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ISRP webpage

ISRP Step Review of the Grays River and Duncan Creek Chum Salmon Hatchery Programs

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ISRP 2021-4
May 10, 2021

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Background

In response to the Northwest Power and Conservation Council's request of March 5, 2021, the ISRP reviewed a submittal by Washington Department of Fish and Wildlife (WDFW), associated with Project #2008-710-00, *Chum Salmon Restoration in the tributaries below Bonneville Dam*. The submittal is intended to address the Step review process and numerous Council recommendations since the initial review of this project in August 2009 (see ISRP 2009-28) and most recently as part of the *Mainstem and Program Support Projects* review of August 2019 (see page 27; and see ISRP 2019-2, pages 124-126).

The ISRP considered the following documents for this review:

- Cover Letter, dated March 4, 2021
- Step Submittal – Titled, Three-Step Review of the Grays River and Duncan Creek Chum Salmon Hatchery Programs (hereafter "2021 Step Report")
- Draft Hatchery and Genetic Management Plans (HGMPs) - Bonneville-Duncan Creek Chum and Grays River Chum

WDFW's Grays River and Duncan Creek hatchery programs are part of a larger effort, including habitat restoration, that has an overarching recovery goal to restore Columbia River chum populations to levels that are self-sustaining and can provide ecosystem-level benefits and fishing opportunities. The hatchery programs are intended to serve conservation and "safety-net" purposes to provide a source of chum salmon for reintroduction efforts, preserve the genetic diversity in the Coast (Grays) and Lower Gorge (Duncan) Strata, and reduce extinction risk.

As described in the WDFW's 2021 Step Report, the biological objectives of these two programs are informed and addressed by the following implementation, monitoring, and broodstock objectives:

- Collect enough broodstock to maintain genetic diversity while also achieving juvenile release goals that met HSRG (2014) guidelines
- Achieve egg-to-release survival rates of at least 90% for artificially produced fed-fry
- Produce hatchery-origin juveniles that achieve smolt-to-adult survival rates that are comparable to natural-origin recruits

- Produce hatchery-origin chum salmon that achieve replacement rates ≥1 (i.e., at minimum, the number of returning hatchery-origin adult chum salmon from previous brood years are equal to the number of natural-origin adults collected for broodstock)
- Estimate potential egg deposition for naturally spawning adults to facilitate estimates of egg-to-fry survival
- Evaluate the performance of two artificial propagation techniques (fed-fry release vs. translocated adults) used for reintroduction
- Maintain the proportion of natural-origin adults in the broodstock such that the proportionate natural influence (PNI) is ≥0.67 and pHOS is <0.30 (based on HSRG recommendations for primary populations with integrated hatcheries)

WDFW's 2021 Step Report contains a detailed summary of the past Council and ISRP reviews (see pages 10-31). Regarding the most recent review of the proposal (ISRP 2019-2), the ISRP stated:

> This is an ambitious, well-conceived restoration project that covers a broad geographical area in the lower Columbia River. The project includes habitat, fish propagation, and monitoring components, and it addresses the critical conservation needed to protect and recover lower Columbia River chum salmon populations, which are ESA-listed. Recovery actions have been prioritized by the proponents and their regional partners. Monitoring and evaluation has been adequate to demonstrate that life cycle productivity (adult returns per spawner, R/S) is typically higher for fish spawning in constructed channels than for fish collected as hatchery broodstock to produce progeny for release as fed-fry, and intermediate for fish that spawn naturally in Duncan Creek. However, productivity is highly variable from year to year, and greater than 1 in only ~50% of brood years, indicating the population may not yet be self-sustainable. Overall chum salmon abundance in the ESU is variable but generally increasing since the low in 2008. The proponents have made good progress toward the overall goal of chum salmon recovery and are working with ODFW to develop a coordinated recovery effort for chum salmon in both Washington and Oregon tributary populations.

In 2005, the ISRP conducted a Combined Step review for *Re-introduction of Lower Columbia River Chum Salmon into Duncan Creek,* Project #2001-053-00 (ISRP 2005-3). The ISRP recommended approval for the project but also made suggestions to improve the potential of the project to recover Lower Columbia chum salmon and provide insights into critical uncertainties associated with supplementation and habitat restoration activities.

