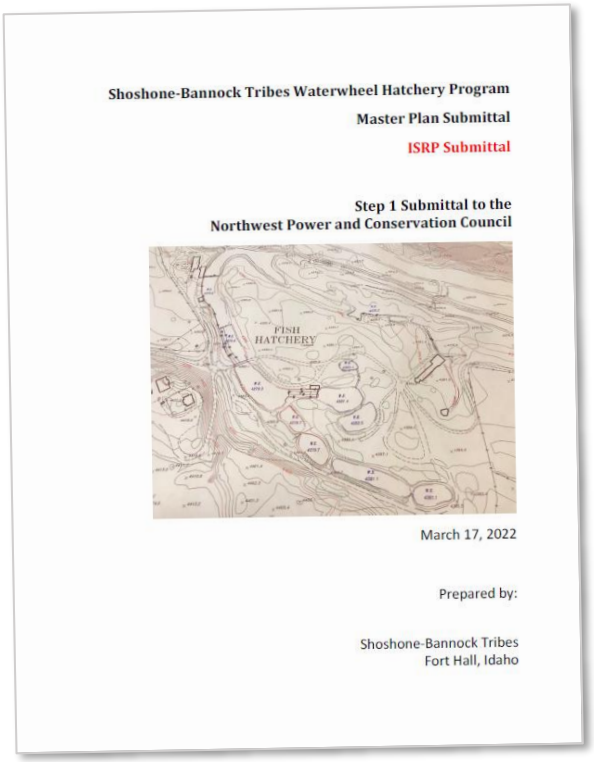
ISRP INDEPENDENT SCIENTIFIC REVIEW PANEL

FOR THE NORTHWEST POWER AND CONSERVATION COUNCIL PORTLAND · NWCOUNCIL.ORG/ISRP

ISRP STEP 1 MASTER PLAN AND PROPOSAL FOLLOW-UP REVIEW: SHOSHONE-BANNOCK TRIBES' WATERWHEEL HATCHERY PROGRAM



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Background

Review Request

On April 26, 2023, the Northwest Power and Conservation Council (hereafter "Council") asked the Independent Scientific Review Panel (ISRP) to review the *Shoshone-Bannock Tribes [SBT] Waterwheel Hatchery Program, Master Plan Submittal*. This is a Step 1 review under the Council's Step Review Process for a proposed hatchery under Project #2008-906-00, *Crystal Springs Planning and Operations/Maintenance* and supporting Project #2008-905-00, *Supplementation Projects*. The 2023 Master Plan and our review build on the previously ISRP reviewed and Council recommended Crystal Springs Hatchery Master Plan from 2011-2012. The Master Plan is for the construction and operation of hatchery facilities and programs for Yellowstone cutthroat trout and spring-summer Chinook salmon to mitigate the effects of the Federal Columbia River Power System through the Council's Columbia River Basin Fish and Wildlife Program.

Review Materials

Our review focuses on how the 2023 Master Plan addressed the Council's Step Review elements for proposed hatchery production and ISRP recommendations and conditions from past reviews. The submittal, received on April 19, 2023, included the following:

- Cover Letter, Dated April 18, 2023
- Shoshone-Bannock Tribes Waterwheel Hatchery Program Master Plan Submittal, Dated March 17, 2023 (date corrected)

We also considered the following background documents:

- Anadromous Fish Habitat and Hatchery Review
  - Council Decision Memo
  - ISRP 2022-1 (see pages 637-645)
- 2011 Master Plan for Crystal Springs Hatchery Facility – Transmittal Letter, MP Volume 1 and Volume 2 (Appendices)
- Council's decision letter to Bonneville Power Administration, 2012.
- ISRP 2012-8 Response Review Crystal Springs Fish Hatchery Program (#2008-906-00)
- ISRP 2011-17 Review of the Crystal Springs Fish Hatchery Program Master Plan (#2008-906-00)

Past Reviews

This proposed hatchery effort's history of proposal, master plan, and response reviews going back over a decade provides important context for this review. The Shoshone Bannock Tribes have made considerable progress in the Step Review Process.

2011-2012 Step 1 Master Plan Review

A Master Plan was submitted in 2011 in Step 1. Following review by the ISRP (ISRP 2011-17) and SBT responses, the ISRP found that the project met review criteria (qualified) (ISRP 2012-8). Based on the ISRP review, the Council recommended the program proceed to Steps 2 and 3 (Council decision letter) and address remaining Step elements and the ISRP qualifications (i.e., conditions) in subsequent Step documents.

ISRP 2012 qualifications included:

> *Chinook salmon*
> *The Master Plan needs revision to reflect the harvest priority of spawning escapement presented in this response to the ISRP. Continuation of the dialogue on the appropriate broodstock source for Yankee Fork is needed, as is planning for broodstock management. Specific broodstock management questions to be addressed in Step 2 are itemized under Issue 3, below.*
>
> *Additional modeling of potential harvest is needed, and an estimate of the harvest benefits and likelihood of broodstock replenishment should be performed using empirical data rather than using the All-H Analyzer (AHA) or AHA rollup models (Issue 4).*
>
> *Further information is needed on how straying rates will be estimated including how hatchery fish will be identified, what locations will be surveyed, how often these surveys will occur, and what the sample size goals will be (Issue 5).*
>
> *The protocols that will be used to assess potential interactions between hatchery origin fish and fishes resident in Panther, Yankee Fork, and the Salmon River need to be more fully explained (Issue 5).*
>
> *The traits that will be measured on project smolts during the rearing period and at the time of release need to be developed (Issue 5).*
>
> *Yellowstone cutthroat trout*
> *The Yellowstone cutthroat trout component has been entirely modified. The artificial production with the objective for a conservation benefit objective will be eliminated from the Master Plan. Instead, up to 5000 five to six inch juveniles will be produced annually for release in a confined oxbow lake on reservation lands. The framework for the*

Yellowstone cutthroat trout sport fisheries is consistent with the Fish and Wildlife Program principles, but the information provided is too brief for an ISRP evaluation. A more detailed assessment for that program is needed. More details are needed regarding the M&E program for these fish, plus a better description of the potential for accidental escape. A comprehensive plan for native and natural trout management and integration with management for fisheries using hatchery produced trout is needed for specific watersheds and geographic regions, per ISRP programmatic comments for the recent Resident Fish Review (ISRP 2012-6).

After the Council's recommendation, the Tribes completed hatchery designs through 90% and a draft EIS was released in 2017. Unfortunately, NOAA operational plan reviews identified a critical high-risk factor for rearing Chinook salmon at Crystal Springs. Specifically, studies found that water hardness made the Crystal Springs site unsuitable for Chinook salmon rearing. Consequently, an alternative hatchery location needed to be found, the planning and Step Review process was delayed, and the SBT are now submitting this "replacement" plan with significant updates and a new hatchery location and strategy.

2021-2022 Anadromous Fish Habitat and Hatchery Projects Review

The most recent reviews associated with this production effort were for the 2021-2022 Anadromous Fish Habitat and Hatchery Projects Review and the 2022-2023 Lower Snake River Compensation Plan Spring/Summer Chinook Program Review. The Council asked us to consider their recommendations from the 2021-2022 review regarding the two projects associated with the master plan:

- **Project #2008-906-00, *Crystal Springs Planning and Operations/Maintenance*** – "*In Step review. Bonneville and Sponsor to take review remarks into consideration in anticipated step submittal. This project is intended to support hatchery mitigation authorized under the Northwest Power Act (Council's Fish and Wildlife Program). See Policy Issue I.b.*" (See ISRP 2022-1, pages 642-645)

    - The Council's "Policy I.b" is included in the Council's Council Decision Memo. The policy provides general context for the review and describes the Council's support of artificial propagation as a Core Program Strategy, the contributions of hatcheries to meet mitigation and conservation needs, the long history of hatchery reviews, regional coordination through the Council's Hatchery Workgroup, and the priority of maintaining and modernizing hatchery infrastructure.

