current MSY escapement levels for steelhead could be estimated. The current use of EDT and AHA do not include a presentation of the existing recruitment curve.

The production tables in Appendix C show some exceptionally high maximum spawning estimates (up to 9,582 steelhead), but there is no mention of how many adults (progeny) can be expected to be produced by this large escapement, which may exceed the capacity of the spawning and/or rearing habitat. The assumed harvest rate seems to be constant for average, minimum, and maximum total run sizes (Appendix C Table 5), which is not a realistic scenario. Harvest rates usually increase with large run size. Will harvests be allowed even when runs of natural steelhead are low?

Numerous assumptions are used when estimating future production, harvest, and conservation scenarios. This highlights the need for a robust monitoring and evaluation program with the ability to adapt to unanticipated outcomes. The program does recognize the need for monitoring and evaluation (M&E) and adaptive management.

3. **Detail regarding on the determination of spring Chinook release sizes, recruits-per-spawner, and harvest**
   Response: Chapter 6.2 and Appendix C

In its review of the 2008 Master Plan, the ISRP asked how the 800,000 smolt goal for the integrated spring Chinook hatchery program had been determined. Ancillary questions were raised about the recruit per spawner value of 9.5 used in the plan and how the harvest objective of 4,000 adults would be met. The 2012 Master Plan and Appendix C indicate that the program's size was influenced by EDT and AHA modeling. Under current conditions, with a segregated hatchery program, the AHA model (appendix C, p11) predicts that 3,800 spring Chinook adults will be produced and 2,600 of those would be harvested. A total of 7,000 adults are expected when an integrated hatchery program is in place along with the successful colonization of spring Chinook into habitat above Castile Falls. Approximately 4,000 of these fish would be available for harvest. Another hundred or more adults might be expected to return to the Klickitat on average if the watershed was to undergo a series of restoration efforts. In this circumstance, harvest would again equal approximately 4,000 fish. The reliability of these forecasts remains to be seen; however, the ISRP recognizes that these predictive tools are widely used and represent the current state of the art.

The current Master Plan also indicated that the mean size at release for spring Chinook has been dropped from 6 to 8 fish per pound (fpp) to 13 to 15 fpp. This was done to reduce the occurrence of mini-jacks or males maturing in freshwater at age two. The Master Plan reported that 75% of the spring Chinook returning to the Klickitat Hatchery for brood years 1996 – 2003 were mini-jacks. This finding led to the decision to decrease smolt size which began in 2004. However, there was no information on the production of mini-jacks after the release of smaller yearlings beginning in 2004. Did the release of smaller smolts result in fewer min-jacks and by how much? Were mini-jacks included in the SAS, SAR, and R/S calculations? The exceptionally high production of mini-jacks will have a significant effect on production and productivity estimates, and additional detail is needed to evaluate attempts to reduce mini-jack production.

Mini-jacks may prey on juvenile salmonids and compete with them for food and other resources. Diverting large numbers of hatchery males into this strategy due to early rapid growth and artificial feeds may also potentially reduce the number of older adult males the hatchery can produce. Thus keeping track of their occurrence is an important metric. It is stated that precocious males will be identified by visual observations. Yet the visual characteristics being used are not described. We suggest that the abundance of mini-jacks in the hatchery population be determined by measuring plasma levels of the reproductive steroid ketotestosterone (11-K-T) on smolts at, or just prior to, release (Larsen et al. 2004). Males with 11-K-T levels greater than 0.8 ng/ml are considered to be maturing minijacks (Larsen et al. 2004). A less sensitive method, determination of the gonadosomatic index (GSI) of sampled male smolts, may also be employed by the project. GSI values are ascertained by dividing the testes weight by the body weight of a male and multiplying the quotient by 100. Individuals with GSI ratios $\geq$ 0.1% are considered to be maturing males (Campbell et al. 2003; Larsen et al. 2004). These two methods will provide the project with an immediate and objective assessment of precocious maturation in males. Fish collected for pathogen inspections just prior to release could be used in these assays.

The reported average R/S for natural spring Chinook salmon (3.69) is misleading because the average is brought up by a few exceptionally high R/S values. An average R/S of 3.69 could support a reasonable harvest if it was consistent from year to year. The median value (R/S = 2.16) and geometric mean (R/S = 1.97) would be more representative of the typically low R/S. The productivity objective should be reported as the R/S at the anticipated average escapement (700 spawners) in addition to the reported intrinsic R/S (7.0) in the absence of density dependence.

Harvest objectives for each of the fisheries are shown in Table 6-12. Given the selective sport fishery harvest (including catch and release mortality) and non-selective harvests, what is the estimated contribution of hatchery versus natural Chinook to the 4,000 fish harvest objective? Does the anticipated productivity and escapement objective for natural spawners support this harvest objective?

