Independent Scientific Review Panel
for the Northwest Power and Conservation Council
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ISRP Step 2 and 3 Review for the Melvin R. Sampson Coho Facility – Response Requested

Part of the Yakima Subbasin Summer and Fall Run Chinook and Coho Salmon Hatchery Master Plan (Project #1988-115-25, Yakima River Design and Construction-Yakima/Klickitat Fisheries Project [YKFP])

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Background

In response to the Northwest Power and Conservation Council's June 6, 2018 request, the ISRP reviewed Step 2 and 3 documents (hereafter the "YN response") from the Yakama Nation for the *Melvin R. Sampson Coho Facility* as part of the *Yakima Subbasin Summer and Fall Run Chinook and Coho Salmon Hatchery Master Plan* (Project #1988-115-25, *Yakima River Design and Construction-Yakima/Klickitat Fisheries Project [YKFP]*). The documents include:

- Cover letter addressed to Tony Grover, dated May 23, 2018
- Yakama Nation Response to ISRP 2013-8 Response Review - including Appendix A, Yakima Basin Coho Monitoring and Evaluation
- Email from Bill Bosch, June 5, 2018, providing a summary of how the YN responses address the six key issues, per the Council decision in 2013

This is the ISRP's third review related to this Master Plan (see ISRP 2013-8 and 2012-13). In the 2013 review, the ISRP found the Master Plan "Meets Scientific Review (Qualified)." Six issues were identified in the ISRP's qualification that the Council requested the Yakama Nation to address in Step 2 (Council October 10, 2013 decision letter):

1. the transition from Phase 3 to Phase 4,
2. management of harvests and spawning escapement,
3. the likelihood of implementing the expected habitat restoration plans (Integrated Plan),
4. management of the overall program in light of high uncertainty in the extent of habitat actions and fish responses to actions,
5. the need for a robust monitoring and evaluation program to support a management decision framework, and
6. overall program size.

The ISRP's review below is organized around these six issues.

ISRP Recommendation

Response Requested

The proponents present a well-conceived plan for coho salmon reintroduction and supplementation in the Yakima subbasin. However, some important details are missing or unclear. A fully revised and updated version of the detailed 2012 Master Plan is required to facilitate an accurate review by the ISRP and to maintain accountability in this final stage of the Step Review process. Accordingly, the ISRP requests that the proponents address the following eight issues in a

revised Master Plan (that focuses just on coho). More detailed comments and questions to help guide the revision are contained in the "ISRP Comments" below.

1. Explain why so many (1,200) coho must be collected for use as broodstock in the segregated program.
2. Provide more details about the biological metrics to be monitored during transition from Phase 3 and Phase 4, how they are expected to change, and how the transition will be triggered.
3. Consider the feasibility and possible benefits of developing separate broodstocks to promote adaptation to the Naches River and Upper Yakima River – major tributaries that exhibit very different biophysical environments.
4. Provide more detail about the locations of release sites for the integrated program, how sites are prioritized, the numbers of parr and translocated adults to be released at each site, and how differences in performance related to release site will be evaluated.
5. Address previous ISRP concerns (ISRP 2013-8 and 2012-13) that the projected increases in both productivity and smolt capacity are based on assumptions that may be overly optimistic.
6. Describe decision rules for coho harvest management, and show they are consistent with spawning targets for unclipped fish (natural origin returns), particularly if natural origin returns are substantially less than expected.
7. Provide more details about contingency plans and decision trees to guide adaptive management if outcomes are not as expected.
8. Describe any proposed changes to infrastructure at, or utilization of, the Prosser Hatchery. (The proponents state that previous ISRP questions about the water supply system and concrete raceways at the Prosser Hatchery are now "out of date" due to subsequent project revisions).

ISRP Comments

Issues 1 and 6: The transition from Phase 3 to Phase 4 and overall program size

> ***Yakama Nation*:** As described in the Master Plan there are actually two coho programs, a lower Yakima segregated program with a primary objective of contributing fish to harvest, and an upper Yakima integrated program with dual objectives of contributing to harvest as well as to natural stock restoration in the upper watersheds. The segregated Coho program will continue to be operated at Prosser Hatchery and have an on-station smolt release goal of 500,000 fish. The integrated Coho program will be operated at the new Melvin R. Sampson (MRS) Hatchery. Phases 3 and 4 of the integrated program will consist of the following release goals: 200,000 smolts, 500,000 parr, and 1,000 adults. The main objectives in Phase 3 of the program are to increase the number of coho spawning naturally in upper watershed tributaries and to increase the proportion of natural-origin returns used for broodstock. We expect Phase 3 to last about six years (two generations), which will allow substantial colonization of tributaries and increase

