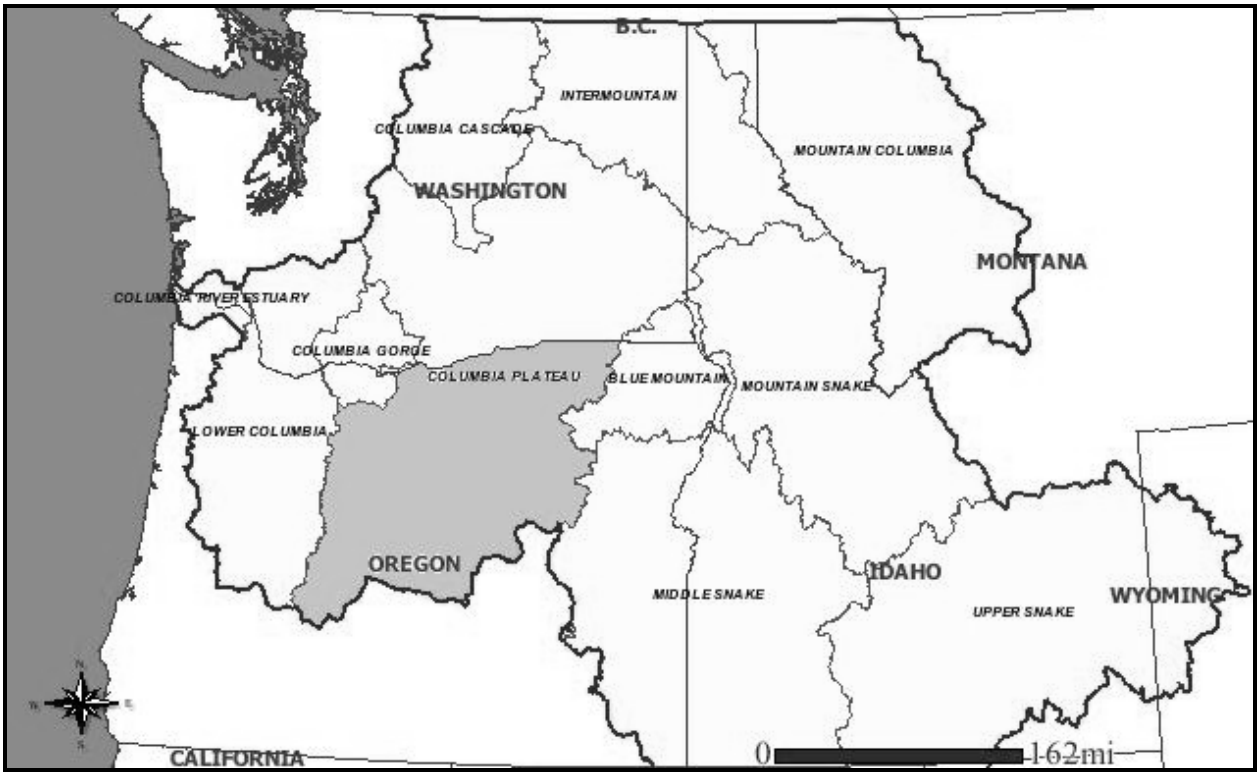
U.S. Fish and Wildlife Service

Pacific Region

Hatchery Review Team

Columbia River Basin
Columbia Plateau Province, Deschutes River Watershed



Warm Springs National Fish Hatchery

Assessments and Recommendations

Final Report, Appendix C:
Comments on Draft Report and Review Team Responses

May 2006

Appendix C: Comments on Draft Report and Review Team Responses

A. Co-Manager Comments and Response

Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO)[1]

1. In short, the CTWSRO feel that the Review Team did a comprehensive and thorough evaluation of the Warm Springs NFH. However, we do have one major concern.

2. At this time, the CTWSRO Branch of Natural Resources does not concur with recommendation WS6. We have serious concerns about phasing out the prophylactic use of erythromycin-medicated feed. Data indicate that we would see a significant decline in smolt-to-adult survival (SAR) if medicated feed was not administered in the method currently used by hatchery staff. A reduction in SAR would lead to reduced harvest opportunities for tribal fishers, reduced donation fish used by the tribal public, and in some cases, the hatchery would not be able to meet its broodstock requirements to maintain current production levels. We feel that the current feeding protocol is a very effective tool in reducing the effects of Bacterial Kidney Disease (BKD). It is premature to phase out the current program until an appropriate alternative has been identified, tested and approved. We would welcome additional information regarding other methods of reducing BKD at the hatchery, as long as these methods would maintain and or exceed the current SAR.

   Review Team Response: *Please see issue statement before recommendation WS6. The Review Team modified this recommendation slightly after the Draft Report. As noted in the Final Report, the relative benefits and risks of using erythromycin-medicated feed in a regularly-scheduled, prophylactic manner generated much discussion among Review Team members. We concluded that uncertainties regarding the known and unknown biological risks of antibiotics warranted some action at this time, including investigating alternatives to antibiotics to achieve the same survival objectives (e.g. reduced rearing densities). The Review Team will continue to discuss options with CTWSRO as we attempt to achieve the most scientifically-defensible solution that maximizes fishery and biological benefits, while minimizing risks to the ecosystem and Warm Springs River stock of spring Chinook. We also noted in the Final Report the need to develop new diagnostic tools for treating disease in a therapeutic manner, rather than feeding antibiotic-medicated feed prophylactically.*

   Review Team Note: *In addition to the comments above, suggested edits from the CTWSRO have been included in the final version of this report.*

Oregon Department of Fish and Wildlife (ODFW)[2]

1. ODFW commends both the work of the Review Team and the Service's efforts to review and improve hatchery operations under their jurisdiction.

[1] *Provided by Mike Gauvin, CTWSRO Fisheries Management Supervisor.*
[2] *Provided by Rod French, ODFW District 7 Biologist.*

2. ODFW feels strongly that results of this review can be used to support the Service's goal of ensuring hatcheries are operated on the best scientific principles and contribute to sustainable fisheries and the recovery of naturally-spawning populations and other aquatic species of concern.

3. ODFW appreciates the opportunity to participate in the review process and provide comment on the draft manuscript resulting from the review.

Review Team Note: *Suggested edits from ODFW have been included in the final version of this report. The Review Team has no additional response.*

National Oceanic and Atmospheric Administration/National Marine Fisheries Service (NOAA Fisheries)[3]

1. This is a good assessment of the Spring Chinook salmon program at the Warm Springs NFH.

2. In the descriptions of summer steelhead in the Deschutes River Basin, the report should refer to the Interior Columbia Technical Recovery Team's (ICTRT) viability and population identification reports.[4] These documents identify the summer steelhead populations in the Deschutes River Basin (Population Identification Report), the type of population (major spawning group, minor spawning aggregate), and what the minimum viable population size would be for those populations. This information should be applied to the assessment, especially the analysis represented in Table 3.

Review Team Response: *NOAA Fisheries' ICTRT has identified two demographically independent population groups for summer-run steelhead in the Deschutes River Basin: those associated with "west-side" tributaries (and adjacent mainstem regions) and those associated with "east-side" tributaries (and adjacent mainstem regions). These distinctions are based primarily on "dramatic habitat and life history differences, although the boundary is uncertain due to continuous spawning via the mainstem."[5] The Review Team has acknowledged this potential subdivision in our final report (footnote 12).*

3. In addition to the updated population identification, the report should base its viability assessment using the VSP criteria that have been developed for the region.[6] The viability assessment drafted by the ICTRT applies these criteria in their analysis. I would recommend that future hatchery assessments refer to these VSP criteria, and the population reviews that are being developed as part of the recovery planning process.