- **Project #2008-905-00, *Supplementation Projects*** – "*Bonneville and Sponsor to address condition #1 (objectives), #2 (methods), #3 (adjustment process) in project documentation. Condition #4 (captive broodstock) will [be] dependent upon a Step Review prior to implementation (see Project #2008-906-00). See Policy Issue I.b.*"

- The ISRP recommended that the project met scientific review criteria (conditional) and included four conditions (ISRP 2022-1, pages 637-642). As noted above, the Council recommended that the SBT address these conditions in project documentation (e.g., annual reports and work plans). The ISRP did not explicitly request any further review until the next review process. The ISRP's conditions:

  1. ***[SMART] Objectives.*** *Provide timelines for each objective where timebound objectives are needed. Consider adding objectives for coordination, education, outreach, and participation in adaptive management processes.*

  2. ***Methods.*** *Describe in more detail (than provided in Appendix A and the methods section) what experimental designs and statistical models will be used to achieve objectives 2-4. The proponents should seek statistical design support if needed.*

     [Objectives 2-4:

     > *2) Agai'an g/kono—salmon fish basket methods to optimize egg incubation;*
     >
     > *3) Wolf teachings "to keep our hands off the fish": Estimate the proportional contribution of egg supplementation to juvenile and adult production;*
     >
     > *4) Re-production*: we will evaluate the effects of egg supplementation on the productivity of natural-origin Chinook salmon. … *Re-production is a marker for saying we are outside the bounds of natural reproduction and artificial production while at the same time adhering most closely to supplementation hence the project name. However, what and how the project and work we do from a Shoshone-Bannock sense is not necessarily definable given our language as a reflection of a verb-thought world. Thus, our interest is driven by our relatives and communities at the processes of interactions around us in our homelands through our seasonal round, Nean Oyose Nanewenee, Figure 3.* See proposal.]

  3. ***Project adjustment process.*** *Provide more information about the institutional procedures and schedule (i.e., meetings and reviews) that will be followed to implement the adaptive management process described in the proposal.*

  4. ***Plans for captive broodstock and Bonneville Hatchery releases.*** *The proposal describes two alternative hatchery strategies to address Snake River Chinook salmon egg limitations for the incubation box supplementation strategies. It is not clear if these options are a component of this project or other projects. If this project is proposing these options, much more information is needed to assess*

the scientific merit. We suggest completing a planning process that examines and compares the potential benefits and risks of the proposed alternatives. A comparison is needed of the current plan for a new hatchery with supplemental breeding and smolt releases at Bonneville Hatchery (combined with transport of a conservation component of eyed-eggs for streamside incubation in treatment streams to provide for a natural life cycle).

2022-2023 Lower Snake River Compensation Plan Spring/Summer Chinook Program Review

The ISRP recently reviewed the Yankee Fork Program components of the Lower Snake River Compensation Plan Spring/Summer Chinook Program (ISRP 2023-1). This review considered a symposium presentation, a summary report for 2008-2018, and related supporting documents. Overall, we found that the LSRCP program is not achieving the mitigation goals or management objectives for reintroduction, supplementation, or harvest in the Yankee Fork. The current approach has demonstrated little progress or improvement toward meeting the goals and objectives. In-river smolt survival and SARs are low and well below objectives. Adult returns have declined to very low levels in recent years, and many adults stray back to the Sawtooth Hatchery rather than return to the release site. Tribal fisheries have not been restored and maintained. The ISRP recognizes the importance of traditional fisheries in the culture of the Shoshone-Bannock Tribes. The Tribes have foregone fishing opportunities in traditional locations throughout the Salmon River Basin with hopes that these essential traditional fisheries could be restored in the Yankee Fork with hatchery releases and supplementation. The poor performance of the hatchery program has precluded the anticipated fisheries. Restoring harvestable levels of salmon to the Yankee Fork is essential to the persistence of Shoshone-Bannock Tribal cultures.

ISRP recommendations for the LSRCP Yankee Fork Program:

- Consider development of acclimation facilities high in the system to improve imprinting, reduce stress, and potentially increase SARs.
- Analyze factors influencing survival of Snake River Hatchery spring/summer Chinook salmon and age-at-return. This could be part of a Program-wide analysis (see Key Finding 6, ISRP 2023-1).

Hatchery Program Purposes

As summarized in our 2022 proposal review, Tribal ceremonial and subsistence harvest opportunities have been severely limited. Chinook salmon runs have declined precipitously throughout the Tribes' usual and accustomed fishing areas. All salmon populations in the Salmon River subbasin are part of an ESU listed as threatened under the ESA. Historically, harvest of salmon and other native species provided up to 700 pounds of fish per Tribal

member annually. In recent years, harvest has only provided 0.5 pounds of fish per member. The loss of available harvest has impacted Tribal culture and subsistence in many ways. Hatchery programs are being planned and developed to restore fishing opportunities for Chinook salmon in Panther Creek and Yankee Fork. In addition, hatchery construction and operations are planned for Yellowstone cutthroat trout to provide tribal and non-tribal harvest on the reservation. The proposed hatchery programs are considered essential for restoring historically important place-based tribal harvest opportunities.

As described in the Master Plan's Executive Summary, the proposed program has important cultural purposes for the spring/summer Chinook and Yellowstone cutthroat trout components:

> *This revised submittal documents this re-envisioned program for a new production facility that will accomplish Tribal goals for both anadromous and resident fish. While the production methods and location has changed, it is far from an entirely new proposal; rather it is the natural progression of a complicated planning process. The Tribes purchased a parcel of fee simple property in mid-2021, located on the Fort Hall Reservation, with the intent to engage in environmental monitoring, conserve critical Reservation lands along the Portneuf River, and work alongside the Fish and Wildlife Department to restore an existing hatchery structure that is located on the property. The parcel is approximately 110 acres and has an existing water right of 75 cfs for aquaculture utilized by previous owners to rear game fish. The program described proposes to utilize a portion of that parcel to develop a captive Chinook Salmon broodstock pilot program and develop a new production program for Yellowstone Cutthroat Trout. The existing Waterwheel Hatchery site would be renovated to improve Tribal hatchery facilities located within the Fort Hall Reservation, with components that include process water systems, utilities, covered spawning area, incubation facilities, rearing facilities, administration and other support facilities, and effluent treatment facilities. Implementing the proposed facilities renovation and production program will enable the Newe--Shoshone-Bannock peoples to better meet their solemn obligation to protect, preserve, and restore native species of deep cultural significance to the Tribe. The existing hatchery was purchased by the Tribes in 2021 to facilitate this program and the renovation would be funded by existing capital funds from the 2008 Fish Accord.*
>
> ***Anadromous Fish Program***
> *The proposed captive Chinook broodstock program would entail (1) developing a consistent Chinook Salmon (Taza agai in Shoshone, Oncorhynchus tshawytscha) broodstock for the Yankee Fork Salmon River and Panther Creek, (2) constructing and operating hatchery facilities to maintain a Chinook captive broodstock program, and (3) engaging in annual management of eyed-eggs for outplanting in the Yankee Fork and Panther Creek in egg boxes on an annual basis.*
>
> ***Resident Fish Program***
> *The resident fish program is designed to offer subsistence harvest opportunities for a resident native fish species of cultural and economic significance to the Tribes: Yellowstone*

Cutthroat trout (YCT) (Aingasayawena, O. clarkii bouvieri). YCT will be released into two confined fishing areas and a genetically-pure broodstock will be developed from existing populations in various streams from the Fort Hall Reservation. The Shoshone-Bannock Tribe's goal for its proposed YCT program is to renovate and construct new facilities at an existing Tribally-owned hatchery facility at the Waterwheel site, located within the Fort Hall Reservation, to provide hatchery fish for Tribal and non-tribal harvest in select areas for harvest. The program will implement a small scale hatchery renovation action to facilitate the production of YCT for release within a portion of the Upper Snake River Basin located within the Fort Hall Reservation or adjacent Tribal lands.