ISRP Review Summary and Recommendations

Meets Scientific and Step Review Criteria (Conditional)

The proponents are complimented for a comprehensive and detailed 2021 Step Report. All requested elements of the Step Review and the additional sections (background, components of recovery and summary of past ISRP reviews with responses) are provided. In combination with the Hatchery Genetic Management Plans and other referenced documents, the report provides an excellent summary of all aspects of program operations and performance to date.

The project has many strengths and accomplishments from more than 20 years of implementation. However, the project is approaching a critical phase where decisions regarding future strategies and actions need to be addressed, a possible crossroads. Many critical uncertainties and questions remain related to the project objectives, strategies, and actions for the future.

The project has generated a wealth of valuable data that are available for analyses and interpretation to help resolve some critical uncertainties and to better understand the benefits and risks. The proponents identified critical data analyses and planning efforts needed to address remaining uncertainties and questions. The information that will be generated from these analyses and plans is essential for not only better understanding the benefits and risks of these programs but also for guiding the future implementation strategies and role of artificial propagation in chum salmon recovery.

Notwithstanding these strengths, the ISRP is concerned that most of the six main issues identified in the 2005 Combined Step Review have not yet been resolved, over 16 years later. Five of the six issues (Spawning Strategy being the exception) still need additional evaluation to complete. However, the project appears to be applying adequate methods to address each of the issues in the future.

The project meets scientific criteria with the conditions that the project complete the following analyses and planning efforts to address past ISRP issues and guide the project in the future. Some of these analyses and products were identified by the proponents as important in the 2021 Step Report.

1. **Duncan Creek reintroduction evaluation**: Complete analyses, interpretation, and reporting of the study to evaluate the three strategies: adult translocation, hatchery supplementation, and natural recolonization. This study will help resolve the remaining uncertainties associated with defining optimal reintroduction strategies.

2. **Grays River reintroduction evaluation**: See Duncan Creek description above.

3. **Integrated Population Model (IPM)**: The model is currently in development and appears to be a cornerstone for program assessment, risk containment, and adaptive management. The model will be used "to assess the role of hatchery supplementation on long term viability of chum salmon populations, strata, and the entire Columbia River ESU." In addition, the model will characterize variation in productivity and marine survival, provide population viability analyses, assess habitat and environmental factors, quantify straying and population connectivity, prioritize habitat restoration actions, and assess reintroduction strategies. There are very high expectations for the model applications, which are well warranted. Based on the description of model objectives, resolution of many of the critical uncertainties will rely on successful model development, execution, interpretation, and reporting.

4. **Straying level - Habitat capacity scenario evaluation**: These analyses will assess the population specific occurrence of different combinations of straying and habitat capacity (minimal straying – underutilized habitat, minimal straying with poor habitat, and low straying and depensation). This evaluation will help resolve the uncertainty related to natural recolonization by straying and expected natural production response from natural recolonization.

5. **Assess fitness effects of the three supplementation strategies**: This assessment will resolve uncertainty associated with specific supplementation strategies.

6. **Revised Enhancement and Recovery Plan (E&R Plan)**: This major effort will incorporate and integrate the reintroduction strategy study, IPM modeling results, habitat restoration actions, and other results. This plan appears critical to the future success of the project and represents an important step in the overall adaptive management process.

7. **Evaluate the efficacy of hatchery supplementation**: This evaluation will resolve some of the initial project uncertainties regarding supplementation. The proponents stated that this will be accomplished in the next few years.

8. **Develop a plan to assess the effects of the hatchery supplementation on wild fish in the receiving stream systems**. Search and gather available information and develop a study plan with costs so that the need and feasibility to implement the plan can be evaluated.

We understand that these conditions will require a major effort by the proponents. However, we believe the success of the project hinges on the information and guidance that will be provided from these efforts. We strongly encourage the proponents to expedite completion

and share their findings and recommendations through journal publication. There are relatively few publications of studies assessing the benefits and risks of salmonid hatchery supplementation and reintroduction, especially for salmon populations that have short freshwater juvenile rearing and sub-yearling smolt life history strategies.

The ISRP does not see any need for additional review of the project associated with the Step review; our review is complete. We look forward to reviewing the proponent's progress on these conditions as part of the next major project review that includes this project.

ISRP Comments on Step Review Elements

The Council has emphasized that an important part of the Three 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.