Review Team Response: *The absence of NMFS's viability criteria in our draft report was a common criticism. However, the ICTRT is only tasked with performing those assessments for anadromous salmonid stocks that are currently listed under the ESA, which in this watershed includes only summer steelhead. Moreover, at the time of this writing, NMFS had not yet*

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[3] *Provided by Richard Turner, NOAA Fisheries, Hatchery and Inland Fisheries Branch.*
[4] *Available at www.nwfsc.noaa.gov/trt/trt_Columbia.htm.*
[5] *See www.nwfsc.noaa.gov/trt/col_docs/steelheadpopulations.xls.*
[6] *McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmon populations and the recovery of evolutionary significant units. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSX-42, Seattle, WA 156pp. Also see www.nwfsc.noaa.gov/trt/trt_Columbia.htm.*

finalized their "Viable Salmonid Population" (VSP) assessments of salmon and steelhead populations nor released recovery plans in the Interior Columbia River Basin. McElhany et al. (2000) have developed a very detailed document describing four criteria of viability (abundance, population growth rate, population spatial structure, and diversity), but those criteria have not yet been translated into published viability estimates for specific stocks in the Deschutes River watershed. In the absence of those specific criteria and estimates, the Review Team has relied on AHA to evaluate current and future viabilities (Appendix A). Qualitatively, the Review Team has also relied on the viability criteria described by Mobrand et al. (2005) for the Western Washington Hatchery Review process and the general conclusions of ODFW, CFWSRO, and Service biologists most familiar with those populations. In our final report, we have added language (p.5) outlining the viability criteria of NMFS. The Review Team will use the viability assessments of the Interior Columbia TRT (ICTRT) and NOAA Fisheries recovery plans in its reviews as those assessments become available.

4. In the Deschutes River summer steelhead AHA model output (Table 3), how was the summer steelhead population determined to be of medium significance? ODFW (in developing a recovery scenario for the MCR steelhead Cascade Eastern Slope Tributaries major population grouping or MPG), identified the Deschutes River Westside population as being one of the four of seven populations in the MPG that is needed for recovery. Because of this, the medium significance should to be changed.

   Review Team Response: *The Review Team used the HSRG criteria to elicit measures of biological significance from the co-managers for each stock in Tables 1–7. This measure of biological significance reflects the biological uniqueness of a stock relative to other stocks of the same species within and outside the ESU. Biological significance, as described here, is a measure of the innate biological attributes of a stock independent of population viability or potential role in ESA recovery. The "medium" rating for biological significance of Deschutes River steelhead is based on the assessment that major life history adaptations and other biological attributes of those fish are shared with other stocks of summer-run steelhead in the mid-Columbia region.*

5. In the population viability discussion (Table 4) for summer steelhead, the population is considered to be viable, while also stating that half of the escapement is composed of hatchery steelhead, and the PNI (proportion of natural influence) shows that hatchery fish will drive population adaptation (Appendix A). These factors, especially the proportion of hatchery fish on the spawning grounds, and the origin of those hatchery steelhead, are the reasons that the populations in the Deschutes River Basin are listed as threatened. The TRT, in their analysis, determined that the population was at moderate risk (6–25% in 100 years) of extinction.[7] This conclusion does not support a determination that the population is viable.

   Review Team Response: *The Review Team understands that there are several reasons why the mid-Columbia ESU is currently listed as threatened under the ESA. Although large numbers of out-of-basin steelhead of hatchery-origin (primarily from Snake River programs) have been straying into the Deschutes River, the actual threat those fish pose to the natural sustainability of steelhead in the Deschutes River is largely unknown. The general conclusions regarding the viability of steelhead in the Deschutes River basin, as assessed by*

[7] *Ibid.*

ODFW and the other co-managers, are that steelhead in the Deschutes River are currently maintaining themselves via natural reproduction (albeit at relatively static levels). As noted previously, the Review Team is currently discussing alternative measures of population viability with NOAA Fisheries.

6. In Table 1, the Warm Springs spring Chinook salmon program is described as being an integrated program. This may need some clarification since the definition of an integrated program differs from group to group. Under the definition of an integrated program on pages 6-7, this program may not qualify as integrated because the hatchery uses such a low percentage of naturally produced spring Chinook in the broodstock. This low proportion of naturally produced fish would be expected to limit the ability of the natural population to drive adaptation of the hatchery origin spring Chinook. This program, under definitions that NOAA Fisheries is developing, would be considered an integrated harvest program, with the goal of providing fisheries benefits while minimizing impacts on naturally spawning spring Chinook. There are some conservation benefits from this program, in that it can act as a gene bank for the Warm Springs Chinook population, if escapement becomes severely depressed, and also as a source of adults for reintroduction efforts, as is being done in Shitike Creek.

Review Team Response: *The Review Team follows the definition of the HSRG, where an "integrated" hatchery broodstock is one in which wild fish are incorporated into the hatchery broodstock at a rate sufficient to maintain the genetic characteristics of wild fish among hatchery-produced fish. The goal of genetic integration, as noted in the comment above, is for the natural environment to be the principal determinant of the genetic make-up of hatchery-produced fish. To achieve this goal, two parameters must be controlled: 1) the proportion of natural spawners composed of hatchery origin fish (pHOS) must be minimized; and 2) the proportion of the hatchery broodstock composed of natural origin fish (pNOB) must substantially exceed pHOS. If pHOS equals zero, then one can show mathematically that the goal of genetic integration will be achieved if at least 10% of the hatchery broodstock is derived each year from natural-origin adults. However, if pHOS is greater than zero, pNOB must be increased proportionately to achieve the goals of genetic integration. As suggested by recommendation WS1, the Review Team believes the goals of genetic integration may currently only be marginally achieved in the Warm Springs NFH stock of spring Chinook salmon because pHOS can approach 10%, and pNOB for the broodstock has been averaging about 10% since 2000. Hence, the Team recommended a reevaluation of the current sliding scale such that pHOS can be reduced and pNOB adjusted upwards.*

B. Stakeholder Comments and Response[8]

Stakeholder Forum[9]

1. Because this is an in-house review, isn't it like "the fox guarding the hen house?"

   Review Team Response: *Collectively, the Review Team represents many decades of professional experience dealing with hatchery issues. The Team approached the review as independent scientists, with the viewpoint that hatchery programs must adhere to three principles: 1) well-defined goals, 2) scientific defensibility, and 3) the need to respond adaptively to new information. Although the Review Team is constituted largely of Service employees, it is applying a set of hatchery review principles, tools, and system-wide recommendations that were developed by an independent science panel (the HSRG), and then using those products to provide a clear scientific basis for our recommendations.*

2. Why do the stock tables' population viability ratings make no reference to the NOAA Fisheries Technical Review Teams' viability criteria?

   Review Team Response: *The Review Team has corrected this oversight in the final version of its report. See also response to comment #3 from NOAA Fisheries.*

3. Because Warm Springs NFH is a "model" hatchery, the Service has given itself an "easy one" before reviewing the Leavenworth complex, where it will meet a lot more challenges.

   Review Team Response: *That is correct. From the beginning, the Service stated that the review of the Warm Springs NFH would be a "pilot" to test and evaluate our procedures as part of the overall review of that hatchery.*

4. Is using the AHA tool to inform discussions and understand goals valuable? Was this tool used appropriately?

   Review Team Response: *Yes, the tool was used appropriately. Several workshops have been held throughout the Columbia River Basin over the past six months to introduce AHA to the co-managers and other interested parties. The model combines habitat parameters (capacity and productivity) associated with the Beverton-Holt stock recruitment function with mortality parameters imposed by harvest and passage through the hydropower system. The model also includes a hatchery component and fitness function that reduces the mean fitness of fish by an incremental percentage each generation that fish are the product of hatchery reproduction based on the relative gene flow rates (pNOB and pHOS) between the hatchery and natural environments. The output of the model shows the distribution (or predicted allocation) of returning adults among harvest, habitat, and the hatchery for both natural-origin and hatchery-origin fish. The model is a planning tool based on an Excel spreadsheet with several background sheets that fully explain the equations and parameters of the model. The non-parameterized model and the most recent datasets for each stock (e.g.*

[8] *Stakeholder comments/questions have been extracted and paraphrased. Compete text of stakeholder written comments are presented in Appendix D.*

[9] *These comments and questions were provided by attendees of a Stakeholder Forum at the Service's Regional Office, Pacific Region, Portland, Oregon on February 9, 2006. Responses were provided by members of the Review Team who attended that meeting, and were clarified at a subsequent meeting of the full Review Team.*

Warm Springs River spring Chinook) can be downloaded from www.mobrand.com/mfs/. A Users Guide can also be downloaded. A technical discussion paper explaining AHA is available from the Publications page of www.hatcheryreform.org. AHA was developed as part of the Western Washington Hatchery Reform project in 2004 through technical discussions between the HSRG and scientists from the Washington State Department of Fish and Wildlife (WDFW) and the Northwest Indian Fisheries Commission (NWIFC). AHA is being used in Puget Sound to develop short-term and long-term harvest, habitat and hatchery strategies consistent with harvest and conservation goals. As part of the Northwest Power and Conservation Council's sub-basin planning process, AHA is being used to bring together hatchery strategies with the habitat components of sub-basin plans. The model and methods are very transparent and readily available.

