[U.S. Fish and Wildlife Service letterhead]

Mark Walker
Director, Public Affairs Division
Northwest Power Planning Council
851 SW Sixth Avenue, Suite 1100
Portland, Oregon 97204

Dear Mr. Walker:

The Fish and Wildlife Service (Service) appreciates the opportunity to comment on the Artificial Production Review Phase I report, especially since four of the eight hatchery production programs addressed in the Phase I report are either operated (Spring Creek National Fish Hatchery (NFH) and Leavenworth NFH Complex) or funded/administered (McCall State Hatchery and Irrigon State Hatchery under the Lower Snake River Compensation Program) by the Service. Enclosed are a number of general comments on the report as well as specific comments that deal with individual program analyses.

If you have any questions or need further clarification regarding our comments, please contact Lee Hillwig at (503) 872-2763.

Sincerely,

[signed]

Bill Shake
Regional Director

U. S. FISH AND WILDLIFE SERVICE
COMMENTS
ON
ARTIFICIAL PRODUCTION REVIEW - ECONOMICS ANALYSIS

General Comments

The report opens with a statement that a very substantial level of funding had been committed to artificial production in the Columbia River Basin in recent years and that the Northwest Power Planning Council has expressed the need to complete a scientific review of hatchery production in general, as well as a cost-effectiveness analysis of hatchery programs. This Phase I report is the Independent Economic Analysis Board's attempt to identify what economic and biological data are readily available, and craft a simple template/framework to conduct cost and cost-effectiveness comparisons between hatchery programs for a limited number of facilities. While the Phase I report is a worthy effort to address the hatchery program cost-effectiveness issue, it fails in many regards to provide the kind of standardized data collection, assimilation, and analysis that would be necessary to meet the objectives of the analysis. As with many preliminary review efforts, rolling up "readily available data" into a cost-effectiveness framework analysis can provide very skewed results and results that do not capture the full picture for the individual hatchery programs. This is because availability of detailed data is inconsistent for individual hatchery programs, and nearly all hatchery programs have specific details and caveats to their programs that need to be well understood and accounted for in a cost-effectiveness comparison. More often than not, detailed data that would be important in the type of cost-effectiveness analysis attempted here are not as complete or readily available as we all would like, and the relevant state, tribal, and federal co-managers need to be fully engaged for advice on how to address the data shortfalls. Some of the shortfalls of this project include the following.

A significant shortcoming of the study appears to be that the investigators are not familiar enough with the potential problems created by making comparison using variable data base periods, data analysis techniques, and other inconsistencies in the cost/cost-effectiveness analysis to understand the skewed results that might come from such an analysis. Release, adult survival, and harvest years are not consistent between programs, nor are the analysis techniques used in calculating adult survival and harvest rates. Relative to techniques used to estimate adult survival and harvest, methods ranging from coded wire tag recovery analysis (Leavenworth Complex) to sport and tribal estimates of terminal harvest (McCall State Hatchery) to hatchery program design planning estimates (Nez Perce Tribal Hatchery) were used in this study. It is apparent that different analytical methods can result in wide variations in survival and harvest rate results in spite of any cost structure that is applied to these results. Any valid comparison must use a common base period and this does not appear to be the case for this report. The investigators need to work closely with the program managers to understand the pros and cons of the various analytical techniques and have agreement from the relevant co-managers for the programs being evaluated that the technique being used is the best and most comprehensive one given the available data. Closer coordination with state, tribal, and federal co-managers likely would have alleviated some of this problem and a peer review should have occurred before submitting the document to the Council or releasing the document to the public.