The primary objective of the [YCT] hatchery Project is to provide subsistence harvest opportunities to Tribal members for this culturally significant species, with an ancillary benefit of utilizing artificial propagation techniques to promote conservation for YCT in the Upper Snake River.

Our review below focuses on the new Master Plan and the new site for the hatchery, and also builds on the past reviews of proposals, LSRCP summary documents, and the Crystal Springs Master Plan.

ISRP Recommendation

The ISRP appreciates the effort and commitment of the SBT in completing another Step One Master Plan submittal. The Master Plan development has been a long and challenging process with significant setbacks along the way. This Plan represents a significant step forward in meeting Tribal goals of restoring traditional Tribal fisheries for salmon and resident fish and restoring natural spring/summer Chinook production in Panther Creek and Yankee Fork Salmon River. The completion of this new Step One Master Plan highlights the importance of the proposed hatchery production in meeting management objectives. The Plan addresses many of the elements required for meeting scientific criteria; however, there are some important elements of the Plan that need to be enhanced and improved. Multiple conditions need to be met before this proposal can be considered as fully meeting scientific criteria. We recommend that the Master Plan be revised in the next Step Review process to address the following six conditions:

Anadromous Fish - Spring/summer Chinook

Meets scientific review criteria for Step Review with conditions:

1. **Consolidate Goals and Objectives:** Goals and objectives are scattered throughout the document and in other documents. The Plan would be much improved if all goals and objectives were presented together. SMART biological and implementation objectives should be developed where appropriate, and there should be continuity and

connectivity of the goals, biological objectives, implementation objectives, and methods. SMART objectives could be written for the 15-year program and for interim and final targets to be met by 5-, 10-, and 15-year horizons. This condition is consistent with the conditions provided by the ISRP in the most recent AFHH project review of the Tribes Crystal Springs and Supplementation Projects.

2. **Best Available Science:** Significant production uncertainties and risks of the artificial propagation elements of the Chinook captive broodstock program were not sufficiently addressed in the Master Plan, and numerous challenges and production alternatives should be considered. This plan presents only a limited review of the science related to challenges, uncertainties, and knowledge of in-hatchery and post-release performance generated from the three captive broodstock programs operated for spring Chinook salmon in the Snake River basin in the recent past. Specifically, the large amount of information available from the Tucannon River (WDFW), Grande Ronde River subbasin (ODFW) and Idaho (IDFG) captive broodstock programs should be incorporated into this Master Plan. A thorough literature review is needed to ensure the best available science is used to guide the project.

3. **Research, Monitoring, and Evaluation:** The RM&E proposed for the spring/summer Chinook captive broodstock program is challenging to understand. Many of the documents containing RM&E objectives and methods are over a decade old and likely need updating. A comprehensive RM&E plan addressing the following areas of performance should be completed and included as part of the Master Plan: natural production and natural population status and trends, in-hatchery performance of captive broodstock, post-release performance of egg outplants (life-stage specific survival and abundance from egg-to-adult life stages), ecological interactions, life history of natural and hatchery fish, and harvest monitoring.

   The ISRP included multiple conditions from the review of the supplementation projects and Crystal Springs project proposals in the 2021-2022 review. We did not find any description or text indicating that these conditions were addressed; thus, it is unclear if the SBT has completed the work needed to address these conditions. It is important that the Tribes complete a comprehensive RM&E Plan that includes and addresses the ISRP conditions related to the supplementation studies along with all elements of the new hatchery production. The comprehensive RM&E Plan can guide the project and provide clear approaches to addressing critical uncertainties. Much of the information needed for a comprehensive integrated hatchery RM&E Plan is available in the previously mentioned plans, proposals, and documents (although some are outdated). The harvest monitoring is well described in the Fisheries Management and Evaluation Plan (FMEP) and the Tribal Resource Management Plan-Chinook Harvest.

4. **Production Assumptions and Management Uncertainties:** The proponents need to develop a more comprehensive and detailed description of the uncertainties,

assumptions, and production protocols for the entire production cycle. Production assumptions are provided in multiple places in the document and are not always consistent. Overall, it would be more helpful and clear if the assumptions and associated survival and production estimates were consistent and presented together with explanatory text and a table with the values and references for each life stage in succession. A number of critical uncertainties regarding elements of the captive broodstock production and management that may significantly affect the facility designs should be better identified (see Section B.1 below). The Plan needs more detail on important production protocols for incubation, rearing, adult sorting, maturation determination, holding, and spawning of captive brood as well as green-to-eyed egg incubation for eggs produced for outplanting. There are challenges at all life stages that must be considered and addressed. These details are important because outcomes will vary considerably based on the specific production protocols that are implemented.

5. **Adaptive Management and Project Adjustment:** A clear and well-defined project adjustment process is needed because the Plan represents a 15-year experimental approach with significant uncertainty. Further information is needed to fully understand how performance will be evaluated, how monitoring data will be assessed, and how project methods and actions will be modified when needed. The proponents should describe their process for project adjustment to adapt their actions and incorporate new information from their monitoring as it becomes available.

Resident Fish - Yellowstone Cutthroat Trout

Meets scientific review criteria for Step Review with conditions:

6. **Broodstock Options Assessment:** Developing a broodstock of pure YCT from local populations may be desirable, but this approach might be difficult and ultimately unsuccessful. There are risks to the donor populations associated with removal of eggs for producing broodstock and challenges for utilizing natural eggs for hatchery broodstock development that are not described and addressed. There is insufficient information provided to determine the impact on sustainability of the YCT natural populations resulting from egg removal. A benefit-risk assessment should be conducted for the broodstock source options including using eggs from wild populations and using an existing IDFG YCT hatchery stock. Given the information provided in the Master Plan, using an existing hatchery stock may have the lowest risk and highest likelihood of success. The plan should include a better characterization of the specific status of the montane populations that may be targeted for broodstock sources and supplementation because it is unclear if hatchery intervention is warranted for conservation purposes. Although the development of broodstock from these pure strain populations may provide a genetic safety net, the risks to their persistence of such actions are unknown and the need for hatchery intervention for conservation purposes has not been assessed.

ISRP Comments on Step 1 Review Elements

The Council has emphasized that an important part of the Step Review Process includes an ISRP review of the responses to the technical elements listed below. The ISRP comments on how the Master Plan addresses the Step Review elements follow below.

A. All Projects

Does the Master Plan:

1) **address the relationship and consistencies of the proposed project to the 2014 Fish and Wildlife Program's six scientific principles (Step 1)?**

The Scientific Principles:
1. Healthy ecosystems sustain abundant, productive, and diverse plants and animals distributed over a wide area. 2. Biological diversity allows ecosystems to adapt to environmental changes. 3. Ecosystem conditions affect the well-being of all species including humans. 4. Cultural and biological diversity is the key to surviving changes. 5. Ecosystem management should be adaptive and experimental. 6. Ecosystem management can only succeed by considering people.

Chinook

The proposed spring Chinook captive broodstock program and eyed-egg outplants into Panther Creek and Yankee Fork contribute to and are consistent with multiple Fish and Wildlife Program scientific principles. The Panther Creek population was extirpated by contamination from decades of mining activity in the watershed. The Chinook population in Yankee Fork was functionally extirpated as a result of degraded habitat conditions for multiple life stages. Extensive habitat restoration in both watersheds has improved habitat conditions for spring Chinook natural production. Enhancing spring Chinook abundance will increase biological diversity and begin to restore the important role of salmon in the ecosystem. Salmon also play an important cultural role, and the availability of salmon for consumption will contribute to subsistence and culture and improve tribal members' well-being. The Plan is described as an experimental pilot effort for an initial duration of 15 years, and there is ongoing and planned RM&E to assess effectiveness and provide information for adaptive management decisions.

