Independent Scientific Advisory Board
for the Northwest Power and Conservation Council,
Columbia River Basin Indian Tribes,
and National Marine Fisheries Service
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Memorandum (ISAB 2010-4) **July 19, 2010**

To: ISAB Administrative Oversight Panel
Bruce Measure, Chair, Northwest Power and Conservation Council
Paul Lumley, Executive Director, Columbia River Inter-Tribal Fish Commission
Usha Varanasi, Science Director, NOAA-Fisheries Northwest Fisheries Science Center

From: Rich Alldredge, ISAB Vice Chair

Subject: Review of FPC 2009 Annual Report to suggest analyses for further review and to provide comments to improve the Annual Report

Background

The Northwest Power and Conservation Council's 2009 amendments to the Columbia River Basin Fish and Wildlife Program call for the continuation of the fish passage related functions currently conducted by the Fish Passage Center. The primary functions are to provide technical assistance and information to fish and wildlife agencies in particular, and to the public in general, on matters related to water management, spill, and other passage measures. The Program also calls for the Fish Passage Center's Oversight Board to ensure that the functions are implemented consistent with the Program. To do this, the Program specifies that the Oversight Board will work with the Center and the Independent Scientific Advisory Board (ISAB) to organize a regular system of independent and timely science reviews of the Center's analytical products.

The Oversight Board, ISAB, and FPC director are currently establishing guidelines for this regular review. Although the guidelines are not finalized, the Oversight Board agreed that the ISAB should implement the first review assignment item included in the draft guidelines and examine the FPC's draft 2009 Annual Report. Item 1 specifies that a subgroup of the ISAB will "initiate an examination of the FPC and CSS draft annual reports when these reports are released for public comment. As part of the examination, the subgroup will look at the annual reports to ensure that work products, methodologies, and analyses appropriate for potential science review have been considered."

The draft guidelines include criteria for identifying FPC analyses/products for ISAB review. These include when new or novel analyses are introduced; new conditions or data bring old analyses into question; and/or consensus cannot be reached in the region on the science involved in the product.

Summary

First, the ISAB acknowledges the continuing improvement in the organization, clarity, and writing quality of recent annual reports, as exemplified in the 2009 FPC Annual Report. Additionally, inclusion of the context for the FPC Annual Report in the Introduction is appreciated, as is the list of Acronyms in Appendix L. An appendix containing a glossary of terms that may not be known to many readers also would be beneficial.

This ISAB review begins by identifying 2009 FPC products for possible ISAB review and then provides comments on the content of the 2009 FPC Annual Report including editorial issues noted.

1. Suggested Reviews

The ISAB identifies the following FPC analyses/work products as meeting the criteria for ISAB peer review:

- Memorandum, Steelhead Adult Returns in 2009, August 27, 2009;
- Memorandum, Reach Survival Estimates for Steelhead reported in 2009, September 29, 2009; and
- Memorandum, Preliminary Reach Survival Estimates and Transport Probabilities for Spring Migrant Juvenile Salmon from the Snake River Basin in 2010, July 8, 2010 [which is not part of the 2009 Annual Report]

Because the guidelines for ISAB review of FPC products are not finalized, the ISAB will not begin a review of these analyses until the FPC Oversight Board completes and communicates its consideration of the suggested reviews.

2. Review Comments

FPC 2009 Annual Report's Executive Summary

This section provides an overview of many of the numerous summaries, analyses, and interpretations of the extensive data organized and reported by the FPC staff in the 2009 Annual Report. The ISAB comments focus on those portions that raised questions concerning inclusion in the executive summary or concerning consistency between the narrative and the data presented in the report.

With reference to spill, the executive summary states, "Spill for fish passage and the additional spill in excess of hydraulic capacity did not cause elevated gas bubble trauma in downstream migrants." It would be more appropriate to state that the 15% action criterion was not reached under the spill conditions experienced in 2009.

The following sentences are not appropriate for the executive summary, "The disparity between acoustic tag relative survival estimates for juveniles and relative adult return PIT tag SARs by route of passage from research at McNary Dam illustrates that these acoustic studies at the

projects do not assess the impact of various passage structures and passage operations on the other life cycle stages such as smolt to adult returns. The acoustic tag data results discussed below are only one component of the decision framework involved in understanding the impacts of dam operations on overall smolt to adult returns." These sentences are a critique of research by others so are not part of the overview of data organized and reported by FPC staff and thus should not be highlighted in the executive summary.