Using a common base period for review for hatchery release, adult survival, and harvest is critical in making valid comparisons between hatchery programs because adult survival and harvest are largely driven by environmental (climatic, ocean productivity cycles, etc.), hydrosystem impacts (including transportation, spill, and associated predation rates), and harvest management (annual fishery regimes) factors totally outside the control of the hatchery program. Even production release goals, which tend to be somewhat static, are not always achieved because of shortfalls in broodstock collection, disease outbreaks, and funding vagaries. Further, some of the older hatchery programs have a limited monitoring and evaluation (M&E) program that is often conducted under other funding sources and may not even register as a hatchery program cost, whereas newer hatchery programs typically have very extensive M&E programs that are a part of the annual base costs. In summary, the best approach to make any kind of valid comparison between programs would be to define a common base period, and calculate an average release, adult survival rate, and harvest or exploitation rate based on a common method for all programs or at least among all programs that raise the same species (i.e., spring Chinook and steelhead tend to have few ocean recoveries versus fall Chinook and coho which are typically harvested much more significantly in marine fisheries).

Variability of cost structure years, although standardized through an amortization procedure, adds to the problem of making valid cost-effectiveness comparisons, especially for programs where the hatchery facilities were constructed 30-50 years ago compared to more recent construction. This is primarily because planning, design, monitoring and evaluation protocols, etc., are so much more extensive and comprehensive today relative to past history because of National Environmental Policy Act and Endangered Species Act requirements and other current legal mandates that must be addressed in the planning and design process. There needs to be acknowledgment that current planning processes are an added expense of doing business that were not required when many earlier facilities were constructed.

It is not surprising and should not be unexpected that the purpose for each individual hatchery program will have a great impact on any cost/cost-effectiveness analysis, even when all efforts are made to conduct a valid comparison that uses a common base period and analysis technique. This is because preservation/restoration programs almost always require special facilities (e.g., captive rearing, offsite broodstock collection, and juvenile acclimation, etc.) and safeguards that are less common for other types of programs. Therefore, valid comparisons between programs should be categorized by hatchery purpose and further categorized by region to help "level the playing field" relative to mainstem survival impacts that the hatchery program has no control over. The species reared will also have a large influence on the cost of each individual program, with production programs that rear fish for a full year or more (e.g., spring Chinook, steelhead, and coho) generally being more expensive at least for annual operating costs than production programs that rear fish for six months or less (fall Chinook). This is because of feed costs to carry fish for a full year as well as other general operating costs (staffing, power, disease prevention treatments, etc.) that total up to a higher cost per fish released. One potential way to standardize these production costs, if comparisons are going to be made across species, would be to conduct the cost and cost-effective analyses relative to pounds of fish released rather than numbers of fish released.

Evaluating hatcheries using the criteria of costs per fish released, cost per fish surviving to adult, and cost per fish caught in ocean and river fisheries provides an overly simplistic measure of hatchery performance that does not adequately define a program's true value or the resource tradeoffs/societal decisions that led to the hatchery program being established. Although the stated goal of the Phase I study was to conduct a simple cost/cost-effectiveness analysis, which again is a worthwhile goal, a more important and perhaps more relevant analysis might be how the costs for hatchery programs by region compare to costs for other methods (i.e., habitat improvement, hydrosystem management, dam removal, etc.) of returning the same number of fish to these areas. This type of analysis may provide enlightenment on whether current and future hatchery programs are a good investment for rate payer dollars towards providing the desired numbers of fish back to the subbasins they once inhabited while meeting other legal mandates such as tribal fishing rights and current mitigation responsibilities. Hatchery programs, of course, need to be evaluated in terms of their potential positive and negative effects on recovery of wild stocks, in addition to any benefit-cost ratio of hatchery programs relative to other management actions to achieve our recovery and rebuilding goals.

In the case of the Grand Coulee Mitigation Programs at the Leavenworth National Fish Hatchery Complex, a decision was made in the 1930's to build Grand Coulee Dam, knowingly removing more than 1000 miles of anadromous fish habitat from production. Providing fish hatcheries to partially compensate for this loss was the only measure that could be reasonably employed, based on costs and the technology available for passing fish above Grand Coulee. Operational costs of the hatcheries pales in comparison to the funding that would be required to provide passage and maintain viable populations above that project. Whatever the cost is to raise fish as compensation for the dams, it should be weighed against the benefits gained to society by building the dam. If you compare the several million dollars it costs for the hatchery versus the value of hydropower produced at Grand Coulee and the value of crops produced by the Columbia Basin Project, the hatchery program cost is insignificant, yet it continues to provide a societal fishery benefit that was highly valued in the 1930's and is still highly valued today.