5. Why would releasing coho upstream of the Warm Springs NFH conflict with Chinook?

   Review Team Response: *We do not know if coho are native to the Warm Springs River. Coho introductions were attempted in the early 1980s, and no sustainable natural reproduction resulted. The Service presumes that unmarked and untagged coho trapped at Warm Springs NFH are, most likely, out-of-basin strays of hatchery origin, and that there could be disease or competition risks in passing them upstream. In addition, coho spawn after spring Chinook and could potentially disrupt Chinook redds.*

6. How will cumulative effects of hatcheries be addressed?

   Review Team Response: *The Review Team is not looking at cumulative effects of all hatcheries because our review is focused specifically on Service facilities. However, we understand that NOAA-Fisheries will be looking at cumulative effects of all hatcheries within a region through their ESA consultations and Mitchell Act EIS processes.*

7. What are the long-term genetic impacts from the hatchery program? Are you comfortable with them?

   Review Team Response: *The Service and CTWSRO have developed a hatchery program at Warm Springs NFH where protection of the genetic resources of the naturally-spawning population is a top priority. The operational plan for the hatchery is renewed every five years, and addressing genetic concerns has been a primary consideration. The Service and CTWSRO also have 30 years of data and experience obtained from intensive monitoring, which indicate that the naturally-spawning population upstream of the hatchery is viable and self-sustaining. Nevertheless, the Review Team recognized that there is room for improvement to further reduce genetic risks consistent with broodstock goals (e.g. recommendation # WS1).*

8. What monitoring and evaluation is occurring at Warm Springs to ensure genetic integration of natural populations is maintained?

   Review Team Response: *More detail on monitoring and evaluation at Warm Springs can be found in the Warm Springs Briefing Book and background documents on the hatchery review website. In addition, the Review Team is recommending long-term monitoring with DNA*

markers (WS15), and the Service is assessing the natural reproductive success and fitness of hatchery-origin adults outplanted into Shitike Creek.

9. How do we best address M&E across the Columbia River Basin programs, given the limited budget?

Review Team Response: *Prioritizing M&E across the entire Columbia River Basin is beyond the scope of this Warm Springs review. However, the Service is participating in several ongoing processes that are taking a system-wide approach (e.g. Federal Columbia River Power System remand process).*

10. Although Trout Unlimited commends this study and the Warm Spring program in general, are we just addressing yesterday's problems? Or are we looking to the future?

Review Team Response: *You are correct, to some extent, about "yesterday's problems" because this review is of an existing hatchery program in terms of it operations, benefits, and risks relative to harvest and conservation goals. However, for each of the hatcheries the Review Team will be reviewing, we will also be examining short- and long-term resource needs over the next 15 and 50 years, respectively, and whether an alternative program would be preferred to the existing program (including the "no program" option). In essence, at each hatchery, the Review Team will be asking, "What is the best use of the current facilities for meeting harvest and conservation goals within the region that the hatchery is located?" Although a program change does not appear desirable at the Warm Springs NFH, it could become a big issue when the Review Team moves to hatcheries in other watersheds. The third scientific principle underlying this review (informed decision-making via M&E) should help to address "yesterday's problems." We need the information from well-designed M&E programs for future decisions and adaptive management.*

11. Why is the proportion of natural-origin fish in the hatchery broodstock constrained to a maximum of 20%, even in years of high escapement?

Review Team Response: *This upper limit will be revisited by a task team in response to recommendation WS1. However, one can show mathematically that a 20% upper limit is more than sufficient to meet genetic management goals if no hatchery fish are allowed to go upstream and spawn naturally. However, because hatchery-origin fish can constitute as much as 10% of the natural spawners upstream of the hatchery (because of tag loss and the mechanics of the automated bypass system), the upper limit of 20% may need to be increased. On the other hand, reducing the upstream percentage of hatchery fish may be a more efficient way of achieving the same genetic management objectives, if those reductions are possible. The Review Team established a task team to work out details of a new sliding scale as part of the next five-year operational plan for the hatchery (to be developed collaboratively between the Service and CTWSRO).*

12. Can you be more specific or clear about the "sliding scale" recommendations for natural-origin fish in the hatchery broodstock and the proportion of natural spawners composed of hatchery-origin fish on the spawning grounds? Perhaps you can provide a "strawman?" Your recommendations do not show what specific alterations of the sliding scale will be made.

Review Team Response: *The essence of this recommendation (WS1) is to ensure that the proportion of the broodstock derived from natural-origin fish (pNOB) should, on average, be at least twice (2:1) the proportion of natural spawners composed of hatchery origin fish (pHOS) upstream of the hatchery in order for genetic management goals to be achieved. The Review Team has revised WS1 to make this more clear.*

13. How do you avoid "mining" the wild population when taking natural-origin fish for the hatchery broodstock at Warm Springs NFH? Does the hatchery selection process affect the gene pool in the wild?

Review Team Response: *Hatcheries can clearly provide a demographic benefit to the propagated stock, either directly (like at Warm Springs NFH) or indirectly by targeting fisheries away from wild fish. If hatchery fish are not allowed to pass upstream to spawn in natural areas, the genetic impact is zero. Under the present management scenario at Warm Springs, approximately five percent (5%) of the natural-origin fish trapped at the hatchery are removed for broodstock each year, according to the sliding scale. Wild fish retained for broodstock need to represent a random sample of all adults potentially available and must be subtracted from the "harvestable number" of wild fish for the stock each year. The sliding scale is further designed to preclude retention of wild fish for broodstock in low return years when the harvestable number is set equal to zero.*

14. If you are maintaining high gene flows from wild to hatchery, how do you justify not allowing these hatchery fish to spawn naturally, especially in years of low natural escapement? Why not take advantage of the opportunity to increase natural spawners by 50% or better by allowing large numbers of hatchery fish to pass upstream to help "seed" the habitat?

Review Team Response: *It is important to not confound a demographic benefit with a genetic risk. Natural populations can be highly dynamic, particularly in response to ocean conditions and rainfall patterns during the time eggs are incubating in the gravel and prior to smolt outmigration. The Service has no data at this time to suggest that the naturally spawning population of spring Chinook in the Warm Springs River is in trouble demographically. The population is considered viable but exhibits natural fluctuations in abundance, particularly among brood years and over decadal time scales. Consequently, the Review Team sees no scientific justification for "seeding" the freshwater habitat with hatchery-origin adults at this time, believing that the long-term genetic risks of doing so far outweigh the short-term (i.e. single-year) demographic benefits. Exclusion of hatchery-origin fish from the naturally spawning population allows the natural environment to significantly influence the genetic constitution of hatchery-produced fish via gene flow from the natural environment to the hatchery environment. Allowing large numbers of hatchery-origin fish to spawn naturally would have the reverse effect over multiple years and generations; that is, the hatchery environment would start having a significant influence on the genetic constitution of natural-origin fish. If the status of spring Chinook in the Warm Springs River declines significantly at some future point in time, then concerns regarding demographic risks may outweigh genetic risks, and aggressive supplementation may be one strategy for recovery (see also following response).*

15. How do you weigh different spawning success of wild and hatchery fish in considering allowing hatchery fish to spawn naturally for conservation purposes? Has a number been proposed for low escapement where you "step in" with allowing hatchery fish to spawn in natural populations?