natural-origin returns. Phase 4 of the program will use 100% natural-origin fish in the broodstock while hatchery-origin spawners (most of which will be from localized parr releases) should demonstrate increasing local adaptation. Beginning in Phase 4, all escaping fish will be allowed to return to the spawning grounds as a major objective of this program is natural stock restoration, and all returning fish will either be the progeny of fish that spawned in the wild, or crosses of natural-origin fish at the MRS Hatchery. See YN Response to ISRP 2013 Comment 3, pages 9-13 for additional information.

ISRP Comment:

The YN response provides a general overview and describes some significant changes to both the segregated and integrated coho programs that are described in much greater detail in the 2012 Master Plan. These changes raise additional questions that the proponents should address as they revise the Master Plan for coho.

The YN response indicates that approximately 1,200 locally returning coho will be collected for use as broodstock in the segregated program (Table 2, page 11). Assuming half of the collected fish are females with a mean fecundity of 3,000 eggs (as stated), the total egg take of 1.8 million seems to be considerably more than needed to achieve the release target of 500,000 smolt for the segregated program. Why collect so many adults as broodstock? Are some to be translocated to subbasin tributaries?

The proponents have already made good progress toward creating an integrated hatchery coho program in the Yakima subbasin. The ISRP agrees that existing habitat restoration efforts coupled with a phased approach to integrated supplementation are likely to produce substantial benefits. However, the proposal still lacks some important details about the transition from Phase 3 to Phase 4. In particular, the YN response does not adequately explain the mechanisms by which the proportion of natural origin adults in the broodstock (pNOB), the proportion of hatchery origin adults on the natural spawning grounds (pHOS), and proportionate natural influence (PNI) will change during the transition from Phase 3 to Phase 4. This issue is potentially confusing for the ISRP because the values in Table 3 of the current proposal differ from those in the 2012 Master Plan. More detail is required in Table 3 to explain how the transition from Phase 3 to Phase 4 might occur. Why is parr-to-adult survival (3.0%) greater than smolt-to-adult survival (1.7%)? If hatchery smolts are marked and subject to additional selective fishing mortality, why is mean smolt-to-adult survival greater for hatchery origin smolts (1.7%) than for natural origin smolts (1.3%)? It would also help to clearly specify 1) the number of hatchery origin adult returns (HOR) and natural origin adult returns (NOR) in the integrated (MRS) broodstock; 2) numbers of parr and smolt released from the hatchery and their expected probability of survival; 3) the numbers of HOR and NOR spawning in the streams; 4) the expected number of smolts and adults produced by natural spawners; and 5) the PNI calculated for the overall integrated population.

The proponents correctly point out that the PNI index does not take into account the length of time juveniles spend in the hatchery prior to release, and they wonder if PNI could be calculated to reflect these differences. The PNI concept is not sufficiently precise to track differences in the extent of natural selection on parr and smolt, but it is still a useful heuristic for balancing natural and artificial selection in the integrated population as a whole. Ultimately, more sophisticated

analysis based on procedures described in the M&E plan to track changes in genetic composition may shed light on differences in the influence of natural selection on parr and smolt releases.

To justify the overall size of the integrated hatchery program, the proposed number of parr and spawners should be compared with the estimated capacity of the watershed for parr and adult spawners, respectively. The 2012 Master Plan specifies an increase in the yearly smolt release target from 200,000 in Phase 3 to 300,000 in Phase 4 whereas the YN response indicates a single target of 200,000 in both phases. Has the Phase 4 target changed? The YN response does not explain (as requested in ISRP 2013-8) why the number of natural spawners is expected to be greater during Phase 3 than Phase 4. Furthermore, Table 3 indicates that escapement will be greater during Phase 4 than Phase 3, but it is unclear whether "escapement" is synonymous with "number of spawners" and to what extent it would include hatchery adults released upstream. Table 3 should specify Phase 3 and Phase 4 targets for both natural origin and hatchery origin spawners.