The proponents provided an extensive explanation of how the project is consistent with and contributes to all six program principles. The losses and degradation of spawning, incubation, and migration habitats throughout the ESU have resulted in severely depressed status of most populations and the ESU. Habitat changes have resulted in impacts to all parameters of viability, including abundance, productivity, spatial structure, and diversity. This project is an integral part of the comprehensive effort to protect and recover Lower Columbia River chum salmon. The project recognizes the importance of linking the artificial propagation programs with habitat restoration strategies and this linkage has been incorporated into the hatchery conservation and supplementation efforts.

The project goals to protect extant populations from catastrophic loss, preserve genetic diversity, enhance geographic distribution, and provide a brood source for reintroductions align well with the importance of maintaining and enhancing biological diversity. The overall recovery strategies developed as part of the recovery planning processes (LCFRB 2010 and NMFS 2013) incorporate human dimensions that represent many different interests and cultural perspectives related to chum salmon management and recovery.

Since inception, the project has been implemented with an effective experimental and adaptive management approach as demonstrated by the numerous changes in broodstock management, rearing practices, production goals, and monitoring and evaluation. Some specific examples include changes to Duncan Creek incubation, rearing, and release strategies as well as transition to 100% PBT marking for hatchery fish.

The responses provided are sound but lack perspective of how the project actions might negatively affect the current function of the ecosystem and the services it now provides. It does not appear that the project is designed to detect these potentially negative impacts, nor is it clear how the project would react and adapt to negative consequences. A number of questions are provided below under individual principles to illustrate the kind of information lacking in the responses.

Principle 1: What are the major challenges and likelihood of success that Columbia River chum salmon are expected to face in their bid, with human assistance, to recolonize historical spawning and rearing areas? How impacted is the ecosystem without healthy runs of chum salmon or the absence of chum salmon altogether? How well is the project prepared to measure and record the expected ecosystem benefits of increasing chum salmon numbers and distribution?

Principle 2: Regarding risks of a supplementation program to natural chum salmon populations, the genetic and demographic risks are well described, but disease risk is not addressed. What is the risk of introducing or magnifying a disease that limits the future success of chum salmon or other co-occurring species? What actions are needed to ensure that disease risks are being monitored and addressed?

Principle 3: Are there concerns regarding impacts of increased numbers of chum salmon on the status of other native species that may have benefitted from the decrease in chum salmon numbers? If there are concerns, how well is the project prepared to detect potential negative effects of reintroducing chum salmon, and how would the project adapt strategies to prevent harmful negative effects?

Principle 4: What ecosystem services are expected to decrease or increase with increased natural chum salmon production? Have there been any major cultural adaptations to the existing array of ecosystem services that will be missed if some of these services decrease under increased production of chum salmon? What other populations might be targeted as high priority for supplementation enhancement based on the successes of the program?

Principle 5: Significant and appropriate effort has been dedicated to monitoring the chum salmon response and adapting the chum salmon production accordingly. It is not clear 1) how or if the project or another Lower Columbia RM&E project is monitoring or plans to monitor information useful to evaluating ecosystem responses (e.g., nutrients, periphyton, density and diversity of invertebrates, growth rate of resident salmonids) and 2) how the project might adaptively respond to negative aspects if and when they are detected.

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)?

The project appears foundational to the overall recovery efforts for Columbia River chum salmon. The adopted recovery plans (CRFRB 2010 and NMFS 2013) identify "hatchery supplementation and reintroduction" as a priority recovery strategy to reduce extinction risk for extant populations and reestablish extirpated populations using reintroductions with hatchery fish. Future reintroduction locations and timing will be informed by progress in habitat protection and restoration. To date, the project has demonstrated effective integration with other projects and activities in the basin.

There are two issues of concern that need resolution. Of the ten chum salmon populations in the Washington part of the ESU listed in Table 9, at least seven have abundance targets that are substantially greater than current abundance, many more than ten-fold greater than current abundance. It is not clear if the subbasins with targets for increased chum salmon populations are also targeted for increased abundance of other species such as Chinook salmon, coho salmon, steelhead, and coastal cutthroat trout. If so, how might these concurrent activities interact to decrease or increase effectiveness of chum salmon enhancement?

It is stated that "Experimental supplementation and reintroduction programs will be accompanied by "aggressive monitoring and evaluation programs," but these evaluation programs were not described. These monitoring and evaluation programs should be described with enough detail to judge their scientific adequacy and feasibility.