Review Team Response: *Warm Springs NFH fish are probably about as close to wild fish as you can get in a long-standing hatchery program intended to produce fish for harvest. The Service is currently assessing, via DNA markers, the natural reproductive success of hatchery-origin spring chinook outplanted as adults into Shitike Creek from the Warm Springs NFH. Perhaps a more critical question is, "At what level of abundance should hatcheries be used to conserve natural populations, to ensure they don't go extinct or become relegated to captive breeding stock?" The HSRG created a technical discussion paper to address this question based on genetic effective population size arguments and the risks associated with loss of genetic diversity due to population bottlenecks and founder effects, particularly during periods of very low escapement. That paper can be found on the Publications page of www.hatcheryreform.org. The Review Team has also added Recommendation No. WS1f to our list.*

16. Does the Review Team intend for Warm Springs NFH staff to discontinue scheduled use of erythromycin for controlling bacterial kidney disease regardless of the effect that will have on survival?

Review Team Response: *The short answer is "no", but with caveats. The Review Team recognizes the survival benefit currently being achieved from the use of medicated feed. Hard data clearly show that fish fed medicated feed, as part of a regularly scheduled "prophylactic" treatment, survive to adulthood at a higher rate than fish not fed medicated feed. However, the Review Team agrees that the use of antibiotics should be minimized. Consequently, the Hatchery Review Team is recommending that the Service and Tribal biologists investigate culture alternatives to the prophylactic use of antibiotics. The Review Team is also recommending that a phase-out plan be developed (see Recommendations WS6 and WS7), and that new diagonostic tools for the therapeutic use of antibiotics also be developed..*

Columbia River Inter-Tribal Fish Commission (CRITFC)[10]

1. The Review Team does not include any recommendations for change in the current spawning practices at Warm Springs NFH. I would recommend, however, that policy be modified to require systematic factorial mating of broodstock up to and including the maximum of 630 fish.

Review Team Response: *Factorial mating is desired when the genetic effective number of breeders per year (N_b) results in an overall genetic effective number of breeders per generation (Ne) of less than 500 fish. Maintaining Ne>500 minimizes random changes in gene frequencies due to genetic drift. From a genetic drift perspective, Ne>1,000 is nearly equivalent to an infinite number of spawners because the drift effect per generation is a direct function of 1/2Ne, not Ne. The current pairwise mating scheme (630 adults per year x*

[10] *Provided by Peter F. Galbreath, Conservation Fisheries Scientist*

five years per generation) more than exceeds those threshold levels. Moreover, a factorial mating design for spring Chinook would substantially increase disease risks from bacterial kidney disease because of potential cross-contamination of eggs from different females with substantially different levels of Renibacterium salmoninarum.[11]

2. The exact nature of WS1 is unclear. While I strongly support the CTWSRO/USFWS "two-stock concept" of the Operational Plan for the WSHFH, I would recommend that it not be applied as strictly as described in years of exceptionally high and exceptionally low natural origin (NO) adult returns. The problem lies in the fact that the 5% restriction (of total number of NO adults retained for broodstock) constrains increasing % NOB in high return years in such a manner as would compensate for low/zero % NOB values in low return years.

   Review Team Response: *The Review Team also recognized this problem and provided some guidelines or "sideboards" to revising the existing sliding scale without proposing a specific alternative. The "5%" value is not a "restriction", but a guideline. A task team will be formed to develop those alternatives.*

3. While procedures to incorporate natural-origin adults into the hatchery broodstock have no doubt been effective in minimizing genetic divergence of the hatchery from the natural stock, there are no stated policies defining "catastrophic loss," nor when and how to utilize the genetic repository represented in the hatchery stock. I propose Ne = 500 as the minimum allowable annual escapement for spring Chinook salmon – the threshold at which the genetic repository created by the integrated hatchery program should be exploited.

   Review Team Response: *The natural population of spring Chinook in the Warm Springs River has been intensively monitored since the late 1970s. Although the number of returning adults has fluctuated widely, there is no indication at this time that the population is threatened or endangered. The short-term demographic benefits of passing hatchery-origin adults upstream to spawn naturally must be weighed carefully against the overall long-term genetic risks of allowing the proportion of natural spawners composed of hatchery-origin adults to exceed the proportion of the hatchery broodstock derived from natural-origin adults. The Review Team has added Recommendation WS1f to address these concerns and contingencies.*

Native Fish Society (NFS)[12]

1. The Native Fish Society appreciates the opportunity to provide our review comments on the assessment of the Warm Springs Hatchery by the U.S. Fish and Wildlife Service. The Warm Springs National Fish Hatchery operations and goals are superior to most other production hatcheries in the Columbia River basin and should be used as a model for hatchery operations in the basin.

[11] *The rationale for these various protocols are described in Campton, D.E. 2004. Sperm competition in salmon hatcheries: the need to institutionalize genetically-benign spawning protocols. Transactions of the American Fisheries Society 133:1277-1289.*

[12] *Provided by Bill M. Bakke, Director, Native Fish Society*

2. The introduction should address National Marine Fisheries Service (NMFS) viability assessment measures. Since these measures are not included in the assessment, a comprehensive assessment is lacking.

   Review Team Response: See response to comment #3 from NOAA Fisheries.

3. Risks: Add to this list of changes in phenotypic characteristics between the wild spring Chinook and the hatchery fish.

   Review Team Response: *The Review Team modified the report to point out this phenotypic risk more explicitly. Also, Recommendation WS1 deals explicitly with this concern. One can show mathematically that this risk increases significantly as the proportion of natural spawners composed of hatchery-origin fish (pHOS) approaches or exceeds the proportion of the broodstock derived from natural-origin adults (pNOB). Under the current broodstock sliding scale, the Review Team concluded that pNOB, over a five-year running average, did not sufficiently exceed pHOS for the broodstock genetic goals to be achieved. We believe that an updated sliding scale is necessary, but deferred a specific recommendation to a task team as part of a new five-year operational plan for the hatchery. Additional background information is also provided in the briefing document.*

4. Ecological Risks: I am pleased that hatchery effluent is addressed; however, it is important to address the release of pathogens into receiving waters so that the hatchery does not function as a point source for pathogens in the Warm Springs and Deschutes rivers. Also, this risk statement should indicate that DEQ criteria for hatchery effluent are the standard by which the hatchery is in compliance with the Clean Water Act.

   Review Team Response: *The team does consider the ecological impact of the hatchery in its entirety. Included are disease and effluent considerations. The team was impressed by the level of pathogen monitoring already being accomplished at the facility and has documented it in our briefing statement. Wild fish health surveys in the area have indicated that the fish in the area, both upstream and downstream of the weir, do not have a significantly different pathogen profile than fish reared at the hatchery. The Service hopes to include this type of wild-fish pathogen monitoring at all of its facilities in the future. As far as effluent discharge risks, the hatchery meets the requirements listed in its NPDES permit issued through the Environmental Protection Agency (EPA). Since the facility is Federal and exists on a Tribal Reservation (the Warm Springs Reservation), the EPA is the regulatory agency with jurisdiction.*

5. I am very pleased with the risk discussion about the potential problem of disease resistant pathogens being created by the use of antibiotics. This problem has been of increasing concern in human health and should be no less important in fish culture. This risk should be identified as a research and management priority.

   Review Team Response: *We agree with the need for this risk to be a research and management priority.*

6. The risk associated with cost and funding for this hatchery operation should be included. Obviously, given the shortfall in federal funding for natural resource and other domestic

agencies, the assessment should recognize this risk and discuss options. If funding for this facility, research, and management were [not] to occur, what impact would that likely have on not only the hatchery product, but the conservation of wild spring Chinook and summer steelhead in the Deschutes Basin? The risk assessment should also evaluate costs of the hatchery program such as the cost to catch of Chinook produced for harvest.