The fish cultural aspects of the program are well described. Appendix A includes adequate detail about the goals, approaches, and specific tasks associated with collecting and handling broodstock, fertilizing and incubating eggs, and rearing parr and smolts. In contrast, the YN response does not provide enough detail about where and how progeny from the integrated program will be dispersed in tributaries, how these release sites will be selected and prioritized, and how the numbers of fish to be released at each site will be determined. Will the mobile raceways previously developed for reintroduction efforts in the Yakima subbasin be used in the integrated program, perhaps as acclimation sites for parr release? Or alternatively, will mobile raceways be used in the segregated program for smolt release downstream of Prosser Dam? These details are important because the overall goal of the program is to reintroduce coho into tributaries and mainstem areas of the Yakima and Naches rivers that once supported coho.

Environmental conditions in the Naches and upper Yakima rivers are distinct enough to have apparently produced tributary-specific adaptations in spring Chinook salmon. Spring Chinook salmon returning to the Naches River are typically older at maturity, larger at maturity within the same age class, and often spawn earlier in the season than Chinook salmon returning to the upper Yakima (e.g., Knudsen et al. 2004; ykfp.org/par04/PAR2004%20Abs%20Demog.pdf). These differences have been attributed to the higher gradient and flow conditions that Chinook salmon encounter during migration to spawning locations in the Naches River compared to the upper Yakima River. Similar adaptations in size at maturity and timing of migration might be possible and desirable in coho returning to these major tributaries. Tributary-specific adaptation could be facilitated by segregating broodstock and progeny destined for release into the Naches and upper Yakima rivers (more on this below).

In the current integrated hatchery proposal, it seems that natural origin returns (NOR) collected as broodstock at Prosser Dam would be a mixture of fish that originated from acclimation sites in both the Naches and Upper Yakima rivers, and from adult translocations to both rivers. Without knowing the origin of NORs collected at Prosser Dam, it seems likely that some fish bound for Naches spawning areas would inadvertently be crossed with fish bound for upper Yakima spawning areas and that their progeny would be released back into tributaries that are mismatched

to any incipient adaptations inherited from their parents. Because Prosser Dam is more than 80 km downstream of the confluence of the Naches River, it will be challenging to distinguish NORs that reared in the Naches River from those that reared in the upper Yakima River.

In contrast, any coho collected at the Roza Dam Adult Fish Monitoring Facility (RAMF) are probably destined for the upper Yakima River. The proponents also mention adult trapping locations in the Naches, at the Wapatox and Cowiche dams. We urge the proponents to consider collecting prospective broodstock at these Naches locations and at the RAMF as originally planned, as opposed to obtaining all broodstock for the integrated program just at Prosser Dam. To hasten fine-scale genetic adaptation, adults from the two major tributaries (i.e., Naches and upper Yakima) could be kept in separate groups and mated only to others within their group. Parr produced from these crosses could then be released back to the major tributary from which their parents were collected.

At present the proponents plan to release 500,000 parr/year produced at the integrated hatchery. None of these parr will be ad-clipped, but all will be marked by CWTs placed in their snouts. The proponents also plan to transfer 200,000 juveniles produced at the integrated hatchery to the Prosser Hatchery where they will be reared and released as smolts. None of the fish transferred to the Prosser Hatchery will be ad-clipped, but all will be tagged with CWTs placed in the post-dorsal region. Will unique CWT codes be used to distinguish CWT inserted into each body position to more reliably distinguish parr and smolt release groups?

As previously noted, the integrated hatchery program might be able to promote adaptation to physically distinct habitats of the Yakima subbasin by identifying and segregating broodstock by major tributary of release (i.e., Naches with Naches, upper Yakima with upper Yakima). If the major tributary of release could be identified from tags or genetic analyses, it would be possible to mate broodstock assortatively, regardless of where they were collected as broodstock. We encourage the proponents to consider the feasibility of marking parr produced at the integrated hatchery to distinguish releases into the Naches and upper Yakima areas. Perhaps CWTs could be inserted in the right versus the left side of the body rather than just in the snout. Perhaps the body location of a CWT could also be used in combination with visible implanted elastomer tags to distinguish not only Naches and upper Yakima release sites but also other release sites. Alternatively, perhaps the parental origins of the juveniles transported below Prosser Dam for release could be identified genetically by parent-based tagging (PBT).

If feasible, we encourage the proponents to evaluate and compare indices of productivity among release areas, both in terms of parr-to-smolt survival and number of smolts produced per translocated adult. We also encourage the use of rotary screw traps (RST), mentioned in the proposal, to estimate the productivity and capacity of major tributaries rather than relying only on total smolt numbers at the mouth of the Yakima River. Collecting this information at the tributary scale would help to identify habitat attributes that are conducive to re-establishing self-sustaining coho populations and to guide future habitat restoration efforts.