4. **Information regarding balancing broodstock collection, hatchery smolt yield, and anticipated SAR with the harvest and stock conservation**

Response: Chapter 6.2 and Appendix C

It is clear from the Master Plan that the primary purpose of all four hatchery programs in the Klickitat watershed is to mitigate for lost harvest opportunities caused by dam construction. Yet the Yakama Nation is also attempting to create programs for steelhead, which can be used to supplement the natural populations, and for spring Chinook that reflect the need for conservation. This is being accomplished in a variety of ways such as by setting up rules that govern the proportion of NORs that can be harvested and incorporated into broodstock programs and by habitat restoration. One such example is the conversion of the segregated spring Chinook hatchery program into an integrated one by incorporating NORs into the broodstock. The eventual goal is to exclusively use NOR spring Chinook in the hatchery program. Early on in this program two lines of spring Chinook lines will be present in the hatchery, a HOR by HOR and a NOR by NOR. Adults produced from the NOR by NOR crosses will be released above Castile Falls to colonize newly available spawning and rearing habitats. These proposed actions were commended by the ISRP in 2008, and we are encouraged to see that they continue to remain important objectives in the current 2012 Master Plan. In its review of the 2008 Master Plan, the ISRP asked for a time table for converting the segregated Chinook program to an integrated one. The 2012 Plan and HGMP for spring Chinook indicate that the conversion will take place over time based on the availability of NOR broodstock. This will occur because a self-imposed restraint of not using more than 25 to 50% of the returning NORs as broodstock has been established as a conservation objective.

Similar efforts have been placed into the steelhead hatchery program. In this case, the amount of introgression between out-of-basin steelhead and wild Klickitat summer run steelhead stock is being assessed on a regular basis. Two trigger points based on introgression levels have been established. If naturally spawning hatchery fish of Skamania origin produce more than 5% of the NOR smolts over a set period to time, then a series of steps in the segregated steelhead program are scheduled to take place. If introgression levels are greater than 10%, then the summer steelhead program will either end or be converted into an integrated hatchery program. In general, the Master Plan attempts to strike a balance between harvest and conservation opportunities with the caveat that creating a reliable and sustainable quantity of harvestable fish is the primary purpose of all the hatchery programs.

Given the current capacity of the Klickitat River subbasin, uncertainty regarding the increases in abundance and productivity from opening up the watershed above Castile Falls and habitat restoration, and uncertainty regarding benefits from reforming the hatchery program, the ISRP believes additional modeling of the transition period is warranted to help develop the decision tree. The 25% NOR collection rate needs to be evaluated to confirm that this rate does not jeopardize the status of the natural population. Cumulative anticipated harvest and conservation benefits under different transition timeframes and protocols need to be modeled. There may be long-term benefits from a faster transition period releasing fewer fish, rather than continuing a segregated component for the foreseeable future to maintain a release of 800,000 smolts.

5. **Summary and synthesis of ecological benefits of ongoing habitat restoration activities**
Response: Appendix A (actions) and C (EDT modeling)

The Master Plan and Appendix A provide an exhaustive list of potential habitat restoration efforts that are designed to enhance the natural production of native summer and winter steelhead, spring Chinook, bull trout, and lamprey. The Master Plan made clear that the Yakama Nation believes habitat conditions (and improvement) within the Klickitat River is the primary requirement for securing the viability of listed steelhead, bull trout, and spring Chinook, and that habitat conditions will determine the abundance and productivity of natural populations that in turn will limit the scale of integrated artificial production intended to provide harvest.

There are at least four challenges associated with habitat restoration. First, identifying what needs to be done and where it should occur. Second, prioritizing these actions in such a way that maximal benefits can be realized by ESA-listed or otherwise depressed populations. Third, obtaining funds to perform the work and establishing partnerships with local and federal entities to facilitate and coordinate restoration efforts. And lastly, to select easily observed but biologically meaningful metrics that can objectively quantify the benefits that may be produced by a restoration action. It takes time for habitats to heal, and that coupled with expected weather extremes due to global climate change make the assessment of restoration projects somewhat problematic.

Information contained in the Master Plan, the HGMPs for Klickitat steelhead, spring Chinook, coho, and fall Chinook indicate that the proponents have identified what needs to be done, where it should occur, have made efforts to prioritize this work, and are working with federal and local partners. One example of this can be found in Appendix C where EDT modeling was used to prioritize geographic areas for protection and restoration. However, EDT modeling inputs are often based on expert opinion rather than quantitative measures of the watershed. The EDT analysis reveals that the increased productivity in response to habitat restoration is based primarily on assumptions. EDT modeling also has no time frame associated with restoration. The assumptions and anticipated benefits from habitat restoration need confirmation through evaluation.

The Monitoring and Evaluation chapter of the Master Plan states that water quality and temperature, streamflow, presence of channel habitat units, substrate composition, occurrence of woody debris, and types and amount of riparian vegetation will be used as metrics to help determine benefits derived from restoration actions. These are all physical attributes that are expected to be linked to biological performance, either food production, shelter, species biomass, growth, movement and so on. Will any efforts be made to directly correlate these physical parameters with biological performance (e.g. increases in juvenile salmonids and lamprey numbers, smolt numbers, insect production, etc.) to validate their use as metrics for detecting habitat improvement over time?