Review Team Response: *The Review Team has been tasked with scientific assessments and is not qualified to perform economic assessments. We do believe, though, that there are cultural, scientific, and conservation benefits of the Warm Springs NFH program that cannot be quantified economically. However, we agree that funding is critical for the operation and understanding of our hatchery programs. The Warm Springs program is progressive in that the M&E budget has been a regular and substantial component since 1975, three years before the hatchery program was initiated in 1978. More than 10,000 hatchery salmon from Warm Springs NFH have contributed to sport and tribal fisheries in the Deschutes River since the start of the program. A substantial amount have also been distributed from the hatchery to tribal members.*

7. The assessment states that "Sustainable natural production of trout, salmon and steelhead is an important fisheries goal …" The term sustainable should be defined so it is clear what the goal actually means. I would also include a definition of what a sustainable hatchery population and production means.

Review Team Response: *"Sustainable" simply means that a population, hatchery or wild, has sufficient viability (capacity and productivity) to maintain itself indefinitely under current environmental conditions. In the context of fisheries management, "sustainable" implies that the recruits per spawner is sufficient to support a harvest. "Sustainable" hatchery programs consistently trap more returning hatchery-origin adults than were spawned artificially to produce those returning adults.*

8. The assessment states: "The White River supports natural populations of rainbow trout and other native resident fish." This population of resident rainbow trout has been identified as a unique form of rainbow that is very unlike other Deschutes Basin rainbow trout. The assessment should more fully describe this unique rainbow trout.

Review Team Response*: Rainbow trout upstream of the falls appear genetically to have been isolated reproductively from fish below the falls for thousands of years. "Unique" in this case is with respect to anadromous and non-anadromous rainbow trout downstream of the falls on the White River and elsewhere in the Deschutes River Basin.*

9. Table 1 Round Butte Hatchery spring Chinook does not include the origin of Round Butte Hatchery spring Chinook. It is my understanding that due to poor survival of Round Butte Hatchery spring Chinook originally derived from Metolius River stock, that the hatchery stock was re-established with Warm Springs Hatchery Chinook. The origin of a hatchery stock should be included in all tables discussing hatchery stocks.

Review Team Response: *Trapping at Sherars Falls by ODFW was used during 1977 to 1980 to revitalize the Round Butte hatchery program. Those fish were wild fish destined for*

the Warm Springs River or Shitike Creek. Warm Springs hatchery stock has also been used recently at Round Butte during low returns to Pelton trap.

10. It is assumed in all tables in this document that harvest, hatchery output and natural production numbers will be increased. The assessment should discuss these assertions in terms of a place holder in reality and the potential impact of increased hatchery production and harvest on wild populations in the Deschutes Basin. Otherwise the assessment contains an optimistic forecast that is inadequately evaluated.

Review Team Response: *Outputs of the AHA spreadsheet (Appendix A) are not "forecasts" but, rather, quantification of assumptions and parameters associated with co-manager goals. For example, rather than simply stating that the long-term goal is to increase habitat quality or quantity for a particular stock, AHA quantifies those goals through parameterized increases in productivity and capacity. In this respect, estimating increased population capacities of the watershed upstream of Pelton Dam is not a precise science, but is comparable to estimating extinction probabilities over the next 100 years assuming no change in habitat conditions (i.e. as tasked by the NOAA Fisheries TRTs).*

11. Table 3 Deschutes Fall Chinook: This assessment by co-managers rates the wild fall Chinook as of medium to high biological significance. Isn't obvious that this population is of high biological significance? How many wild fall Chinook populations are there above Bonneville Dam that are as productive as the Deschutes population? Hanford Reach?

Review Team Response: *Biological significance and population viability are independent assessments or parameters that contribute to an understanding of stock status. The biological significance of a particular stock will increase if the viability of other stocks of the same species decrease, which clearly contributes to the medium-to-high rating for Deschutes River fall Chinook. However, the viability of the stock in question has little bearing on its biological significance relative to the species or ESU to which it belongs. For example, Redfish Lake sockeye salmon are considered to have very high biological significance because they possess many unique biological attributes and are the only population in the ESU. In this context, "biological significance" is not equivalent to "conservation" or "management" significance. A population of very high viability, like Deschutes River fall Chinook, may have very high conservation or management significance but not possess any unique biological attributes relative to other fall Chinook stocks within the ESU. During our discussions, comanagers did not identify any unique biological attributes of Deschutes River fall chinook relative other fall chinook stocks in the mid-Columbia. Also, assessing stock status was not a responsibility of the Review Team. We simply relied on the evaluations provided to us by the comanagers.*

12. Table 3 Summer Steelhead: The biological significance of this population is rated medium now and into the future. To me the summer steelhead is of high biological significance and the threats from stray hatchery fish and habitat degradation, primarily on east side tributaries, is a high priority to be fixed. This rating is probably related to the high stray rate from out-of-basin hatchery steelhead. Many of these strays come from U.S. Fish and Wildlife Service funded hatchery programs. I assume that if this assessment process will clean up this stray steelhead problem, therefore the wild steelhead significance should increase. The viability rating in this table is confusing. The co-managers consider the steelhead viable even though it is an ESA-listed species and there is information that some populations are not viable.

Review Team Response: *See response to NOAA Fisheries comments #4 and #5.*

13. Table 4 Round Butte Hatchery summer steelhead: The table says that 125 adult steelhead are needed for hatchery broodstock but the average annual return of hatchery steelhead to the hatchery is over 750 fish. This would indicate that the contribution rate for these hatchery steelhead [to harvest] could be higher. The goal of this hatchery is to produce fish for the fishery and excess fish do not contribute to this fishery.

Review Team Response: *It is beyond the scope of the Review Team's mandate to recommend changes to the Round Butte Hatchery summer steelhead program or to address contribution rates to harvest of this stock.*

14. Since the Warm Springs Hatchery spring Chinook have diverged from the wild spring Chinook in the Warm Springs River in life history traits and in survival rates, releases of these hatchery fish in Shitike Creek would be inconsistent with a conservation goal to maintain the wild Shitike Creek spring Chinook. What is the scientific basis of this stock transfer program and how is it consistent with conservation of the last two wild spring Chinook populations remaining in the Deschutes subbasin?

Review Team Response: *The life history attributes between hatchery- and natural-origin spring Chinook are more similar now than several years ago when the paper by Olson et al. was published (1995). The Shitike Creek population has suffered from habitat degradation. The research and potential conservation benefits of outplanting surplus hatchery-origin adults trapped at the Warm Springs NFH are considered substantially greater than the genetic risks to the existing natural population in Shitike Creek, which is not considered viable because of low escapement of natural spawners.*

15. Removing marked stray hatchery steelhead at the Warm Springs Hatchery weir is a definite benefit for wild steelhead conservation in the Deschutes basin. This program is important since the Warm Spring River is the only tributary that has maintained a long term gene flow barrier by excluding stray steelhead in the basin. However, as Hand and Olsen (2003) noted in their paper, unmarked steelhead strays represent a substantial risk to the conservation management goal for the Warm Springs River wild steelhead. They make two recommendations: 1) a comprehensive coded wire tag program in the Columbia River Basin hatchery programs, so that stray hatchery fish can be identified at the Warm Spring Hatchery and the hatchery of origin can be determined; and 2) Mark all hatchery steelhead released in the Columbia River basin to allow Warm Springs Hatchery workers to exclude strays from the river above the hatchery. Given these concerns, the conservation account presented in the assessment is incomplete and should reflect the above issues.

Review Team Response: We have highlighted the conservation benefit of excluding stray, hatchery-origin steelhead from the upper Warm Springs River. Issues related to tagging and straying of hatchery-produced steelhead from other hatcheries outside the Deschutes River basin will be addressed in subsequent reviews of federal hatcheries in those other regions.

16. In addition, the evaluation must be viewed in context of the whole Columbia River Basin, since fish released from the Warm Springs Hatchery have an impact on and are affected by

management in the Columbia River Basin. This includes predator attraction, strays, harvest impact, contribution, etc.

Review Team Response: *All fish released from the Warm Springs NFH are marked with a clipped adipose fin and carry a coded-wire tag. The Service is unaware of any data to suggest that spring Chinook from Warm Springs NFH stray to any extent outside the Deschutes River Basin.*

17. Risks to other non-target species: The assessment does not clearly display the impacts to migrating resident rainbow and bull trout moving up stream from the Deschutes River into the Warm Springs River. Does the hatchery weir block the access of these species to the upper Warm Springs River? Other species that may be blocked besides lamprey are the native sucker using the Warm Springs River as a spawning and rearing stream. These issues should be addressed in this assessment for both Shitike Creek and the Warm Springs River.