The Tribes have had some success outplanting eggs (Pahsimeroi summer-run stock) in egg boxes to Panther Creek, during three brood years in 2014-2016 (Conley et al. 2020). Outplanted eggs represented about 40-50% of total egg deposition (natural plus hatchery) and, based on

parental-based tagging (PBT), made up 6, 22, and 35% of offspring sampled as parr or emigrants. The efficacy of the egg boxes improved over the three years. The parr produced had similar survival rates downstream through the hydropower system as NOR fish. On p. 9 it states, "The YFCSS project has also released eyed eggs, fry, smolts, and adult Chinook Salmon using broodstock from the Idaho Department of Fish and Game's Sawtooth Hatchery located near Stanley, Idaho. This long-term data set enables our managers to adaptively manage to changing conditions in the watershed and, more broadly, to changes in the Columbia River basin." What do these data show in terms of average survival, variability, trends, carrying capacity, and other population metrics?

This strategy of exposing hatchery-produced eggs/fish to natural selection from the eyed-egg stage will likely produce hatchery fish with higher natural reproductive success than releasing smolts from the Sawtooth Hatchery into Panther Creek and the Yankee Fork (e.g., ongoing under LSRCP for the Yankee Fork). There is existing information that would help in the design phase to ensure flexibility and adaptability needed for captive broodstock production.

Yellowstone Cutthroat Trout

The YCT production addresses an important cultural need to increase the availability of resident fish for harvest and consumption. Although this is a relatively small-scale hatchery production project, it serves an important role of increasing the availability of fish and diversity in the diet of tribal members. One additional objective – providing economic benefits from non-tribal angling permits for YCT – was not addressed adequately in the Plan, but should be.

Developing a pure YCT broodstock from local populations may be a useful goal, but this approach might be difficult and ultimately unsuccessful. The Plan does not adequately describe and address risks to the donor populations associated with removal of eggs for producing broodstock and challenges for utilizing natural eggs for hatchery broodstock. Insufficient information is provided to determine the need for supplementing or the impact on sustainability of the YCT natural populations. Escapement of YCT hatchery fish into release locations in the Fort Hall Bottoms confined area poses little risk because all YCT in this area are extensively hybridized with rainbow trout.

2) **describe the link of the proposal to other projects and activities in the subbasin and the desired end-state condition for the target subbasin (see 2014 Columbia River Basin Fish and Wildlife Program, Part Three, Section II) (Step 1)?**

Chinook

The project builds on and is linked to past and ongoing habitat, research, monitoring, and supplementation efforts in both Panther Creek and Yankee Fork. In Panther Creek, since 2014,

the SBT has planted eyed eggs, estimated natural juvenile abundance, installed PIT tag arrays, operated screw traps, and estimated adult abundance. These efforts have provided new information regarding production potential for spring Chinook, which were extirpated in large part due to the degraded habitat conditions in Panther Creek. Extensive habitat restoration and enhancement as well as land acquisition have occurred over the past two decades and additional work is planned. At the same time, remedial actions and water treatment facilities at the Blackbird Mine site improved Panther Creek habitat. The Plan states that "Panther Creek now supports naturally reproducing Chinook Salmon; however, these fish are likely of hatchery origin (Evans and Denny 2016). More recent evidence from redd counts estimated 25 returning adults in 2017, 173 adults in 2018, 98 adults in 2019, and 135 adults in 2020."

This project proposes to combine eyed-egg outplants with habitat improvement to increase adult returns for harvest and natural production. Habitat improvement efforts were initiated in Yankee Fork in the mid-1990s with extensive rehabilitation of the dredged reach. Multiple habitat projects have been implemented to establish perennial connectivity of dredged reaches to side channels and the floodplain. The proposed project is consistent with the Yankee Fork Chinook Salmon Supplementation Project, which has been underway for over a decade. The production and outplanting of eggs from a locally derived source will contribute to accomplishing the Yankee Fork Chinook Supplementation (YFCSS) objectives, contribute to Chinook restoration and recovery, increase tribal harvest, and help reduce the problem of hatchery adult straying that currently affects the smolt release program from the Sawtooth Hatchery.

The project is linked with and supported by numerous other projects including: SBT Harvest Management Program, SBT Salmon River Habitat Enhancement (1994-050.00), SBT BIA Alternative Rearing Techniques for Threatened Chinook Salmon to design and fabricate re-usable instream indicators, Snake River Chinook salmon PBT (IDF6 2010-031-00), and SBT Supplementation Projects that focus directly on development of methods and M&E of eyed-egg outplanting in the Panther Creek.

New studies evaluating the efficacy of eyed-egg outplants for enhancing summer Chinook salmon in the South Fork Salmon River under the Lower Snake River Compensation Plan are currently being developed. This Master Plan would benefit from a clear description of the South Fork study and how it integrates with the captive brood eyed-egg approach.

Yellowstone Cutthroat Trout

The YCT production program is relatively small and geographically confined, so it has little linkage to other projects, but it is linked to and supported by the SBT Harvest Management Program, which will assess the success in meeting harvest objectives.

3) define the biological objectives with measurable attributes that define progress, provide accountability and track changes through time associated with this project (see 2014 Fish and Wildlife Program, Part Three, Section III) (Step 1)?

Chinook

The Plan states, "The purpose of the Waterwheel Hatchery program is to mitigate for fish losses caused by the construction and operation of the Federal Columbia River Power System (FCRPS) and to contribute to the conservation of listed and sensitive species in their historic range."

The project goals remain identical to those of the Crystal Springs proposal, which were previously reviewed and supported. The goals are to: 1) restore traditional-method harvest opportunities for SBT members in traditional places to revive Shoshone-Bannock salmon-based cultures, 2) increase natural production using supplementation informed by Shoshone-Bannock Traditional Ecological Knowledge (SBTEK), 3) to increase the abundance of spring/summer Chinook returns to the Panther Creek and Yankee Fork watersheds. For the Yankee Fork, the SBT goal (YRCSS 2006) is 2,000 returning adults. The escapement goals for both streams are reported in Table 2-4, as 3-143 adults (NOR or HOR) for Tribal harvest and up to 500 NOR adults for natural spawning. The sliding scale for harvest apparently increases when adult returns exceed the Viable Population Thresholds of 500 for each stream, based on Tables 5-7 in Appendix B. Alternatively, a more ambitious goal of achieving Tribal harvest of 500 Chinook salmon is presented on p. 9. Additional clarity regarding the different harvest objectives would be useful.

The specific objectives as stated in the Plan are to: 1) develop a consistent source of spring Chinook broodstock and eggs for Yankee Fork and Panther Creek, 2) construct and operate hatchery facilities to maintain a captive broodstock program, and 3) produce and outplant eyed eggs. The proposal provides specific time-bound objectives for the number of captive adults needed to meet egg-take objectives, water requirement by life stage and by broodstock age, holding volume, type and number of incubators, and rearing tanks.

The Plan would be much improved if all goals and objectives were presented together in one section of the report, separately for Chinook and YCT. SMART biological and implementation objectives should be developed where appropriate, and there should be continuity and connectivity of the goals, biological objectives, implementation objectives, and methods. SMART objectives could be written for the 15-year program, such as "Use egg outplanting to increase abundance of spring/summer Chinook salmon in the Yankee Fork and Panther Creek, to achieve Tribal harvest of at least 3-143 adults based on a sliding scale, and escapement of at least 500 NOR adults, by 2037." Interim goals could be written for 5- and 10-year periods. It is unclear if the combinations of life stage-specific survival needed to achieve these goals have

been quantitatively determined. This would help assess the assumptions and range of potential outcomes and how they were estimated.