The report fails to identify the source of much of the information used in the analysis. There appears to be conflicting information regarding numbers of fish released, costs of operating programs, and number of returning adults throughout the analysis. We understand that an independent analysis is important; however, coordination with the agencies that operate the programs and those that maintain the data is critical to ensure that the data used to generate the analysis is correct and complete. Furthermore, the referencing of the information source is important for a complete and comprehensive peer review.

Specific Comments:

Part 1. Page 2, section 3,

The report acknowledges that smolt to adult return rates (SARs) are generally lower for upriver programs "(all else equal)." All else, however, is not equal since fish returning to upstream locations must negotiate more dams in their downstream and upstream migrations. The report must, therefore, recognize that the hydropower system, among other factors, is a cause of higher costs per adult fish.

This section also recognizes that adult survival at any given location can vary widely based on river and ocean conditions and environmental factors, but then the investigators make no attempt to develop a common base period within which to conduct the analysis. Years used in the individual program analysis for comparison across programs range from brood years 1980-93 for Spring Creek NFH fall Chinook to release years 1987-1997 for Irrigon State Hatchery for steelhead to release years 1992-1996 for Clatsop Economic Development Council (CEDC) coho. It is unclear why the report points out the problem but does not address it.

Part 1. Page 3, section 5,
The report states that "Mitigation hatcheries often seek to increase the run size of distinct stocks." It would be more accurate to state that Mitigation hatcheries seek to **replace production lost due to construction of the Columbia River hydro system**." It is important to understand that there is a distinct difference between augmentation and mitigation. Augmentation is a program to "enhance" production for harvest, whereas mitigation is a program to "replace" lost production. Furthermore, mitigation programs may be for the purpose of conservation, as well as for harvest.

Part 1. Page 3, section 6,
The report makes a very cursory comment about potential interactions between augmentation hatchery production and wild stocks and then says, "We do not attempt to evaluate net benefits or these interactions in this report." At the very least there needs to be additional narrative of the types of effects that management for wild stocks has on augmentation type production programs. For example, harvest regulations that are established to protect listed and other wild stocks of concern may have a significant effect on the ability to fully harvest augmentation program production and therefore reduce the potential economic benefits, at no fault of the facility. This may necessitate a re-evaluation of program goals if the trend of inability to fully harvest augmentation hatchery surpluses is long term.

Part 1. Page 3, section 8,
The report states that a restoration project proposal for restoration (supplementation) would be expected to contain among other things "an estimate of how the restoration effort would shorten the time until the stock is rebuilt to capacity." This expectation, however, fails to recognize that supplementation programs may need to be maintained over an indefinite period to conserve an at- risk stock until factors that limit the return of that stock to an "appropriate level" can be achieved.

Part 1. Page 4, Item B.
The report should state in this summary section that these analyses were in a window of time that does not necessarily reflect program data (releases, returns, costs) for the life of the program. That is, the sub-sample of data they chose may not accurately represent the entire population of data. This type of sampling can grossly misrepresent the true characteristics of the program.

Part 1. Page 5, last sentence of first partial paragraph,
The cost of $.18 per fish is not in any way comparable to other programs because the costs only include rearing during the time when the fish are in the acclimation net pens and includes no rearing or annualized construction costs. For several of the CEDC programs, the majority of the rearing takes place at other

normal production facilities. To conduct a comparable cost and cost-effectiveness analysis, a prorated portion of the annualized construction costs of these "mother facilities" needs to be included in the CEDC cost analysis.