Review Team Response: *The fish ladder and hatchery facility is annually operated to pass native fish upstream. We are not aware of passage problems, except for temporary trapping operations. Nevertheless, the Review Team raised the same concern and recommended an assessment of this potential problem (Recommendation WS12). Recent research with Pacific lamprey however may warrant further review of passage problems for this species. The Review Team also noted that predation by otters has been observed on some native fish using the ladder.*

18. WS1a and WS1b: These two recommendations seem to be responding to the same issue but with different values. One calls for natural origin fish to be represented in the hatchery brood stock at the 10% level and the other calls for a 5% mix.

Review Team Response: *WS1a implies that a minimum of 10% of the adult fish spawned for broodstock at the Warm Springs NFH should be natural-origin fish (i.e. unmarked wild fish). WS1b implies that approximately 5% of the total number of natural-origin adults intercepted at the Warm Springs NFH should be retained for broodstock (i.e. approximately 95% of the unmarked wild fish trapped at the hatchery should be passed upstream). In practice, the 5% removal of natural-origin fish for broodstock would be considered part of the "harvest" on those fish.*

19. It appears that this plan is proposing a deliberate passage of hatchery spring Chinook into the Warm Springs River above the hatchery weir for natural spawning. The risks of allowing this interaction, given the stated divergence in the hatchery population (Diggs 1995) should be evaluated in this assessment.

Review Team Response: *The Review Team was also concerned about potential passage of hatchery-origin adults upstream of the weir, whether inadvertent or deliberate, because we believe the natural population upstream of the weir is viable and self-sustaining. Under these circumstances, we believe the long-term genetic risks of passing hatchery-origin fish upstream far outweigh the short-term demographic benefits, although some passage is unavoidable. A reassessment of the sliding scale and passage protocols are thus warranted (Recommendation WS1).*

20. WS8: On my most recent visit I found painted raceways but the fish were starved for shade, using the thin shadow provided by the raceway wall on one side. This concentrated the fish into a very small space and they were speaking quite loudly that more shade is needed to make the raceways a more benign environment.

Review Team Response: *Since your visit, shaded structure has been provided over all raceways from late spring through fall. The covers are removed during winter to prevent damage (which occurred during the first winter they were left on).*

21. WS10a: The assessment calls for a plan to provide better protection for hatchery smolts from predators that are staged at the hatchery release outlet. I do not know how this can be accomplished but I do not support the elimination of predators. Perhaps more training is needed so the hatchery fish are more aware of predators.

Review Team Response: *This recommendation has been re-worded to specifically state that we do not recommend the "elimination" of predators. We recommend that fish released from the facility be given the opportunity to quickly adapt to predators. This may take the form of additional predator training or modifying the point of release to provide temporary shelter from predators. Specific modifications could simply be starting the release at night rather than day, or investigating volitional vs. force release, or plumbing in multiple release sites/shelters. Also providing additional shelter for adult fish entering the hatchery ladder and trap needs to be investigated. Predation on adult native fish can now occur from otters entering the ladder and human poaching.*

Review Team Note: *Suggested edits from NFS have been included in the present version of this report.*

Trout Unlimited (TU)[13]

1. The report states that it is "based upon the best scientific information available at the time of the review." Yet the description of the watershed, goals, stock status and hatchery program ignores all of the best available science in the Interior Columbia Technical Recovery Team's (TRT) analyses, the State of Oregon's stock status assessment pursuant to the state Native Fish Conservation Policy, and the numerous investigations and studies done pursuant to the Pelton-Round Butte FERC relicensing process, instead relying on the AHA model and agency "estimates" of stock status and habitat quality, including estimates of management objectives.

Review Team Response: *ODFW and NOAA Fisheries were full participants in this review. The Review Team used all the information they explicitly provided us. As noted in our response to comment #3 from NOAA Fisheries, the Interior Columbia TRT (ICTRT) has not yet published the results of their viability analyses of salmon and steelhead populations in the Deschutes River watershed based on the biological criteria they have developed. Our goal was simply to provide a general assessment of the current viability of salmonid stocks in the Deschutes River Basin for assessing the benefits and risks of the hatchery program on those stocks., Our statement regarding the "best scientific information available" refers to the peer*

[13] *Provided by Kaitlin L. Lovell, Trout Unlimited.*

reviewed, scientific literature that is published in scientific journals and agency reports, specifically with respect to our understanding of the biology of salmonid fishes and the effects of artificial propagation on that biology and aquatic ecosystems. Information regarding the FERC relicensing process in the Deschutes River Basin deals with habitat and salmonid issues in the upper Deschutes River Basin upstream of Pelton Dam, and that information has little bearing on the benefits and risks directly conferred by the Warm Springs NFH. We invite T/U to provide the Review Team with the specific information that T/U believes we overlooked in our analyses, recognizing that our responsibility was to evaluate the operations, benefits, and risks of the Warm Springs NFH, not perform detailed habitat or viability analyses on salmon and steelhead stocks in the Deschutes River Basin.

2. The draft report fails to explain why it chose the AHA model, what the advantages and disadvantages are to the model, the assumptions underlying the model and other alternatives. As a result, it is very difficult to comprehend the tables in the report produced by the application of the AHA model.

Review Team Response: *See response to Stakeholder Forum comment #4.*

3. The spuriousness of this approach is seen in Table 4 under population viability where the AHA model relies on co-manager's conclusions that the "stock is viable, although it is listed as threatened under the ESA, and recent viability analysis for recovery planning suggest that some populations may not be viable."

Review Team Response: *We have provided our justification for the AHA model previously. Regarding Table 3, the Deschutes River stock of steelhead is not, by itself, listed as "threatened"; rather, it is the entire mid-Columbia ESU of steelhead that is formally listed under the ESA. Indeed, the scientists convened by NOAA to assess the status of the mid-Columbia steelhead ESU were divided almost evenly between those who concluded that a listing was warranted and those who concluded that a listing was not warranted at this time.*

> *"A slight majority (51%) of the BRT votes for this ESU fell in the 'likely to become endangered' [aka "threatened"] category, with a substantial minority (49%) falling in the 'not likely to become endangered' [aka "not warranted"] category. The BRT did not identify any extreme risks for this ESU but found moderate risks in all the VSP categories (mean risk matrix scores ranged from 2.5 for diversity to 2.7 for abundance). This ESU proved difficult to evaluate for two reasons. First, the status of different populations within the ESU varies greatly. On the one hand the abundance in two major basins, the Deschutes and John Day, is relatively high and over the last five years is close to or slightly over the interim recovery targets (NMFS 2002). On the other hand, steelhead in the Yakima basin, once a large producer of steelhead, remain severely depressed (10% of the interim recovery target), in spite of increases in the last 2 years. Furthermore, in recent years escapement to spawning grounds in the Deschutes River has been dominated by stray, out-of-basin (and largely out-of-ESU) fish—which raises substantial questions about genetic integrity and productivity of the Deschutes population." (Updated Status Review for Steelhead, NOAA-Fisheries, 2004).*

Based on our discussions with BRT members, an ESA listing would most likely not have occurred if the status review had been restricted to steelhead in the Deschutes and John Day Rivers. Nevertheless, the BRT was clearly concerned about the large number of out-of-basin hatchery-origin steelhead that were straying into the Deschutes River basin (see also our response to comment #5 of NOAA-Fisheries). Also, as noted previously, it was not our mandate as a Hatchery Review Team to determine the exact status of every stock or population in the Deschutes River Basin. Our job was to assess the extent to which operation

of the Warm Springs NFH affected the status of those stocks, either negatively or positively, based on the best information currently available. Regardless of the actual viability or status of steelhead in the Deschutes River Basin, we concluded – as others have elsewhere -- that the Warm Springs NFH was posing little direct risk to steelhead in the Deschutes River. Indeed, as the Native Fish Society has concluded, the hatchery may actually be conferring a benefit to steelhead by precluding stray hatchery fish from ascending the upper Warm Springs River, thus maintaining a natural steelhead "sanctuary" in the Warm Springs River upstream of the hatchery.