Yellowstone Cutthroat Trout

The goals of the YCT program are to 1) restore and enhance SBT subsistence harvest opportunities for YCT, 2) develop a pure YCT broodstock for producing 30,000 10" catchable trout, and 3) use these fish to develop a confined fishery for harvest by Tribal and non-tribal anglers. The specific objectives are to 1) renovate and construct new hatchery production facilities to maintain broodstock, and 2) produce 30,000 fish for release annually. Time bound detailed information is provided for broodstock needs, egg take objectives, water requirements by life-stage, and holding and rearing container requirements. These objectives could be written as SMART objectives, by adding interim and final targets to be met by 5-, 10-, and 15-year horizons. For example, objectives might be to provide 5,000 catchable YCT by 5 years, 15,000 by 10 years, and 30,000 by 15 years, as production is ramped up. As with Chinook salmon, the goals and objectives for YCT should be clearly stated together in one section, not scattered throughout the document.

4) define expected project benefits (e.g., preservation of biological diversity, fishery enhancement, water optimization, and habitat protection) (Step 1)?

Chinook

The project is designed to provide numerous benefits including cultural connection to salmon, enhancement of fisheries and natural production, and diversification of tribal food resources. Adult returns from eyed-egg outplants in Panther Creek and Yankee Fork will enhance opportunities for tribal fisheries in traditional locations using traditional spear fishing methods. Allocation of adults between these goals will apparently be balanced using a sliding scale (see Appendix B, Tables 5-7).

Consumption of salmon historically played a key role in the health and well-being of the Tribes. Salmon harvest and consumption has declined to alarming low levels that jeopardize aspects of cultural persistence. Restoring harvest is important to the future of the SBT's culture. In addition to cultural contributions of adult returns, adults that spawn naturally will support enhancement of production in Panther Creek and Yankee Fork.

With adequate monitoring and evaluation, the project as designed can provide valuable information to understand the effectiveness of eyed-egg outplants as an alternative approach to traditional broodstock sources and smolt releases. Outplanting eggs, if successful, has the added benefit of exposing fish to natural selection during incubation, which should result in parr, smolts, and adults that have higher fitness than those produced by outplanting smolts. If

so, this may increase the likelihood that self-sustaining populations can be eventually restored in these two watersheds.

Yellowstone Cutthroat Trout

The Master Plan defines the primary benefit as enhancing resident-fish fisheries that provide subsistence foods for Tribal members, with additional benefits of providing a permit sport fishery to generate revenue for habitat improvement projects and conservation of native YCT in montane watersheds.

Two concerns are: 1) it is unclear how much of the production will be reserved for subsistence for the approximately 5,000 residents of the Fort Hall Reservation and how much is planned for permitted angling by non-tribal members, and 2) given the reasonable likelihood that IDFG stocks will ultimately be used (owing to the risks and difficulty of developing a stock from pure wild fish), stocking such fish into montane watersheds risks reducing the fitness of the native populations through introgression of genes from domesticated YCT. Outplanting any domesticated hatchery fish into pure strain YCT populations is risky and should not be pursued.

5) **describe the implementation strategies as they relate to the current conditions and restoration potential of the habitat for the target species and the life stage of interest (Step 1)?**

Chinook

Extensive habitat restoration efforts have improved spring Chinook salmon habitat conditions in Panther Creek and Yankee Fork. Past restoration work and continued habitat restoration efforts provide much improved opportunities to restore and enhance spring Chinook production in these subbasins. Native populations are considered extirpated or functionally extirpated; however, low levels of natural production are currently supported. The implementation strategies are straightforward: 1) develop hatchery facilities to produce mature captive brood adults and to incubate 1.68 M green eggs to the eyed stage, 2) outplant eggs in RSI stream incubators in Yankee Fork and Panther Creek, and 3) monitor and evaluate to assess success of achieving all program objectives. The implementation strategy is sound in theory, but the probability of success is uncertain. However, given major limitations of other alternatives, the lack of success of the current smolt releases in Yankee Fork, lack of availability of eggs from existing hatchery programs for SBT programs, and absence of availability for a location to construct a smolt production facility, this is a reasonable implementation strategy.

One overarching concern is that high radon levels have been measured in the water source planned for hatchery use, so degassing systems are proposed to remove this gas. Will the

success or failure of these systems to avoid exposure of workers or fish to radon gas be monitored?

Yellowstone Cutthroat Trout

The YCT hatchery construction, catchable trout production, release strategies, and management plan appear appropriate given the objectives, hatchery site, and the proposed confined release site conditions. However, the Plan needs to address multiple uncertainties related to broodstock development, allocation of releases for tribal and non-tribal fisheries, risk to the native montane stream YCT populations with removal of eggs for broodstock, and risk of hybridization from potential supplementation of the montane natural populations with hatchery-reared fish. If fish are exposed to radon gas above approved thresholds, is there any risk of effects on YCT raised for human consumption (which seems unlikely), or for mutagenic effects on those used as broodstock? Fish disease management protocols should be developed to monitor any deleterious side effects and a literature review to determine if there are reports of negative side effects would be useful.

6) **address the relationship to the habitat strategies (Step 1)?**

Chinook and Yellowstone Cutthroat Trout

Habitat restoration and management strategies focus on improving habitat conditions to support recovery of ESA-listed spring Chinook salmon and steelhead. Extensive habitat restoration and enhancement has occurred in the past and additional restoration efforts are planned for the future in Yankee Fork, Panther Creek, and in the montane streams that support production of pure strain YCT. The SBT Accords identify extensive future restoration projects and associated funding. The outplanting of eyed eggs may facilitate more rapid Chinook salmon restoration than natural colonization via straying or smolt outplants from existing facilities. The Chinook eyed-egg outplanting strategy is far more likely to succeed now than in the past, given the improving habitat conditions in Panther Creek and the Yankee Fork.

7) **ensure that cost-effective alternate measures are not overlooked and include descriptions of alternatives for resolving the resource problem, including a description of other management activities in the subbasin, province and basin (Step 1)?**

Chinook and Yellowstone Cutthroat Trout

Alternative measures were presented and evaluated during the review process for the Crystal Springs Hatchery Master Plan. The preferred alternative, to build Crystal Springs Hatchery and produce smolts for release in Panther Creek and Yankee Fork, was not feasible due to water chemistry constraints on rearing and development of spring Chinook juveniles. Other

alternatives, such as obtaining eggs or smolts from existing programs, finding an alternative location for a smolt production facility to replace the Crystal Springs site, or no hatchery supplementation action, are not currently reasonable given recent and future shortages in eggs to meet existing production demands and Master Plan goals and objectives. The design and cost analyses included assessment of three hatchery construction alternatives for spring Chinook and YCT. It would be worth considering re-opening of the Bonneville Hatchery Captive Broodstock Facility as an alternative to the new Waterwheel Hatchery option. This facility was highly effective for the ODFW Captive Broodstock Program, which was operated from the mid-1990s until the mid-2000s. It would also be worth exploring private, state, or federal hatcheries as an alternative to the new YCT proposed facility. However, we recognize that these options may not fully meet Tribal goals of directly managing these proposed hatchery production programs on Tribal lands.

There are numerous challenges and production options related to Chinook captive broodstock programs. However, this plan provides too little review of the challenges, uncertainties, and scientific knowledge associated with the three captive broodstock programs that were operated for spring Chinook salmon in the Snake River basin. A large amount of information about uncertainties, challenges, and performance is available from the Tucannon River (WDFW), Grande Ronde subbasin (ODFW) and Idaho (IDFG) captive broodstock programs, but this has not been incorporated into this Master Plan. In addition, Chinook salmon were raised to maturity in freshwater systems for both aquaculture and life history research in New Zealand and British Columbia, and papers from those studies might be informative. Publications by Clarke et al. (1994), Hopkins and Unwin (1997), and Unwin et al. (1999, 2004, 2005) could provide important knowledge related to this planning effort.

8) provide the historical and current status of anadromous and resident fish and wildlife in the subbasin most relevant to the proposed project (Step 1)?