Part 1. Page 5, first full paragraph,
The high costs per fish for Leavenworth, and especially Entiat and Winthrop hatcheries, are the result of several factors. First, smolt to adult survival is generally low for facilities in this area because of the greater number of dams that these fish must negotiate compared to programs lower in the river system. Second, the period of years used in the calculation were generally very poor ocean productivity years. Third, the method used to estimate survival (recovery of coded wire tags) does a poor job of representing total survival when there are terminal fisheries that are poorly sampled for the tags, which is the case for at least Leavenworth NFH.

Part 1. Page 5, second full paragraph,
The report inappropriately compares the cost of rearing spring Chinook with the cost of rearing summer steelhead. In addition, comparisons are inappropriately made for fish in different geographic locations that face different challenges in numbers of dams to negotiate in migrating out of the Columbia River as juveniles and then in their upstream migrations as adults.

Part 1. Page 5, last paragraph,
Using the Independent Economic Advisory Board (IEAB) analytic approach to "screen artificial production proposals" will result in a mis-characterization of the relative expense of new facilities compared to older established programs. As stated in our general comments, planning, design, and monitoring and evaluation costs for new facilities have increased dramatically because of the legal mandates that must be followed now. These higher costs for new facilities must be accepted as part of the NEPA driven paradigm of the current age. The real comparison needs to be the costs of alternate actions to achieve the same results of augmentation and/or supplementation type programs (i.e., habitat improvement, dam removal, etc., to increase harvest and natural population size). It is only fair to expect that these other cost-effectiveness analyses will also be conducted in the near future if hatcheries are to be singled out for cost-effectiveness analysis now.

Part 1. Page 6, first bullet under Findings,
The $5.25 million annual cost for the Nez Perce Hatchery relative to the $527,000 for the Priest Rapids Hatchery is a perfect example of our comments above where new facilities incur substantial planning, design, and monitoring and evaluation costs relative to much older facilities. The Nez Perce tribal hatchery is not even complete yet so annual operating expenses are not really known with certainty. Further, the comparison here is between a mitigation/augmentation type hatchery (Priest Rapids) and a supplementation type hatchery (Nez Perce).

Part 1. Page 6, second bullet under Findings,
This bullet points out that a common base period was not used in the analyses. We have already stated that this is a significant flaw of the report for the reasons given. A standardized base period for cost per

smolt release is not quite as critical as the cost per adult or cost per fish caught because feed, staffing, power, and other O&M costs are less variable than annual survival and harvest rates which greatly effect the other cost comparisons.

Part 1. Page 7, first full bullet,
Cost per fish harvested is used as the metric in this comparison. Another relevant comparison might be cost per adult fish available for harvest (i.e., adult survival minus broodstock needs). Often fishery regulations to protect weak stocks preclude the full harvest of surplus hatchery fish. If a long term trend of unharvested surpluses develops, managers may need to reevaluate the facility program goals. Again, the very high costs per fish harvested for several of the programs were generated from a time frame of low ocean productivity and resultant low survival rates. This brought correspondently highly restrictive fishery management actions so that the few fish caught were at very high cost. A different base period, during a time of good out-migration conditions and ocean productivity, would give a quite different picture.

Part 1. Page 7, Data Gaps and Needs.
This section should acknowledge that the data sets chosen for the analysis does not represent the entire population of data and the results may be a misrepresentation of the entire program.

Part 1. Page 8, first full bullet under Recommendations.
The Council should not fund Phase II until the flaws of the Phase I report are addressed and corrected. This is going to take a very closely coordinated effort of the investigators working with state, tribal, and federal comanagers.

Part 1. Page 8, last bullet under Recommendations.
It is important to recognize that the costs of mitigation are not assessed on their "benefits" since there are none. It is merely a pay back or replacement of losses caused by water resource projects. Mitigation production costs, along with all water resource project costs, are compared with the overall benefits of these projects — usually power, irrigation, and flood control.

Part 1. Page 9, Table 1.
The individual hatchery programs need to be better delineated (i.e., Yakima Fisheries Project, CEDC, etc.). Delineate 700K full term smolts and 2.7M acclimated release for the CEDC coho program rather than 3.7M smolts. It is highly likely that the identified operator is not covering all true costs for that production program, especially if these are acclimation and short term net pen rearing programs (CEDC). Other substantial costs accrue prior to these final rearing locations. The release for Priest Rapids Hatchery upriver bright fall Chinook should be 6.7M smolts not 3.7M smolts.