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)?

The project has a clear, well justified, and broadly supported goal of contributing to restoration of Columbia River chum salmon populations to self-sustaining levels that provide ecosystem benefits and fishing opportunities. The Grays River and Duncan Creek hatchery programs seek to provide a safety-net for two core populations in the ESU by preserving genetic diversity in the coast (Grays/Chinook population) and Lower Gorge (Duncan Creek population) strata and reducing extinction risk by enhancing abundance. The proponents acknowledge that conditions have changed since the programs began, and under current conditions "it is quite possible that the role of these two programs as safety-nets may no longer be warranted." Both hatchery programs will serve as brood sources for reintroduction into vacant or underutilized habitat. The biological objectives support the project goals well and generally meet the elements of SMART objectives. The project assesses a comprehensive suite of measurable attributes for both hatchery and natural production that provide the basis for tracking progress. Although the specific methods for tracking change were not provided, they are presented, for most objectives, in the HGMP's and other project reports and documents (except as noted previously in this review).

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

The project benefits are clearly articulated and directly address preservation of biological diversity and population recovery. The initial focus on protection and enhancement of the Grays/Chinook and Lower Gorge populations seems wise as these are two of the three healthiest stronghold populations in the ESU that have served a safety-net role in the near term and will serve a reintroduction role in the future. The focus of building out from the strongholds is supported by sound conservation principles. The proponents acknowledge and address the uncertainties and risks of using artificial propagation to enhance natural production, particularly over multiple generations. The project is designed with appropriate monitoring to evaluate the efficacy of hatchery supplementation as a strategy for enhancement and reintroduction.

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)?

Items 5 and 6 were not included in the 2021 Step Report's section containing WDFW's response on step elements, but we found information related to items 5 and 6 in other sections in the document. Items 7-13 below in this ISRP report correspond to items 5-11 in WDFW's report.

The project has well established past and near-term implementation strategies that are consistent with sound conservation principles. However, future implementation strategies are uncertain and not well described in the document. From the numerous references in the document highlighting the need for additional analyses, modeling, and planning, it is clear that the project is at a key point in the adaptive management process where significant changes in implementation strategies may be warranted. The proponents have identified the need for a new "Enhancement and Reintroduction (E&R) Plan" for Columbia River chum salmon. The E&R Plan will "describe WDFW's recovery strategy for Columbia River chum … and how hatchery supplementation, as well as other intervention techniques, will be used to accomplish recovery goals. The recovery strategy will be informed, evaluated and adapted using an Integrated Population Model (IPM) that we began developing in 2020." In addition to the modeling and plan development, the project needs to complete analyses and reporting for the evaluation of the three reintroduction strategies and this information will be essential for IPM development and completion of a scientifically sound E&R Plan. There were no specific timelines provided for the reintroduction strategy evaluation, IPM, or the E&R Plan. It is paramount that the analyses, modeling, and plan development be completed soon, given their importance to the future of the project. At this time, the implementation strategy can best be characterized as outdated and in early stages of revision.

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

Project implementation to date has been clearly integrated with habitat restoration strategies as demonstrated by the sequencing in development of spawning channels followed by the subsequent release of hatchery fish into the created habitats. Based on the brief descriptions of the IPM and E&R Plan, it appears that these efforts will provide needed additional details regarding the linkage of habitat restoration and hatchery implementation strategies for the future. One identified threat to the success of this effort is further human development in key chum salmon spawning areas. If not already occurring, we again encourage the proponents to work with others in the Columbia River Basin to establish conservation easements and other actions to protect such areas from further development. Given the importance of groundwater inputs to habitat suitability, it would be beneficial to understand the effects of timber harvest, other land uses, and potential climate change on current and future habitat conditions.

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)?

Several reasonable alternate measures have been evaluated. However, the project should complete analysis and publication of evaluation of the three reintroduction strategies—adult translocation, hatchery supplementation, and natural colonization—to assess the most effective reintroduction strategies. This information is essential to the development of the IPM and E&R Plan, and will be useful for cost-benefit analyses. Other management activities that might be beneficial (or detrimental) to chum salmon populations (e.g., habitat improvement projects for other species such as stream bank stabilization; changes in fish harvest; changes in forest management) were not described.

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)?