Chinook

The Panther Creek and Yankee Fork populations historically supported substantial production of spring Chinook, and these populations played an important role in the Tribes' culture. The Panther Creek population is extirpated and the one in the Yankee Fork is functionally extirpated. Both Yankee Fork and Panther Creek currently support low levels of natural production. From 2004-2020, the number of redds observed in Panther Creek ranged from 5 to 131. The stock origin of Panther Creek is believed to be a mix of naturally produced and hatchery origin spawners from eyed-egg outplants. Yankee Fork natural production is severely depressed. Natural adult returns are believed to be offspring of a mix of hatchery and natural origin. Although these populations are not required to achieve viable status for recovery and delisting of the ESU, their persistence and sustainability are critical.

Yellowstone Cutthroat Trout

The YCT trout populations on the Fort Hall Reservation are extensively hybridized due to non-native hatchery rainbow trout releases throughout their native distribution. Currently, the distribution of pure strain YCT is restricted to small montane watersheds on reservation land. YCT populations have declined for many decades, and consequently there is limited tribal harvest opportunity. The plan needs to better characterize the specific status of the montane populations that may be targeted for broodstock sources and supplementation. It is unclear if the current status warrants hatchery intervention for conservation objectives. Although the development of broodstock from these pure strain populations may provide a genetic safety-net, the risks of such actions to their persistence is unknown and needs to be assessed more extensively.

9) describe current and planned management of anadromous and resident fish and wildlife in the subbasin (Step 1)?

Chinook

Numerous management and recovery plans provide guidance and support for restoration and enhancement of natural production and tribal subsistence fisheries for spring/summer Chinook salmon. The NOAA Snake River Spring/Summer Chinook Salmon Recovery Plan does not identify Panther Creek or Yankee Fork populations as essential populations for recovery. These populations are identified as appropriate populations for restoration and enhancement using artificial propagation.

In addition to the Federal Recovery Plan, the SBT Snake River Spring/Summer Chinook Tribal Resource Management Plan provides a harvest framework and decision processes for tribal fisheries throughout the Snake Basin including Panther Creek and Yankee Fork. Annual harvest plans are also guided by the US vs. Oregon Management Agreement.

The 2008 Accords Agreement between the SBT and the federal agencies identifies hatchery and habitat funding commitments and agreements for restoration and enhancement activities and RM&E in Panther Creek and Yankee Fork.

The Master Plan proposal describes future hatchery development, management, and RM&E for YCT and spring/summer Chinook salmon. Future management of spring/summer Chinook includes development and implementation of captive broodstock to provide eggs for outplanting. The primary objectives for this hatchery production are to provide adults for traditional tribal subsistence harvest and to enhance natural production.

Yellowstone Cutthroat Trout

Production of YCT serves three purposes: 1) enhancing tribal subsistence harvest, 2) increasing non-tribal harvest opportunities, and 3) providing a conservation benefit by culturing genetically pure local origin YCT. The status of the YCT populations in the montane streams on the reservation needs to be described. To better understand the status of YCT, the Master Plan should provide information on: 1) the current distribution of all the populations, 2) the number of populations that are extant, 3) the abundance within the individual populations and the total abundance, 4) the life histories expressed, and 5) genetic characteristics. This information is needed to assess the potential risks associated with broodstock removal and supplementation as well as the viability status of YCT on the reservation.

10) demonstrate consistency of the proposed project with NOAA Fisheries recovery plans and other fishery management and watershed plans (Step 1)?

Chinook

The Master Plan provides extensive detail addressing consistency and connectivity to the NOAA Recovery Plan, US vs Oregon, SBT Tribal Resource Management Plan, and the LSRCP. Review of the proposed program and RM&E have been completed by NOAA through ESA consultations and permitting. Comprehensive HGMP's for Panther Creek and Yankee Fork were approved by NOAA authorizing various elements of the proposed programs. However, it remains unclear how directly the HGMP and biological opinions apply to the revised production program because it was based, in large part, on the proposed Crystal Springs Hatchery smolt production proposal with integrated traditional adult broodstock strategies. This approach has been replaced with the captive broodstock and eyed-egg outplant proposal. In general, the risks of the captive broodstock approach to natural Chinook production and other native fishes are lower than a traditional program that traps broodstock and releases smolts into the natural production areas.

Some important and relevant supporting comments from the 2021-2022 ISRP review of the Crystal Springs Hatchery proposal appear directly applicable to this Master Plan as well. "The project is well guided by clear Tribal policy standards that highlight the need to restore natural conditions and ecosystem processes, revitalize traditional Tribal systems of management including place-based fisheries, and protect Tribal treaty rights."

Yellowstone Cutthroat Trout

The YCT proposed project is consistent with the SBT Resource Management Plan and harvest plans.

11) describe the status of the comprehensive environmental assessment (Step 1 and 2)?

Chinook and Yellowstone Cutthroat Trout

Little detailed information was provided regarding the comprehensive environmental assessment. Extensive environmental compliance assessments were completed for the proposed Crystal Springs Hatchery. However, since that proposal has been terminated, the environmental compliance work is starting over. Although some elements of the Crystal Springs assessment may apply to the new proposed Waterwheel Hatchery, most of the assessment will require new information and analyses. The Master Plan Section 5.0 identifies that the SBT, along with the funding agency, will begin preparation of the environmental documents necessary to manage the project throughout the entire construction process. Section 5.0 provides a detailed and comprehensive summary of all the environmental compliance acts, plans, permits, and opinions that will be addressed in the compliance process, which we presume will take place during steps 2 and 3.

12) describe the monitoring and evaluation plan (Step 1, 2 and 3)?

Chinook

Multiple spring Chinook documents describe and detail the proposed monitoring and evaluation including the Master Plan, HGMPs, 2021 SBT project proposals for Project 200890500-Supplementation Project, project 200890600-Crystal Springs Hatchery, FMEPs, and the Tribal Resource Management Plan. The Master Plan should have integrated all of these RM&E planning elements into a comprehensive RM&E plan. As currently written, information related to RM&E is dispersed throughout the document, making it difficult to review the monitoring and evaluation plan. It appears that extensive monitoring and evaluation are planned for natural production and all aspects of hatchery performance.

The Master Plan provides a brief overview of the planned RM&E activities. Juvenile production from natural spawning and eyed-egg outplanting will be monitored using screw traps and PBT analyses to identify origin of migrants. Adult abundance will be estimated with weirs and redd counts.

The RM&E associated with the spring/summer Chinook captive broodstock program is challenging to understand. Many of the documents containing RM&E objectives and methods are over a decade old and likely need updating. We recommend that a comprehensive RM&E plan that addresses the following areas of performance be completed and included as part of the Master Plan:

1. natural production and natural population status and trends,

2. in-hatchery performance of captive broodstock,
3. post-release performance of egg outplants (life-stage specific survival and abundance from egg-to-adult life stages),
4. ecological interactions,
5. life history of natural and hatchery fish
6. harvest monitoring.

The ISRP included multiple conditions in the review of the SBT supplementation projects and the Crystal Springs project proposals in the 2021-2022 review. We did not find any description or text addressing these conditions, so it is unclear if the SBT has completed the work needed to address them. It is important that the SBT complete a comprehensive RM&E Plan that includes and addresses the ISRP conditions related to the supplementation studies along with all elements of in-hatchery and post release performance, and disease assessment. The comprehensive plan can serve well to guide the project and provide clear approaches to addressing critical uncertainties.

Much of the information needed for a comprehensive integrated hatchery RM&E Plan is available in the previous plans, proposals, and documents (although some are outdated). The harvest monitoring is well described in the FMEP and the Tribal Resource Management Plan-Chinook Harvest.

The proponents should consider adding a comparative survival study in Panther Creek by continuing the outplanting of eyed eggs from the Pahsimeroi Hatchery stock and comparing performance with the egg outplants from the captive broodstock. The performance of the Pahsimeroi Hatchery eyed-egg outplants would serve well as a reference for the captive broodstock approach.