Issue 2: Management of harvests and spawning escapement

> ***Yakama Nation:*** Segregated program smolts will be 100% adipose fin-clipped prior to release to allow maximum retention in selective fisheries. Because integrated program hatchery-origin fish will not be adipose fin-clipped, we expect them to be harvested at rates similar to natural-origin coho in all fisheries. Harvest management decisions will be made by tribal and state fishery managers outside the scope of the Master Plan; however, we describe harvest monitoring efforts in Appendix A of our response. Segregated program fish escaping above capture points at and near Prosser Dam and Hatchery may spawn in the wild. However, we expect the majority of these fish to remain in reaches of the Yakima below its confluence with the Naches River in Yakima, WA. PIT-detection data indicate that these fish do not ascend Roza Dam. Beginning in Phase 4 of the integrated program, all fish escaping above Roza Dam will be allowed to return to the spawning grounds as a major objective of this program is natural stock restoration, and all returning fish will either be the progeny of fish that spawned in the wild, or crosses of natural-origin fish at the MRS Hatchery. See the complete response and Appendix A, pages 7-10, for additional information.

ISRP Comment:

The 2012 Master Plan indicates that coho harvest rates would be set to ensure a total of 5,000 spawners (NOR + HOR) in Phase 3 and 3,500 NOR spawners in Phase 4. It is unclear in the YN response if these targets still hold. The targets should be specified clearly in the revised Master Plan and should be based on the estimated current capacity of the Yakima River watershed.

Maintaining a specified PNI target (e.g., PNI >0.50) requires that harvest from an integrated hatchery population be regulated in accordance with the size of the natural spawning component. The revised Master Plan should specify a decision rule for allocating NOR among terminal harvest, broodstock for the integrated hatchery, and natural spawning in the river when NOR are insufficient to meet the spawning escapement goal. Will abundances of NOR and total integrated hatchery coho be monitored in-season as a means to adjust terminal area harvests when needed? If so, will the terminal fishery in the Yakima River be reduced to achieve a minimum escapement goal for the unclipped (NOR) spawning component of the integrated population? In other words, the harvest plan should describe if and how the harvest rate will be adjusted, at least in the terminal area, to match the productivity of natural origin coho and to meet the escapement targets.

The YN response provides an estimate of the approximate harvest rate on fin-clipped (HOR) coho but does not mention the harvest rate on unclipped coho caught by non-selective gear such as gillnets or killed incidentally following catch and release. Will tribal commercial and subsistence fisheries retain unclipped coho? What is the current harvest rate on unclipped coho?

Appendix A adequately covers most tasks related to harvest monitoring and evaluation proposed by the proponents. The marking of coho with fin clips, CWT, and PIT tags should facilitate selective fishing on segregated hatchery coho while enabling accurate monitoring of HOR and NOR in the integrated population. However, the proponents still need to clarify how the monitoring and evaluation activities will influence decision making under adaptive management (i.e., update section 3 of the 2012 Master Plan). A few of the tasks in Appendix A (e.g., A.5.1.4, A6.1, A.8.1.5)

indicate that M&E findings would influence future decision making, but decision trees or contingency plans are not presented.

Appendix A describes all tribal fisheries in the mainstem Columbia and Yakima rivers but states that *"The fisheries monitoring methodologies used by WDFW and other state and federal agencies are outside the scope of this document."* Even so, the Master Plan should include a brief description of the level of monitoring effort by non-tribal agencies to demonstrate that the overall data set expected from monitoring will be adequate to evaluate the success of the plan. The ISRP is concerned that non-tribal fisheries (commercial and sport) in the ocean, mainstem Columbia, and Yakima River, if not managed appropriately, might undermine the success of the project by significantly reducing coho returns to the Yakima River. Documenting this information would also help to demonstrate co-management of Yakima River coho by YN and the agencies.