The comprehensive summary of historical and current status of Columbia River chum salmon was informative and illustrates the importance of the project's conservation goals and objectives. The ESU remains at moderate to high risk, detectable numbers of chum salmon persist in only 4 of 17 independent populations, and only 3 populations meet or exceed recovery goals. The current status is little improved from the past with severely impacted abundance, productivity, spatial structure, and diversity within individual populations and the ESU as a whole. The information provided is restricted to chum salmon. While chum salmon are certainly the most relevant species of the project, it is important to document what is known about the existence and abundance of other fish and aquatic species in the subbasins to track and understand changes through time. Are restoration actions to enhance other salmonid species being implemented concurrently in these subbasins? Changes in management and abundance of other aquatic species may substantially influence chum salmon populations and the success of the project. Understanding changes in abundance of other species will help to identify the contributing influence of changes in hatchery production and supplementation, annual variability, and changes in habitat.

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

Current and planned management of chum salmon are well described. The overarching management goal is "to recover populations to healthy and harvestable levels." The ESA Recovery Plan for Columbia River chum salmon (NMFS 2013) provides management descriptions for all planned actions including habitat, hatchery, harvest, and hydropower. Based

on this plan, harvest rates will be maintained at low levels (3-5%), extensive habitat restoration will be implemented, and hatcheries will be managed based on sound hatchery conservation principles and practices. Again, future hatchery management is somewhat uncertain and will rely on guidance from the IPM and E&R Plan. HGMPs for both hatchery programs were recently updated and provide extensive information related to all aspects of hatchery management and evaluation. The description of forest management activities was useful, but it could be moved to the description of other management activities (item 7).

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

This project has a long history of demonstrated consistency with and support from many past and current recovery and management plans. The 2020 Columbia River system BiOp specifies that action agencies should continue to fund Columbia River chum hatchery conservation programs. The Hatchery Scientific Review Group (HSRG) concluded that the existing hatchery programs are important for addressing short-term demographic risks. The LCFRB (2010) and NMFS (2013) Recovery Plans both identify these two hatchery programs as important to recovery of Columbia River chum salmon. Overall, this project is consistent and well-integrated with numerous recovery and other plans.

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

The environmental assessment has not been initiated. However, once the Step review is completed and the recently updated HGMP's are reviewed and authorized by NMFS, the assessment process will be initiated.

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

The proponents provided a general overview of the monitoring and evaluation plan with references to numerous other documents for details. The proposed Grays River and Duncan Creek HGMP's (WDFW 2018a and 2018y) provide comprehensive detail on hatchery operations, performance indicators, methods, and past results. The hatchery monitoring and evaluation are comprehensive, consistent with numerous sets of hatchery guidelines, and examine the major elements of hatchery performance, including in-hatchery survival, post-release survival, productivity, fish health, growth, genetic diversity, phenotypic diversity, straying, and spawner distribution. Tables 3-8 illustrate the type of information currently provided from the monitoring and evaluation efforts. The response would be improved with specific information related to disease monitoring and results.

Natural population performance is assessed based on a sound scientific framework and methods of the Integrated Status and Trends Monitoring (Rawding and Rodgers 2013) that provide unbiased probabilistic estimates. An array of variables are assessed to estimate and evaluate Viable Salmonid Populations (VSP) indicators including abundance, productivity, spawner distribution, life history characteristics, smolt production, smolt-to-adult survival, pNOS, pHOS, and PNI. The project shares results through reports and posting on numerous data portals.

The project has generated extensive long-term datasets for hatchery performance indicators as well as viability status and distribution of natural populations. Unfortunately, due to various reasons, limited data analyses have been completed to address important critical uncertainties associated with hatchery effectiveness and hatchery influence on natural production dynamics. The lack of analyses and the remaining uncertainties are highlighted by the proponents in numerous sections of the Report.