Adaptive management will require data on the success of egg outplanting in producing parr, smolts, and returning adults. Estimating these abundances is discussed only briefly in the plan, although it has been accomplished in Panther Creek for egg outplantings in 2014-2016 (Conley et al. 2020) and is described in other proposals and reports. That paper describes the use of parental-based tagging (PBT) to estimate success. Would this method be most effective for such estimates for this project? Once these data are in hand for several brood years, it will be useful to evaluate whether modifications are needed for the program. For example, if few smolts are produced from egg outplants, or few adults return, how will the project be adjusted, or evaluated to plan such adjustments?

Yellowstone Cutthroat Trout

The Master Plan reports that the YCT fishery will be evaluated solely using creel census throughout the Fort Hall Bottoms and at the Legacy Springs site to determine catch, effort, harvest, and catch-per-unit-effort. Given this, how will the program be adjusted if catch rates are different than expected (e.g., too low owing to low interest or effort)?

After outplanting, the YCT may suffer mortality or loss of condition before harvest, which may require further adjustments to culture operations. Will length and weight of angler catches be recorded to allow assessing condition? Could a subset of fish be marked in some way to allow an estimate of abundance based on angler recaptures, and hence an estimate of mortality after stocking? How will the percentage of fish that are harvested be determined?

If surplus fish are released into other montane watersheds where they might interbreed with locally adapted wild, pure native YCT, will these populations be sampled before and afterwards to determine whether genetic diversity has changed and fitness has been reduced?

13) describe and provide specific items and cost estimates for ten fiscal years for planning and design (i.e., conceptual, preliminary and final), construction, operation and maintenance and monitoring and evaluation (Step 1, 2 and 3)?

Chinook and Yellowstone Cutthroat Trout

The Plan provides specific items and cost estimates for ten fiscal years for design, construction, operations, maintenance, and monitoring and evaluation for both programs. A summary of these costs is presented in Table 6-9.

Some important potential performance issues and uncertainties related to the captive broodstock program were not discussed or considered in the production program or facility design that may significantly influence the design and costs of the facility construction and operation. The lack of adequate literature review of other captive broodstock programs is a serious deficiency in the planning and design elements of the plan. These uncertainties and challenges are discussed in the review of the Artificial Production Initiatives section below. One cost that appears missing for both programs is the cost of feed, which would be substantial for growing YCT to a catchable size of 10".

B. Artificial Production Initiatives

Does the Master Plan:

1) **address the relation and link to the artificial production policies and strategies (see 2014 Fish and Wildlife Program, Part Three, Section IV, B and C1, 2, 4, 5, and 6) (Step 1)?**

Chinook

The eyed-egg outplant strategy provides an approach that is consistent with the improving habitat conditions in Panther Creek and Yankee Fork. The approach is consistent with the Tribes desires to minimize handling of salmon and the management footprint. Extensive habitat restoration efforts in both subbasins have improved habitat conditions so that natural production might now be supported. This approach has demonstrated some success in Panther Creek, and the monitoring and evaluation plan should provide information to assess this 15-year pilot project.

Restoring abundant spring Chinook to these subbasins that historically sustained high levels of natural production and harvest is important to reestablishing the ecological and cultural role of salmon. This effort is consistent and supportive of the Fish and Wildlife Program goals and the objectives and strategies of management and recovery plans adopted by tribal, state, and federal management entities. The project is consistent with federal and legal mandates for fish protection and mitigation. The supplementation approach (eyed-egg outplants) represents a relatively low ecological risk hatchery strategy compared to other hatchery intervention options, like traditional adult collection and smolt production. However, there are significant production uncertainties and risks of the artificial propagation elements of the Chinook captive broodstock approach that have not been addressed in the Master Plan.

Production assumptions are provided in multiple places. Overall, it would be much more helpful and clear if all the assumptions and numbers were made completely consistent and transparent, and presented together with explanatory text and a table with the values and references for each stage in succession. For example, p. 45 gives values of 5,000,000 eyed eggs, 120 smolts per spawner, and 25,000 smolts, but it would be helpful to provide the number of females, eggs per female, and the survival in the incubators and in the stream. That way the whole series of estimates can be evaluated. Similarly, the estimates of survival during downstream migration, at sea, and exploitation rates before the fish arrive at the return sites should be provided. Notably, the proposal states that "harvest rates are highly variable and dependent on a multitude of factors in these fisheries." Table 2-6 gives harvest rates of 1 – 35% "of fish that enter the fishery management area," but what about the downstream fisheries?

Some aspects of the production plan need clarification. For example, p. 47 indicates that the assumptions are 1680 adults and 50% females thus 840 females to produce 1.6 million green eggs, resulting in 1 million eyed eggs. This represents a fecundity of 1900 eggs per female. More information supporting these estimates is needed. Also, the survival between egg take and eying is 62.5% (1 million/1.6 million). This seems rather low compared to the rates achieved at most of the LSRCP spring Chinook facilities. On p. 78 the value of 60% survival to the eyed stage is listed.

p. 44 states that "Employing a remote site incubator will have the highest likelihood that Tribal members can harvest Chinook Salmon using both traditional hunting methods." This presumably assumes that the adults from these incubators will return to those sites. What is the basis for this assumption? Are the incubator sites chosen for their suitability for Tribal fishing, spawning habitat, or juvenile rearing areas, and are these needs compatible with each other?

If the egg outplanting is successful at producing higher adult returns, perhaps owing to greater exposure to natural selection from the earliest life stages, then eggs could be taken from these returning spawners and integrated into the captive broodstock. This would have the additional advantage of improving the fitness of the future egg outplants.

The Plan would be much improved with expanded review of the previous Chinook salmon captive broodstock programs that were implemented for the Grande Ronde subbasin, Tucannon subbasin, and in the Salmon subbasin. There is much to be learned from the experiences, information, and knowledge that these programs and associated evaluations provided. The results of these programs were highly variable, and in some cases unsuccessful. A comprehensive review of the current knowledge would better identify critical uncertainties related to the proposed approach and provide approaches to address uncertainties and maximize the likelihood of success. The proponents also need to address the potential effects of climate change on the proposed facilities and water sources. A climate vulnerability analysis similar to the one proposed by the LSRCP would be a valuable addition to the Master Plan.

Existing information would help in the design phase to ensure flexibility and adaptability needed for captive broodstock production. The Plan lacks detail on many important production protocols for incubation, rearing, adult sorting, maturation determination, holding, and spawning of captive brood as well as green-to-eyed egg incubation for eggs produced for outplanting. There are challenges at all life stages that must be considered and addressed. These details are important as outcomes will vary considerably based on the protocols. The proponents need to develop a more comprehensive and detailed description of the entire production cycle that addresses the following questions and concerns. These do not represent

all of the important details that should be included in the production protocols and are provided as examples to consider.

Fry-to-smolt rearing: Growth rates from fry-to-smolt will affect age-at-maturity and size-at-age. Hoffnagle et al. (2003 and 2010) and Eddy et al. (2018) found that wild parr grown at natural rates to the smolt stage produced adults that were older at maturity and larger for their age than parr reared on an accelerated growth profile. What are the targeted growth rates (natural or accelerated) for the fry-to-smolt stage? If the plan is for a natural profile, are there chillers to control water temperature?

Smolt-to-adult rearing: In general, captive brood programs maximize growth during this phase to produce the largest adults possible. What are the desired growth rates for this phase and what feed types and feeding schedules will be used to achieve the desired growth rates? How will the goals of rapid growth be balanced against the tendency of rapidly growing fish to mature at a younger age than slower growing members of the cohort?