The executive summary also states that, "Multi-year analysis indicated that survival of sub-yearling fall Chinook continued to decline in the Rock Island to McNary reach in 2009. Juvenile salmon survival has declined each year since 2003" (p. xviii, last paragraph). This statement is not supported by the survival vs. migration year data for sub-yearling fall Chinook shown in Figure 37 (page 87). This figure shows that observed survival rates (RI to McN) were higher in 2000 and 2002 than in subsequent years, but no continued decline (trend) is apparent from 2003 through 2008. In 2009, survival could be estimated for only one release cohort; survival was relatively low for this cohort (0.22), but similar to estimates for comparable release cohorts (August 18 to 31) in 2003 (0.28) and 2004 (0.19). The change from 2000-2002 to 2003-2009 appears to be discontinuous, rather than a downward trend; survival has not declined "each year."

As the most often read part of a report, the executive summary, although broadly descriptive, could benefit from a more structured, quantitative, and statistically supported approach to presenting the main points. For example, instead of just reporting that mean survival was higher for one species than another, or one year than another, it would be preferable to make statements such as "Steelhead survival in 2009 (give number) was higher than the mean survival over the period 2002-2009 (give number)" and support it with whatever statistic or test (if any) that might have been used to make this statement. Each statement would thus have more rigor, and it would be clearer to the reader what was statistically tested and what was not. The emphasis on this section should be on key results and the key numbers supporting those results. Inferences made (if any) could then be summarized in the last few sentences of the summary.

Water Supply

The Water Supply section of the FPC 2009 Annual Report is much like that of the 2008 report in that it briefly reviews averages and percentages of flows, storage, precipitation, and snowpack, and gives a more detailed review of management of discharges from various projects and the related decision making process. There is nothing in this section that meets the criteria, described in the Background section above, for requiring further review.

Spill Management

This section has two sub-sections, one outlining spill actions in relation to court-ordered spill and river discharge at the projects, and a second sub-section on gas bubble trauma monitoring. The spill section consists mainly of factual presentation of implemented actions. For the gas bubble trauma section, the action criteria for gas bubble trauma were not approached, and the protocol seems to be operating as planned. There is nothing in either section that meets the criteria for requiring further review.

Editorial Notes
Paragraph indentation is inconsistent in this section, for example see pages 29 and 36.

The second sentence in the last paragraph on page 31 needs to be edited.

References cited on pages 31, 32, and 33 should be in the list of references for section A.

Smolt Monitoring
The Smolt Monitoring chapter reports on special operations at Snake and Columbia River dams (testing of devices and methods to improve spill passage efficiency), standard smolt monitoring operations and dam-passage estimates (fish passage and population indices), and estimates of fish migration timing, travel times between monitoring sites, and reach survival rates. Data are reported in extensive tables, and figures illustrate differences in various indices over time or between sites. Conclusions are in general well founded, but in a few instances go beyond what seems to be reasonably supported by the data. These instances are detailed below.

The statement concerning Ice Harbor conclusions, "It appeared that the BiOp operation (45 kcfs day/gas cap night) provided the best project passage alternative based on the combination of spill passage efficiency and project survival", should be supported by summary statistics in the text.

The following sentences (p. 61) seem inconsistent or convoluted, "In contrast the median travel times for hatchery and wild yearling Chinook released at the Snake River Trap in 2009 were identical. Steelhead, hatchery and wild mark group median travel times were more comparable (than Chinook) for all release locations. Overall there is an indication that, based on median travel time wild steelhead migrate more rapidly than hatchery origin fish."

This section opens with a Summary (p. 45) that states in the first sentence: "The 2009 out-migrant survival, timing, and travel time from the Snake River basin reflected the court ordered spill operations that took effect in what was an average flow year in the Columbia River and an above average flow year in the Snake River." The following observations (from section "Results for Multi-year Reach Fish Travel Time and Survival Estimates, p. 67-76) indicate that this is a premature conclusion and not appropriate for "headlining" in the report.

Increased court-mandated spill levels in 2006 and subsequent years coincided with increased flow levels in those years: flows during the critical period for smolt migration through the lower Snake River dam complex (April 14 to May 21) were higher for all years from 2006 through 2009 than for the years 2001 through 2005. The two highest-flow years from 2001 through 2009 were 2006 and 2009. Therefore, increased flow and increased spill are confounded for the period of interest.

Figures 26, 27, 28 and 30 (p. 72 to 74) summarize annual mean Lower Granite-to-McNary Dam survival estimates for steelhead, hatchery Chinook, wild Chinook, and sockeye in the years 1998 through 2009. Excluding 1998 and 1999 (because flows were relatively high and some spill occurred) and 2001 (an extremely low-flow year), visual comparisons of survival rates for the 2000, 2002-2005 period (prior to court-mandated spring spill) and the 2006-2009 period (after initiation of mandated spring spill) do not suggest improved survival rates in 2006-2009 for

hatchery or wild yearling Chinook, but do suggest somewhat higher survival rates for steelhead. Mean survival rates are also higher in 2006-2009 for sockeye, but confidence limits are very wide. The improved survival rates for steelhead (and possibly sockeye) in the 2006–2009 period are associated with both increased spill levels and higher flows in those years.