The following analyses, models, and plans, that have yet to be completed, were identified as high priority information sources needed to guide the adaptive management of hatchery strategies and actions in the future:
1. Duncan Creek – Evaluate reintroduction strategies
2. Grays River – Evaluate reintroduction strategies
3. Integrated Population Model (IPM) – Model development in process to "assess the role of hatchery supplementation on long term viability of chum salmon populations, strata and the entire Columbia River ESU."
4. Straying – Habitat capacity scenario evaluation – Evaluate three scenario combinations of straying levels and capacity levels: minimal straying and underutilized habitat, minimal straying with poor habitat, and low straying with depensation.
5. Assess fitness effects of the three colonization (supplementation) strategies. Samples and baseline data are available to monitor genetic changes following recovery actions.
6. New Enhancement and Recovery Plan (E&R Plan) – Updated comprehensive recovery plan.
7. Evaluate the efficacy of hatchery supplementation – the proponents state that this will be accomplished in the next few years. All of these efforts are clearly needed and should be pursued with urgency.

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)?

An extensive array of past, current, and future cost estimates was provided. Specific budgets were provided for the Duncan Creek and Grays River artificial production programs including hatchery and natural production monitoring and evaluation.

B. Artificial Production Initiatives

Does the Master Plan:

1) address the relation and link to the fish propagation principles and measures (Columbia River Basin Fish and Wildlife Program, Part Three; Section IV; B, and C1, 2, 4, 5 and 6) (Step 1)

The proponents provided an extensive description of how the project relates to and is consistent with adopted fish propagation principles, practices, and measures. The project has a comprehensive monitoring and evaluation program for artificial and natural production that provides essential information to track progress and for adaptive management decisions. It is strongly supported by the LCFRB (2010) and NMFS (2013) recovery plans. The project has incorporated HSRG recommendations into the production and monitoring programs. The project is designed to contribute to recovery and improve viable salmonid population characteristics. The hatchery programs are small and operate as integrated programs with nearly 100% natural origin brood stock. The project is a critical component of the overall recovery efforts for Lower Columbia River chum salmon.

Although the response covered many of the links to key principles, some deficiencies in the linkage descriptions for the fish propagation principles and other strategy principles remain.

Principles for fish propagation including hatchery programs:
Principle (1): Disease incidence and control are not mentioned as factors for assessing hatchery performance. No measures of the effect of hatchery releases on the stream ecology are described.
Principle (4): While the chum salmon populations and demographics are extensively monitored, critical environmental and ecological aspects of receiving stream systems are apparently not being measured.
Principle (5): The entire focus of the project is chum salmon, with limited effort expended to understanding what the affect that the project has on the broader basin and regional systems.
Principle (13): The response does not indicate how the project assesses chum salmon productivity as a function of other fish species and environmental aspects.

Principles for other strategies—1. Wild fish:
Principle (5): Is WDFW really “unaware of studies directly evaluating adverse ecological effects to listed salmon”?

The response about disease transmission to wild fish ("Disease transmission to natural origin populations is believed to be negligible since only healthy fish are released") is not an adequate response to this complex issue. It would be good to see a table on disease history of the relevant hatcheries and some sort of record of treatment for diseases, including sacrificed diseased fish. The disease history of a hatchery might limit future transfers to other hatcheries and location of releases. An indication of which diseases are of primary concern for a particular hatchery should be provided. What safeguards are in place to prevent contamination from and for early detection of novel pathogens?

Principles for other strategies—2. The use of hatcheries for reintroduction:
Principle (1): The response indicates that limited effort is being expended to assess and understand the potential ecological and genetic interactions that the hatchery releases have on wild fish.

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

The proponents have completed draft HGMPs for the Grays River and Duncan Creek chum salmon hatchery programs (WDFW 2018a, WDFW 2018b). It is their understanding that both HGMPs will be updated if needed and submitted to NOAA-Fisheries for consultation by Bonneville Power Administration (BPA) upon the completion of this combined Step Review.

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

An adequate response was provided. Harvest levels are managed under the *US v. OR* management agreements. Harvest is incidental and rates are consistently low (5% or less) and are proposed to remain low (3-5%) into the future.

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

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

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

The three facility design elements listed above (4-6) do not apply to this project because no facilities are being proposed.

References

LCFRB (Lower Columbia Fish Recovery Board). 2010. Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan. May 28, 2010. Lower Columbia Fish Recovery Board, Longview, Washington.

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WDFW (Washington Dept of Fish & Wildlife). 2018a. Hatchery and genetic management plan for Grays River Chum salmon. Updated July 24, 2018. 78 pp.

WDFW (Washington Dept of Fish & Wildlife). 2018b. Hatchery and genetic management plan for Bonneville-Duncan Creek Chum salmon. Updated July 24, 2018. 87 pp.