Mature adult identification, sorting, and holding: Hoffnagle et al. (2003) encountered difficulty in identifying and sexing maturing adults visually. They also highlighted the need to separate maturing adults as soon as possible to allow for disease treatment and alternative feeding protocols. Use of ultrasound greatly improved the ability to identify sex and sort maturing adults. What are the planned protocols for identifying maturing adults and their sex? Once identified, the maturing adults will be separated and held in separate tanks. Will the adults be held in natural stream temperature water or more constant temperature spring water, and how will the temperature profile influence maturation schedules? Will the maturing adults be exposed to a natural light photoperiod or a natural photoperiod regulated with indoor lights? Will the maturing adults be fed during the maturation period? Hoffnagle et al. (2003) found that captive brood matured 3-4 weeks later than natural-origin adults for all three stocks produced (Catherine Creek, Upper Grande Ronde River, and Lostine River). What approaches will be used to ensure adults mature within the window of timing that is natural for Panther Creek and Yankee Fork? Spawn timing is critical to the success of this program because the importance of timing eyed-egg outplants to match natural timing.

Spawning: Complex spawning protocols to maximize number of family groups and minimize sibling inbreeding have been used in other Chinook captive brood programs. A more complete spawning protocol description is needed. Hoffnagle et al. (2003) found that nearly 90% of males matured at age 2 and age 3. Mention is made of cryopreservation of sperm from male Chinook that mature at earlier ages than the females, and this makes sense, but what are the specific spawning and breeding protocols? What are the plans if females are ripe but not enough males are available to fertilize their eggs under the desired protocol? Will mating be random or will there be some deliberate selection for age, size at age, etc.? Will there be any selection

(deliberate or not) on timing of maturation? Have the proponents considered using sperm from conventional hatchery males that return to Sawtooth Hatchery?

Incubation from green-to-eyed egg stage: It is likely the spawn timing of captive brood will be substantially later than the natural spawn timing in Panther Creek and Yankee Fork. Matching the natural timing for the eyed-egg outplants is critical to the success of the program. If eyed eggs are planted 3-4 weeks later relative to the timing of naturally deposited eggs, the likelihood of success will be minimal because fry emergence timing and survival will be strongly influenced. If spawn timing is delayed will the incubation facility be able to accelerate the incubation rate to mimic the temperature units experienced by eggs deposited in nature by natural spawners?

Many of the concerns identified above have important facility design implications and should be addressed in a timely manner to ensure consideration at the next design phase.

Yellowstone Cutthroat Trout

The Plan needs a more rigorous benefit-risk assessment of the two broodstock options under consideration as well as better justification for a YCT hatchery safety net and supplementation. Caution is needed in using the hatchery fish produced for stocking beyond the confined fishing areas. If broodstock cannot be developed from pure wild fish, as seems likely, then it would be ill-advised to stock fish in montane streams where the risk of introgression with wild, pure native populations is high.

It is unclear if the benefits of developing broodstock from wild fish would outweigh the risks to the source populations. If unsuccessful, the proponents indicate that current IDFG broodstock would be used, which are likely to have undergone significant domestication selection. If surplus fish are then outplanted into montane streams with locally adapted populations, this could reduce their fitness through introgression and such actions are not consistent with conservation of wild YCT. There is no discussion of the life history of the two potential broodstock sources or if life history will influence the growth and maturation schedules. Are the potential broodstock sources adfluvial or fluvial? What influence might the life history have on the production of catchable size trout? Might offspring from fluvial broodstock mature at a small size and thus limit growth rates needed to achieve the target release sizes?

The following USDA publications from the Western Regional Aquaculture Center may be useful in the planning and production phases of the cutthroat trout.

- Fornshell G. and C. Myrick. 2014. Early rearing of cutthroat trout. USDA Western Regional Aquaculture Center, Technical Report. Seattle, WA.

- Fornshell G., C. Myrick, M. Powell, W. Sealey. 2019. Feeds for production of market-sized cutthroat trout. USDA Western Regional Aquaculture Center, Technical Report. Seattle, WA.

In addition, Jake Bledsoe, the University of Idaho Extension Specialist for Aquaculture, could provide advice on optimum methods for rearing the catchable cutthroat trout.

At this time in the planning process, we conclude that the most scientifically sound path forward with the lowest risk for YCT broodstock source appears to be the use of an existing IDFG hatchery stock, given 1) the current lack of information related to the status of the YCT populations, 2) the potential challenges with successful production of broodstock from eggs collected from wild fish redds, 3) the need for a genetic safety net for the wild populations, and 4) uncertainties associated with supplementation.

More information is needed about the ponds or streams where the fish will be stocked. Given the costs of feed (also not reported) and labor to produce 30,000 ten-inch catchable trout, it seems imperative to measure catch, effort, and cultural uses by the SBT. In addition, a process for adjusting YCT production to the uses established by such monitoring will be required.

If the target is to release 30,000 fish, what are the assumptions regarding survival and catch rates? How many females will be needed to produce this many fish for release, given average fecundity, survival, etc.? Can that many females be obtained if the source is natural fish from the montane streams? As with the Chinook, it would be helpful to have all these numbers presented in a single comprehensive table. Table 4-5 indicates that 150 adults will be retained year-round, with 75 of them being females. If they produce 50,000 green eggs, that is an average fecundity of 667 eggs. This seems reasonable, but what is the basis for this assumption? On p. 74, it states that age-3 females average 2000 eggs, and age-4 females average 2500 eggs. These values seem high and why is there a discrepancy?

2) provide a completed Hatchery and Genetic Management Plan (HGMP) for the target population(s) (Step 1)?

Chinook

Final HGMPs were submitted for formal consultations in 2017. The consultation and review process was lengthy, starting with original submittals around 2012. In September 2020, NMFS concluded that the HGMPs for Yankee Fork and Panther Creek met all requirements of Limit 6 ESA 4(d) Rule and authorization was granted.

The authorization covered smolt and egg outplants in Panther Creek and only smolt outplants for the Yankee Fork. Authorization was requested and approved for production programs that

would have been implemented if the Crystal Springs Hatchery had been constructed. It is unclear how the authorization applies to the new proposed captive broodstock program. Although the overarching management goals and objectives remain the same, the new proposed hatchery production program presents different risks than the original traditional broodstock and smolt production programs. Much of the benefit-risk assessment contained in the HGMPs relates to broodstock collection and smolt releases. It is unclear if the Section 6 authorization covers all ESA compliance elements of the new proposed production program.

3) **describe the harvest plan (see 2014 Columbia River Basin Fish and Wildlife Program, Part Two, Section II) (Step 1)?**

Chinook and Yellowstone Cutthroat Trout

There are numerous harvest plans provided for managing tribal ceremonial and subsistence Chinook salmon fisheries in both Panther Creek and Yankee Fork. The Master Plan, FMEPs, and the Tribal Resource Management Plan provide adequate and appropriate descriptions of harvest goals, harvest management, and harvest monitoring and evaluation for Chinook salmon. The Plan mentions that the tribal fishery for Chinook would be non-selective because it involves spearing. It seems likely that spearing would tend to harvest larger fish, as they are both easier to see and strike than smaller ones. The harvest plans for YCT are described in the Master Plan. There is a need for the plan to describe how the needs of tribal and non-tribal anglers will be managed.

4) **provide a conceptual design of the proposed facilities, including an assessment of the availability and utility of existing facilities (Step 1)?**

Chinook

The Master Plan provides a clear conceptual design of the proposed facilities. The design utilizes retrofitting and new construction of an abandoned existing facility and associated infrastructure. The proposal should identify many critical uncertainties regarding elements of the captive broodstock production and management that may significantly affect the facility designs (see comments in Section B.1 above).

Yellowstone Cutthroat Trout

One concern is that the spring ponds proposed for holding broodstock of YCT appear to have very low control structures (see Figs. 3-2 and 4-3). Might broodstock escape downstream and be lost, and can this unwanted outcome be prevented?

5) **provide a preliminary design of the proposed facilities (Step 2)?**

Although a preliminary design is not required in a Step 1 submittal, this Step 1 Master Plan provides extensive detail on all design elements in Section 4 and Appendix D. As stated above, considerably more research and review of past programs should be completed as soon as possible to ensure all design criteria are appropriate.

6) **provide a final design of the proposed facilities, including appropriate value engineering review, consistent with previous submittal documents and preliminary design (Step 3)?**

Not applicable for Step 1.

References

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