Issues 3 and 4: The likelihood of implementing the expected habitat restoration plans (Integrated Plan), and management of the overall program in light of high uncertainty in the extent of habitat actions and fish responses to actions

> ***Yakama Nation:*** Over the past 10 years, the Yakima Basin Integrated Plan has gained broad support at both the local and federal levels. There has been substantial funding of the Plan since at least 2011 and funds are already being committed well into the future. Our response includes a summary of habitat and water enhancement projects completed during the 2013-2017 period. There is broad support in the literature for our assumption that projects such as these provide benefits to fish, with many studies specifically citing benefits to Coho. We expect the changes in life-stage release strategies planned for Phases 3 and 4 of the program, as well as these ongoing habitat enhancements and actions, to result in increased natural smolt production over time. A comprehensive monitoring and evaluation program for all anadromous species in the Yakima River Basin, funded by the Bonneville Power Administration, has been in place for many years now. While habitat action effectiveness monitoring is beyond the scope of the MRS Coho master plan, we intend to continue monitoring results from our Yakima Basin M&E efforts, ongoing habitat action evaluation programs throughout the region, and the literature. Should these results bring recommended changes from our technical staffs, we will apply adaptive management protocols established within the Yakima Klickitat Fisheries Project framework to modify the coho program(s) as necessary. See the complete response, particularly at pages 3-5 and 7, and Appendix A for additional information.

ISRP Comment:

At the time of the ISRP's 2012 review, funding to implement the Yakima Basin Integrated Plan seemed uncertain. The YN response indicates that the plan is being funded by nine federal agencies with additional support from state agencies and local entities. It also provides an update on the status of restoration projects listed in the Plan. To date, 17 of 26 habitat projects and 8 of 16 water conservation projects have been completed at a total cost of about $200 million. When the Plan was being developed, the total cost to completion was estimated at between $4 billion and $5.6 billion

(excluding costs of land acquisition). Half to three quarters of this expected cost was associated with five projects: Wymer Reservoir with Thorp Intake and Roza delivery - $1.6 billion; enhanced agricultural conservation - $0.4 billion; Bumping Lake enlargement - $0.4 billion; fish passage at Tieton, Kachess, and Keechelus Dams - $0.3 billion; and mainstem floodplain restoration program - $0.27 billion.

Specific ISRP questions have still not been addressed about the amount of habitat that will be restored, how such actions might increase productivity and capacity, and how anticipated gains in fitness will be measured. For example, the proponents have not yet adequately responded to ISRP concerns that projected increases in both productivity (from 34 to 93 smolts per spawner) and smolt capacity (from 72,059 to 256,720 smolts) are based on assumptions in the 2012 Master Plan (Table 3-2) that may be overly optimistic. Further, the proponents have not responded to the ISRP recommendation that *"Step 2 should model a scenario that is more likely to occur in the next 25 years than the ambitious option three and describe the anticipated Phase 4 outcome of a more likely habitat scenario, perhaps option one"* (ISRP 2013). The 2012 Master Plan states that the full ($4 billion plus) "Integrated Plan" will be implemented. The YN response does not provide any assurance that the Integrated Plan will be fully implemented, nor does it reevaluate benefits from less optimistic restoration scenarios or describe changes in the Master Plan if components of the Integrated Plan do not occur.

The ISRP also found it difficult to reconcile updated data provided in Tables 1-3 of the YN response with the optimistic projections of increased productivity and capacity in the 2012 Master Plan. Data in Table 1 lead us to conclude that the most recent 5-year (2011-2015) geometric mean SAR index for natural origin smolts is only 1.0%, with the last 2 years being the lowest on record (since 2000). (Note that the SAR value of 1.3% specified in Table 3 appears to have been calculated as the geometric mean of 2010-2014). Also, of concern, the time series of SAR for natural origin smolts (or more precisely the log of the SAR index) is significantly negatively correlated with the number natural origin smolts. The correlation is driven largely (but not entirely) by the record low SAR (0.2%) in 2014 which is associated with a record high number of natural origin smolts (i.e., 159,642). That record high smolt abundance is only 62% of the estimate of smolt capacity (i.e., 256,720) used in the 2012 projections. If we have interpreted these data correctly, the negative correlation might indicate that current (or recent) carrying capacity is limiting smolt survival. However, it is not clear from the data presented how or when density dependence might occur for these natural origin smolts. Accordingly, we urge the proponents to further investigate the strength of correlations among smolt size, abundance, and survival and to discuss the strength of the evidence for (or against) density dependence and the implications for smolt capacity.

The YN response states (page 7) that benefits from habitat restoration and the integrated hatchery program will be evaluated. The revised Master Plan should explicitly state that one objective of the program is to track the productivity of natural origin coho in response to restoration actions over time. The comprehensive monitoring and evaluation plan described in Appendix A appears adequate to evaluate changes in the productivity of natural origin coho.

Key metrics that should be monitored over time include smolts produced per spawning adult (or female), smolt size, smolt-to-adult survival, and abundance of mature natural origin coho. It will

also be important to evaluate changes in coho productivity in relation to indices of coho density (e.g., coho spawners by origin, hatchery smolt and parr abundances, and natural smolt abundances) as a means to detect and account for density dependence, as described above.