Appendix A provides a long list of habitat restoration efforts that received one of three "implementation" ratings. However, none of the projects were prioritized. Although project costs are shown, there is no information clearly indicating which projects have been funded. The most certain benefit would be through increasing fish passage at the passage impediments. Also, it is not clear how the elements on the list relate to the EDT results or the Subbasin Plan.

6. **Confirmation of study design and statistical validation of tagging rates and tag recovery**

   Response: Chapter 7

A general framework for collecting vital parameters is provided, but Chapter 7 states that final designs have yet to be completed. Additional experimental designs are needed to evaluate the effect a steelhead segregated harvest program has on abundance and productivity of the ESA listed population.

Table 7.1 in the Master Plan summarizes the types of tags and marks that will be applied to the hatchery fish produced from the steelhead, spring Chinook, coho, and fall Chinook hatchery programs. For completeness, the ISRP requests that this table be expanded by two additional columns. One would indicate the purposes of the tags, for example identification of fish origin at Lyle Falls or ocean harvest and so on. The second column would state the statistical test(s), if any that would employ the recovery data collected from tagged or marked fish. This will help the proponents determine if expected recovery rates of their various tags will provide them with enough statistical power to answer the questions for which the tags or marks were applied.

The ISRP notes that the proponents plan on using scale analyses to help separate hatchery from natural origin adults. We suggest that the proponents contact an independent state, federal, or university fish ageing lab that has experience reading Columbia River steelhead and spring Chinook scales to provide an independent reading of these structures. This will help corroborate origin assignments. It is good that PIT tag shedding will be evaluated in the hatchery, but post-release shedding and the effect of PIT tags on survival also needs evaluation. Consequently, we also suggest that CWTs, ad-clip, or other marks and tags be used to calculate SAR, R/S, and other viability parameters as PIT-tagged fish may underestimate these values. This will provide the proponents with two independent estimates of each of these parameters and further help refine any possible effects of PIT tags on survival.

We also request further clarification on the marking and tagging associated with the fall Chinook hatchery program. The HGMP for this species states that 16.5% of the released fish (~600,000) will be ad clipped and tagged with coded wire. The remaining 83.5% will receive blank wire and will also be ad clipped. Table 7.1 just shows the 600,000 ad clipped and coded wire tagged fish. We raise this question because the fall Chinook HGMP reports that straying of Klickitat fall Chinook into the Snake River has been a problem in the past. Recently the brood source for this project was changed from the Priest Rapids Hatchery to Little White Salmon, and the plan is to eventually shift it to a locally adapted broodstock. The expected result of these changes in broodstock was to reduce straying. We recommend that all the fall Chinook released from the program be ad-clipped and CWT tagged, either with blanks or with codes, as information from these fish will help determine if straying rates have decreased as anticipated. The blank tags will have the agency name on them so if the Yakama Nation is only using them on these fall Chinook they will be able to link project fish back to where an individual was recovered. If that is not the case, perhaps consideration could be given to increasing the number of coded wire tags inserted into project fish to ensure the acquisition of precise and accurate straying rates.

It is good that the Yakama Nation program will evaluate the quality of fish and tagging prior to release (Objective 7.1.5). Fin clipping needs to be evaluated for partial clips that might be mistaken for unclipped fish.

Harvest monitoring of tribal fisheries on the mainstem Columbia and Klickitat River is briefly described. It is difficult to evaluate whether the level of observations is adequate to accurately estimate harvests of hatchery and wild salmon. Are tribal fishermen required to report harvests used for subsistence and commercial purposes, or are buyers of commercial salmon required to report numbers? If so, how do reported harvests compare with expanded observations of harvest?

The lack of information on the sampling effort and frequency of sampling makes it difficult to evaluate whether the monitoring program is adequate.

Will steelhead be aged, as suggested by Objective 7.4.2? If so, why was a brood table not shown and used to develop a recruitment curve for steelhead?

To evaluate capacity of the system to support supplemented populations, the project should consider showing the relationship between smolts per spawner and the number of natural spawners; a negative slope would suggest habitat is affecting productivity.

Finally, some consideration of evaluating the effects of mini-jacks on small native fishes is needed.

7. **Information addressing the conditions of termination of supplementation above Castile Falls should also be outlined in the requested "decision tree"**

   Response: Chapter 6 (6.1.5) page 61

Escapement estimates for steelhead and spring Chinook were made for the Klickitat watershed above Castile Falls. Approaches were also developed for colonization of this area by these two species, including, if necessary, the use of an acclimation site at McCreedy Creek. However, the Master Plan does not explicitly state the triggers that will be used to stop supplementation of spring Chinook and steelhead, if needed into this area. These triggers need to be identified and placed into the decision trees for both of these species. Also the caveat that “If all parties agree” for termination of supplementation above Castile Falls leaves this decision very uncertain. Elaboration on this point is needed.

Hatchery steelhead will not be released above Castile Falls until it is determined that wild fish cannot colonize this habitat on their own; e.g., <120 steelhead migrate above the falls. The decision metric does not seem to depend on the abundance of native steelhead. Hatchery steelhead releases above Castile Falls would be terminated when population goals for this basin are achieved. It was not clear whether the trigger metric was based on the basin goal of 750 steelhead.

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