Part 1. Page 10, Table 2.
Table 2 needs to show the base period years that were used in the analysis because, as stated above, the base periods are quite variable between programs and this will have a very significant affect on the comparison analysis. Since a common base period was not used, the report must at least clearly

identify the time periods used in the analyses so that the reader clearly understands what is being analyzed. The "Full Cycle Costs" of $124,249 for CEDC coho appear suspect in terms of truly representing total costs. The $5,250,025 annualized cost for the Nez Perce tribal hatchery program is strongly affected by the high planning, design, and M&E costs, and since production has not yet started for this program the average cost per adult and per fish harvested estimates, at best, are guesses.

Part 2. Page 3, section A.
The third paragraph states that "Spring Creek Tule Fall Chinook make up a large percentage of the commercial, sport ocean fishery and the Columbia River sport and tribal fishery." Although Spring Creek NFH provides a large number of fish to those fisheries it can hardly be characterized as a large percentage of the fishery.

Part 2. Page 4, section F.
The period used for survival estimates (1980-1993) had poorer returns than any other period in Spring Creek history and does not reflect a true historic perspective of the survival record. The 1972-1978 survival record shows survival rates ranging from 0.5 percent to over 3.4 percent with an average of 2 percent. These brood years should have been included in determining average survival rates. In addition, the 1998, 1999 and 2000 brood years, when final data is collected, will show survival rates in the 1.5 percent to over 2 percent range.

Part 2. Page 4, section G.
The title, "Average Harvest Rates by Area of Harvest" is incorrect. It should be titled, "Average CWT Recovery Distribution." The corresponding titles in the table should be Recovery Area and Proportion, respectively.

Part 2. Page 9. section F.
Replace title with "Average CWT Recovery Distribution" and replace the column headers that read "Harvest Rate" with "Proportion."

Part 2. Page 9. section G.
The costs identified in this section are O&M costs only. They include one year of operating expense with no annualized capital construction costs for the "mother" facility. In addition, the cost estimates given are predominately for the acclimation program. Under the current cost analysis, it is inappropriate to compare this program to any other program in the Basin.
Part 2. Page 11, number 2 of section A.
In the third line from the bottom of the paragraph, replace "first" with "fish." The cost estimates in this section for survival and fish caught are all based on planning estimates of survival and harvest rates which are seldom accurate in real life facility operation.

Part 2. Page 19.number (2) of section A.
The 400,000 sub-yearling spring Chinook program has been discontinued.

Part 2. Page 20, section C.
The convention of charging no capital construction costs for facilities older than 50 years creates an inappropriate comparison with other newer facilities.

Part 2. Page 22, third paragraph of section F.
Using the Dworshak NFH's average steelhead survival rate to represent the survival rate for Leavenworth and/or Winthrop is inappropriate for several reasons. First, many of Dworshak's steelhead are transported by barge to below Bonneville Dam, unlike steelhead released from upper Columbia River facilities. Second, the stocks are totally different in run timing, return age structure, and harvest pattern with Dworshak a Group B stock and Leavenworth/Winthrop a Group A stock. It would have been much better to use another steelhead stock from the local upper Columbia River area, which are all Group A stocks, to represent the Leavenworth/Winthrop stocks. At least the out-migration and stock characteristics would be similar. The use of survival rates from another facility defeats the purpose of the analysis in that the analysis is no longer representative of that facility.

Part 2. Page 23, top two paragraphs,
The terminal sport and tribal fisheries at Leavenworth NFH are not well sampled for CWTs so fisheries and total survival are likely underestimated. Rather than borrowing survival rates from other facilities, it would be better to apportion out costs for programs where there are survival data and recalculate costs by specific program. The borrowed survival rates are inappropriate for a number of reasons. As stated above, steelhead survival rates between upper Columbia and Snake River releases will be different largely because of different hydrosystem impacts (e.g., transport versus non-transport) and different stock characteristics. Coho survival rates are typically much higher than yearling spring chinook and so should not be represented by Winthrop spring Chinook data. Finally, as stated above, when survival rates from another facility are used, the analysis is no longer representative of the facility for which the analysis is conducted.