Issue 5: The need for a robust monitoring and evaluation program to support a management decision framework

> ***Yakama Nation:*** A comprehensive monitoring and evaluation program for all anadromous species in the Yakima River Basin, funded by the Bonneville Power Administration, has been in place for many years now. We intend to continue monitoring results from our Yakima Basin M&E efforts. Should these results bring recommended changes from our technical staffs, we will apply adaptive management protocols established within the Yakima Klickitat Fisheries Project framework to modify the coho program(s) as necessary. See the complete response and Appendix A, which describes monitoring and evaluation activities planned for the coho programs, for additional information.

ISRP Comment:

The ISRP appreciates the comprehensiveness of the M&E plan described in Appendix A. We believe this plan is critical for addressing questions and uncertainties identified in previous ISRP and ISAB reviews. Appendix A appropriately includes objectives, a general approach to address each objective, and a list of tasks. The revised Master Plan should also specify sample sizes and the amount of effort needed to adequately achieve each objective and task. Improvements in genetic techniques like parentage-based tagging (PBT) have provided more powerful monitoring options than were foreseen at the time of writing the 2012 Master Plan. Accordingly, the monitoring and evaluation section of the 2012 Master Plan should be updated to include details of the proposed PBT work. In addition, the following list of specific questions and comments should be addressed.

Specific questions and comments under M&E objective A.1 (Hatchery Monitoring and Evaluation):

1) What is the policy for including jacks in hatchery matings?
2) What are the performance standards for: (a) broodstock survival prior to spawning, (b) green-egg to eyed-egg survival, (c) eyed-egg to ponding survival, and (d) ponding to parr or smolt release?
3) The proponents state that the general condition of project fish will be assessed prior to release. We assume that this will be conducted by the USFWS pathologists associated with the project. What protocols will be used to make such assessments?
4) Tag retention assessments are planned at release. Procedures to evaluate tag retention are described for PIT tags but not CWT. How will CWT retention be estimated, and will retention be compared for groups tagged in different body positions? Will CWT and PIT tag retention from release to adult return also be assessed? Additionally, 100% of the segregated smolts are supposed to be adipose clipped. What procedures will be used to determine the number of segregated smolts that received adequate adipose clips—those recognizable at the adult stage? Correctly estimating rates of CWT retention and adipose

clip quality are important because these data are needed to determine the percentage and number of segregated hatchery coho that may be misclassified as integrated coho. Retention of CWTs in integrated coho is also important since it can be used to estimate how many integrated coho may be misidentified as natural origin recruits.

5) Include a map of the acclimation sites that will be used in the project.
6) It is stated (page 6) that smolt releases will occur primarily from mobile acclimation sites located throughout the Yakima Basin. Yet, elsewhere the proponents state that smolts will only be released below Prosser Dam. Clarification is needed to correct or reconcile these conflicting statements.
7) Currently the proponents plan to use PIT tag recoveries to estimate adult return rates. Why is this being done if all project fish will be tagged with CWTs? Previous work done on Yakima spring Chinook, in part by Tribal biologists, demonstrated mortality and tag loss effects in PIT-tagged fish. Both effects may substantially reduce estimated SAR values.

Specific questions and comments under M&E objective A.4 (Productivity Monitoring and Evaluation):

1) Will genetic analysis (PBT) be used to identify the origin of sampled smolts? PBT might make it possible to estimate productivity from individual release locations, provided the progeny of specific parental crosses are released at unique locations.
2) Will adult return-per-spawner (R/S) indices of productivity be calculated for each release strategy (i.e., parr versus smolts)? Because jack returns can complicate R/S assessments of productivity, we urge the proponents to consider basing assessments of productivity on adult female returns per female spawner.
3) Will habitat monitoring be adequate to assess the effects of habitat restoration actions and environmental conditions on coho productivity and the overall benefits from this project?

Specific questions and comments under M&E objective A.5 (Ecological Interactions Monitoring and Evaluation):

1) Will project fish be released into areas covered by current surveys to examine possible impacts on Non-Target Taxa of Concern (NTTOC)? A map showing the areas being sampled for such impacts should be included in the Master Plan.
2) What efforts will be made to investigate interactions between released coho parr and other resident native fish species while the project parr reside in the areas of reintroduction? The risks and impacts to native fishes should be taken into account when choosing the location of release sites and the number of parr to be released at each site.