4. The report never asks the whether the goals for the basin, including the hatchery, are appropriately matched for the watershed itself and if the hatchery is the appropriate management action to accomplish those goals. One reason we do not think the report addressed these questions is because it fails to look at the comprehensive and cumulative impact of the hatchery. There is simply no analysis of the downstream effects of the hatchery production on the wild population and no discussion of the monitoring and evaluation, with the exception of its costs, that is taking place upstream to demonstrate the minimal impact. There is no evidence that genetic testing is being done upstream and downstream, or evaluations of phenotypic changes, behavioral differences, habitat uses etc.

   Review Team Response: *The Review Team believes its recommendations address most of the concerns expressed in this comment (see also response to Stakeholder Forum comments #6-#9). Regarding "goals," we must recognize that one of the principal goals of salmon management in the Pacific Northwest is "harvest". At the present time, approximately 1,000 adult spring Chinook salmon from the Warm Springs NFH are harvested annually. The desire of the CTWSRO to harvest fish returning to their reservation and traditional fishing areas is a right guaranteed by treaty. We believe that the harvest goal is well founded, both biologically and legally. The alternative to harvesting 1,000 hatchery-origin fish would be to impose that harvest on wild fish. We believe that this latter approach would be more detrimental to the natural population of spring Chinook salmon in the Warm Springs River than the current management strategy that combines a hatchery program with aggressive conservation measures to protect the natural population.*

5. The model [AHA] uses a different approach to viability than that adopted by NOAA Fisheries and the region in the Viable Salmonid Population (VSP) concept. Therefore, it is difficult to understand or even gauge the value of applying the concepts of "biological significance" and "population viability" to pure hatchery stocks such as the Round Butte Hatchery spring Chinook (an identified segregated stock). Unlike the VSP criteria, the AHA model does not explain how it is sensitive to future changes in conditions, such as habitat changes, ocean conditions, or global warming, nor does it measure the ability of the stock to sustain itself over time, as required by the recovery criteria of the ESA, which binds the agency.

   Review Team Response: *We have already addressed concerns regarding the AHA model and the TRT process (see response to comment #3 of NOAA-Fisheries and response to Stakeholder Forum comments #4). At the present time, there is no "VSP model" that would allow one to plug in parameters to develop a measure of viability, at least to our knowledge after scrutinizing the ICTRT website and consulting with our own USFWS representative on the ICTRT. As noted previously, the ICTRT has not yet completed its tasks and has simply*

described the scientific criteria on which it will base it viability evaluations. Regarding "biological significance" and "viability", these concepts – as described in our report - were developed by the HSRG in western Washington as a mechanism for assessing risks and benefits of hatchery programs, largely because previous assessments by the comanagers had confounded those two measures in their risk assessments. Those measures are equally applicable to hatchery and wild populations, but in different contexts. It would be an inappropriate "value judgment" to conclude that wild populations are biologically significant but hatchery populations are not. Some hatcheries are currently maintaining unique stocks of fish that previously inhabited watersheds that are currently blocked by dams. Unique stocks would be considered "biologically significant" regardless of whether they are propagated naturally or artificially. Most captive breeding programs take a similar approach. Regarding viability, a hatchery population that produces fewer adult returns annually (harvest + escapement) than are spawned (R/S < 1.0) over two-or-more generations would be considered inviable.

6. We would like to see more description of the current hatchery program, especially the monitoring and evaluation, as well as how well the current hatchery is meeting its goals (for example, how close are they to the 0.3% juvenile to adult survival rate at the mouth of the Deschutes River? What is the ratio of male to females (i.e. how many males fertilize how many eggs?), and what is the rationale behind the different ages at time of release?

   Review Team Response: *The report is the top layer of a three-layer set of information documents. The second layer is a "Briefing Document" that summarizes most of the information requested in this comment from Trout Unlimited. This Briefing Document represents a synopsis of relevant information and data extracted from over 20 different reports and other documents (the third layer of information). All of the details regarding spawning protocols, return rates, etc. can be found in the original source documents and the Briefing Document. Both the Briefing Document and the original source documents can be downloaded from our FWS hatchery review web site (www.fws.gov/Pacific/fisheries/HatcheryReview).*

7. Under the description of Broodstock Choice/Collection, Hatchery and Natural Spawning, we are confused about the statement "hatchery adds considerable capacity to the natural habitat, but not necessarily increased productivity."

   Review Team Response: *Capacity and productivity are biological terms that have precise meanings. "Productivity" refers to the ratio of mean number of adult recruits relative to the mean number of adult spawners that produced them at low spawner densities. It is equivalent to the slope of a spawner-recruit curve at the origin (e.g. in a Beverton-Holt equation). "Capacity" refers to the total number of adult recruits that a particular ecosystem or watershed can produce. It is equivalent to the asymptote or maximum number of recruits in a spawner-recruit curve. Overall, the mean recruit per spawner(R/S) for the hatchery over the past 20 years is approximately one to two times greater than the R/S for the natural habitat. Although the hatchery clearly confers an egg-to-smolt survival advantage over the natural environment, the mean smolt-to-adult return (SAR) rate for hatchery-produced fish is less than the SAR for naturally-produced fish. The net effect is that the recruit-per-spawner (productivity) is similar for the two groups. However, the hatchery adds considerable extra "spawning and rearing space" that results in substantial increases in the total number of adults returning to the Warm Springs River compared to the "capacity" of the natural*

habitat to produce adult recruits by itself. Hence, the hatchery adds considerable "capacity" for spring Chinook salmon in the Warm Springs River.

8. The analysis of benefits and risks appears to be very focused "inside the hatchery fence" and not towards the overall landscape. For example, the genetic and demographic risks do not look at the risks of the hatchery production on the life history changes, morphological changes or other behavioral changes that may result from hatchery fish spawning with the wild population. (Einum and Fleming, 2001, Heath et al., 2003).

Review Team Response: *On the contrary, our analyses of benefits and risks was focused primarily "outside" the hatchery fence. For example, regarding genetic risks, if the proportion of natural spawners composed of hatchery fish (pHOS) exceeds the proportion of hatchery spawners composed of natural fish (pNOB), then the hatchery environment will have a dominant effect on the mean fitness of natural-origin fish and their productivity would then be expected to decrease over multiple generations. This decrease in fitness is specifically modeled in AHA and truly separates it apart from other population dynamic models. This concern is also the principle reason for our first recommendation (WS1).*

9. We take issue with attributing a conservation benefit to the hatchery because it provides the opportunity to screen and treat adults and carcasses (presumably of hatchery fish), but this wouldn't be a benefit if there wasn't a hatchery in the first place. Thus, instead of being a "benefit" it is better suited as a minimization of risk.

Review Team Response: *This "benefit" has been clarified in our revised report. It is related, to a large extent, to the use of spawned-out carcasses from the hatchery for "nutrient enhancement" in the Warm Springs River and elsewhere on the reservation. Only carcasses certified "low-risk" for disease by our Lower Columbia River Fish Health Center are allowed to be outplanted. Indeed, the Review Team was quite impressed with the quality and diligence with which this disease screening of carcasses is conducted.*

10. We find it difficult to attribute a strong demographic buffer or genetic repository benefit to the hatchery. For one thing, it would be much cheaper, and much more effective in maintaining diversity, to simply take a genetic sample from each wild fish and cryopreserve it.

Review Team Response: *The Review Team disagrees. We believe a well-managed hatchery program can serve as a "living gene bank." The advantage of a "living gene bank" is that the population can continue to "evolve" over time and over multiple generations in response to dynamic changes in environmental conditions. A living, reproducing population will remain viable if it remains genetically in dynamic equilibrium with the environment. The current hatchery program thus provides a genetic repository in the event of a catastrophic impact to the natural population (e.g. mudslide from Mt. Hood). A cryopreseved "gene bank" literally freezes the population in time with no ability to respond genetically to changing environmental conditions. There are also technical and logistic concerns regarding long-term storage of DNA in a cryopreserved state.*

11. While the hatchery may serve as a "safety net" for the wild population in the face of a catastrophe, it has the opposite effect of pulling out the most suitable fish to survive the

environmental stochasticity. Indeed, at some point in the face of catastrophic events, it makes sense to take all of the wild populations out of the habitat and institute a captive broodstock program, but that is not analyzed here, nor is it one of the purposes of the hatchery.