Part 2. Page 24, Table 2a.
The estimated adults for summer steelhead uses Dworshak's average steelhead survival rate which is inappropriate as explained above. Leavenworth has not reared steelhead since 1994. The Program of 100,000 summer steelhead has been transferred to Winthrop NFH.

Part 2. Page 25, Table 2b.
The sub-yearling spring chinook program at Entiat NFH has been discontinued.

Part 2. Page 25, Table 2c.
The 1988-94 average line should not include 1988 because no fish were tagged that year. Averages need to be re-calculated. The Winthrop Spring chinook production has been reduced to 600,000 and stock changed to ESA- listed Methow Spring Chinook. These changes in program will result in very different results in program costs and total adults returning. It is not clear whether all the excess fish returning to Leavenworth NFH and given to the Tribes were included in the analysis. Close coordination with the operating agency and data managers would ensure that the information used in the

analysis was correct. In addition, the report should reference the source of data to support the analysis. The coho program is operated by the Yakama Tribe and is not part of the Leavenworth mitigation program. It is, therefore, unclear whether the report considered all the costs associated with the coho production program. Referencing the source of information would clarify what costs were considered.

Part 2. Page 26, Table 3a.
It is likely that the average 4 percent harvest rate for Leavenworth and 2 percent average harvest rate used for Entiat and Winthrop underestimate true harvest rate. Because CWT recoveries are used to estimate survival and fisheries contribution, and because it is known that the terminal sport and tribal fisheries are very poorly sampled for CWTs, this is probably not a good technique to use. The methodology for McCall Hatchery, which uses a direct estimate of terminal area harvest and assumed mainstem harvest rates in the Zones 1-6 area equal to the general rate for upriver summer Chinook, may give a more accurate estimate for the Leavenworth Complex facilities also. As a reality check, the methodology used in this report suggests that the cost for fish caught for the 1990 brood year for Entiat and Winthrop hatcheries vastly exceeds the annual operating cost for each of those facilities.

Part 2. Page 39, section F.
The survival rate and harvest rate methodology used for McCall Hatchery (i.e., direct estimates of terminal returns and harvest and assumed harvest rates for mainstem fisheries equal to the general upriver summer Chinook rates), even though McCall releases are tagged with CWTs, is probably better than the CWT recovery method used for the Leavenworth Complex hatcheries. This is because, as at Leavenworth, the terminal area fisheries in the South Fork Salmon River where the McCall fish return are very poorly sampled for CWTs. Direct fishery estimates provide a better indication of harvest and survival rate.

Part 2. Page 40, Table 4.
The third column is mislabeled and the values are incorrect. "On-site+Joint Costs" should read, "Joint Costs+Amortized Construction Costs." (A simple addition of the values in the rows would have caught this error.) Replace the values in column three with $5,876,809; $0.55; $136.56; and $528.73, respectively. Also, the values in column one for Adults (42,980) and Harvest (11,115) are incorrect. (See comments for Page 41 below.) Correcting these values will further change all the other values on those two rows.

Part 2. Page 41. Appendix 1.
The values in columns 11, 12, and 13 are all incorrect and need to be recalculated because they do not incorporate the Zones 1-6 harvest rate. Footnote "6" should be labeled "7." Footnote "7" should be labeled "6." In footnote 11, "dividing col.8 by (col.11*col.12)" should be replaced by, "dividing col.7 by (1-col. 8/100 (divided by col. 9*col. 10)." (These corrections need to be made to the table.) In footnote 12, "(col.12)/(col.1)" should be replaced by, "(col.11/col. 1)." In footnote 13, "Col. 13*Col. 9" should be replaced by, "col. 8*col.11."