Review Team Response: *At the present time, the hatchery removes — at mos t— approximately five percent of the upstream migrating natural-origin adults for broodstock. This percentage (≈ 5%) is substantially less than the harvest rate on most natural populations that are considered viable. The demographic impact of the hatchery program on the wild population is thus minimal. However, the hatchery clearly provides a potential "safe haven" in the event of a major catastrophe. In addition, there is no need to develop a captive broodstock plan because spring chinook salmon in the Warm Springs River are viable and self-sustaining. We have added Recommendation WS1f, though, in response to a similar comment from CRITFC.*

12. We agree that there is a potential conservation benefit of fish being planted in Shitike Creek, but believe that all of the "potential" benefits and risks should be separated and placed into a section on monitoring and evaluation instead of counting equally with known benefits and risks.

    Review Team Response: *The outplanting program confers both a research benefit and a potential demographic benefit. These benefits must be evaluated in the context of the risks imposed by the program.*

13. The section on the risk to the "target stock" is confusing because it moves between risks to the hatchery stock, such as domestication, and the risks to the wild stock. They should be separated. This is especially true under the "genetics," where there is very little discussion of the risks of the hatchery stock passing upstream and spawning, or any lack of genetic monitoring associated with that risk.

    Review Team Response: *Under the current "integrated" management strategy, hatchery fish and wild fish are the same stock genetically (one gene pool, two environments). By controlling gene flow in both directions between the two environments, the goal is to make the natural environment drive the genetic constitution of both components, not allow the hatchery environment drive the genetic constitution of wild fish. Our Recommendation WS1 specifically addresses this concern regarding the genetic risk of hatchery fish passing upstream. Indeed, we are specifically recommending that hatchery fish be precluded from passing upstream to the extent physically possible.*

14. Some of the risks outlined under "demographic" are also genetic risks if they are applied to the wild stocks. For example, the risk of removing wild fish for broodstock, even as low as 5%, imparts a genetic risk by shrinking the effective population size (Ne), the genetic diversity of the species and possibly life history diversity and spawning distribution. There are also additional predatory risks, aside from the demographic risks of concentrating predators at release locations, such as downstream effects at the smolt life stage, that should be included.

    Review Team Response: *We addressed this concern regarding effective population size in our response to CRITFC Comments #1 and #3. In short, effective population size is only a surrogate (i.e. imaginary) number for evaluating genetic drift effects and potential losses of*

genetic diversity. The true concern is loss of genetic diversity, not minor reductions in Ne., As noted in our response to comment #1 of CRITFC, the amount of drift per generation is a direct function of 1/(2Ne), not Ne itself. Consequently, an effective population size of 1,000 fish is essentially equivalent to an infinitely large population from the standpoint of the amount of genetic drift expected per generation. For the naturally spawning population of spring Chinook salmon in the Warm Springs River, removing 5% of the returning adults will have virtually no effect on the parameter 1/(2Ne) if Ne is sufficiently large. Only when Ne drops below 500 do geneticists become worried about loss of genetic diversity due to short-term, drift effects (Ne for spring Chinook in the Warm Springs River is much larger than 500). Also, we specifically addressed predatory risks in our Recommendation # WS10a.

15. The AHA model estimates that the upriver carrying capacity is roughly 2,000 adults, yet the average returns have been 1,338 adults. Why is it that the population is viable, but yet not nearing carrying capacity? If we read the information correctly, the adult-adult returns for the hatchery stocks are 4.3 while they are 3 for the wild stocks. If that were the case, the wild stocks should be improving dramatically, but that is not the case.

    Review Team Response: *Intensive monitoring of the spring Chinook population in the Warm Springs River began in the late 1970s after the construction of the hatchery. That time period coincided with a major decrease in marine trophic conditions and ocean productivity. The net result is that all stocks of salmon in the Columbia River Basin suffered some of the lowest smolt-to-adult survivals on record during the 1980s and 1990s. Adult returns to the Warm Springs River were particularly low in the years 1991–99 (see Fig. 4 in the Warm Springs Briefing Document). Beginning in 2000, returns of natural-origin spring Chinook salmon to the Warm Springs River have exceeded or approached 2,000 adults.*

16. Why is it that the hatchery recruits are doing that much better than the wild stocks? Have the wild stocks been depressed by the hatchery releases, either by competition, predation, introgression or other factors? Have the long term releases of the hatchery stocks changed the wild population to such an extent that it may not reach capacity? What kind of monitoring, especially genetic, is occurring to evaluate these risks? These questions should be captured in some form under the risks discussion as well as a discussion on monitoring and evaluation.

    Review Team Response: *These concerns have already been addressed in our previous responses and are clearly addressed in our recommendations (e.g. WS1, WS4, WS6, WS10a, WS14, WS19, WS20).*

17. The report should include a description of the ongoing monitoring and evaluation. For example, what monitoring and evaluation is currently occurring for the differential age releases, the accidental escapement of hatchery origin Chinook onto the spawning grounds, the effectiveness and impacts of the planting of hatchery Chinook in Shitike Creek and why the up river habitat seems consistently below capacity?

    Review Team Response: *Please refer to the Warm Springs Briefing Document and the many reports on our website that document the results of our current monitoring and evaluation activities.*

18. The recommendations include research, monitoring and evaluation of conditions. The results of those recommendations automatically require a corresponding adaptive management program if the actual research, monitoring and evaluation are meaningful. For example, the current protocol plants hatchery fish into Shitike Creek but there is no description of corresponding research and monitoring and adaptive management that responds to the data collected. Delaying the development of an adaptive management plan, has historically resulted in perpetuation of poor practices. Inclusion of the monitoring and evaluation as well as an adaptive management recommendation would overcome these concerns.

    Review Team Response: *As we noted previously, our report is not a stand-alone document but is the top layer of a three-layer set of documents. Most of the details for our report are summarized in our Briefing Document which, in turn, represents information extracted from a large number of reports. Details about monitoring, evaluation and adaptive management plans are included in those documents. Also, the Operations and Management Plan for the Warm Springs NFH is reviewed and updated every five years, based largely on the results of obtained from M&E activities and research.*

19. We agree with many of the recommendations and believe, based on the issues raised above, that there can and should be additional recommendations. Can USFWS simply ignore the recommendations? We would like to see a discussion of the next steps to incorporate the recommendations so that they do not gather dust on a bookshelf.

    Review Team Response: *In addition to our Hatchery Review Team, the Service has formed a Hatchery Oversight Team consisting of regional managers with direct supervisory authority over the managers of our National Fish Hatcheries. One of the primary responsibilities of the Oversight Team is to secure approval and funding necessary for implementing our recommendations. However, the Oversight team will also need to consider USFWS policies/regulations, treaties, court orders, legal mandates, conservation agreements, memoranda of understanding, etc. in conjunction with implementation of the recommendations.*

20. We agree with the recommended alternative at this time, but would suggest that additional review and data are needed to better support the recommended alternative, as described above in our comments

References

Einum, S., and I.A. Fleming. 2001. Implications of stockings: ecological interactions between wild and released salmonids. Nordic J. Freshwater Res. 75: 56-70.

Heath, Daniel D., John W. Heath, Colleen A. Bryden, Rachel M. Johnson, Charles W. Fox. 2003. Rapid Evolution of Egg Size in Captive Salmon. Science. 299: 1738-1740.

Pacific Region Fishery Resources
911 NE 11th Avenue
Portland, OR 97232
503/872.2763
E-Mail: Douglas_dehart@fws.gov

U.S. Fish and Wildlife Service
www.fws.gov

For Columbia River Basin Hatchery Review Information
www.fws.gov/pacific/Fisheries/Hatcheryreview/

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people.

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