Figures 31 and 32 (p. 76) summarize annual mean McNary-to Bonneville Dam survival estimates for steelhead and yearling Chinook in the years 1999 through 2009. No temporal-trends are apparent, although the single estimate for steelhead in 2009 is relatively high (similar to high estimates in 2002 and 2006). We realize that analyses in other reports have shown correlations between spill and travel time, but they are not reported or cited here.

Travel times for steelhead, hatchery and wild Chinook, subyearling Chinook, and sockeye from Lower Granite Dam to McNary Dam (Tables on p. 68 to 71) and from McNary to Bonneville Dams (Tables on p. 72-75) are reported for various release groups (2-4 groups each year) from 2002 to 2009. Perhaps analyses should be performed to test for trends in travel times, and/or the data plotted so that they can be visually evaluated for trends or discontinuities.

In the section "Multiyear Analysis of Subyearling Chinook Rock Island to McNary Dam Survival" (p. 80) an attempt is made to model the effects of environmental variables (flow, spill, water temperature, fish release date) on survival of subyearling Chinook. Results of the analyses, which used information theoretic methods, suggested that water travel time (flow) was the most important variable influencing survival. Estimated survival rates were not, however, a good fit to observed survival rates after 2002. The report suggests that the poor fit may have been due to the effect of increased spill on detection probability at McNary Dam, resulting in increased variance in survival estimates. Complex changes in the operation of the mid-Columbia dams in the 2005-2009 period (increased spill at McNary dam, decreased spill at Priest Rapids and Wanapum dams, along with installation of surface bypass structures) clearly presented a challenge to this modeling attempt; future attempts with additional years of data may be more successful. Unevaluated interactions between variables, particularly between flow and spill, may also have contributed to a poor fit of predicted to observed survival values.

Editorial Notes

In several places in the report it appears that that a new paragraph was started without an indent, e.g. p. 23 (the last two paragraphs in the Executive Summary), p. 67, and p. 74.

On page 63, Tables 23 and 24 are referenced as Tables "12" and "13", and on page 65 Tables 25 and 26 are referenced as Tables "13" and "14".

In Table 32 (p. 75), average spill levels are given as percentages, but in Table 33, on the same page, average spill levels are given as proportions.

The first three of the four subheadings (p. 80, 81, 83) under "Multiyear Analysis of Subyearling Chinook Rock Island to McNary Dam Survival" are preceded by a number; the fourth ("Conclusions for the Subyearling Chinook Analysis"", p. 89) is not preceded by a number. Only the third subheading ("3. Results") appears in the Table of Contents (p. ii).

In sections where observations are reported for different species-rearing groups in sequence (e.g., the "Results for Multi-reach Fish Travel Time and Survival Estimates" section starting on p. 67), it would help readers if a new paragraph were started for each group. The text is difficult to follow when descriptions of different species-rearing groups, sites, and time periods follow without breaks.

The sockeye travel times reported in the last sentence on page 67 are not consistent with the data presented in Table 31.

The captions for Figures 31 and 32 (p. 76) read "Reach survival estimates...from 1999 to 2007", but should read "Reach survival estimates...from 1999 to 2009".

On page 74 some mention (reminder) of why 2008 is not included in Table 33 and Figure 32 would be useful.

It is not clear why only years 1999 to 2000 are used for survival comparisons. Further explanation would be useful.

Adult Fish Passage

The standardized graphical summaries are particularly useful and easy to read. The section is not intended to provide an assessment of stock status or productivity, and seems uncontroversial in that it documents rather than interprets any unusual observations about abundance or timing. In general, the report was clear and helpful on the matters covered, but there were certain matters that could profit from a bit more attention. In particular:

Table 41: The 2009 projections are matched by 2009 observations, and then (along with other information) converted to projections for 2010. In some cases, 2009 observations were substantially less than 2009 predictions, presumably based on earlier returns, which are then followed by very large increases in the corresponding 2010 predictions. In other cases, the 2009 observations exceeded the predictions by a comfortable margin and were then converted into smaller predictions for 2010. When the 2009 match was close, the 2010 predictions were changed very little from those for 2009. The text states that the predictions employ a lot of information, without being very explicit about the translation of "information" into "prediction." That would be OK, but the predictions for 2010 seem odd; they go up when performance in 2009 is below expectation and seem to go down when the 2009 performance exceeds expectations. One realizes how inexact these predictions can be, of course, but these values seem peculiar. Perhaps the FPC Annual Report could direct readers to the U.S. v. OR Technical Advisory Committee (TAC) web site for more information.

In the draft annual report, there is a consistent pattern of describing shortfalls or decreases over time as percentages of the higher number (e.g., 83.2%), but when there is an excess or increase over time, it is reported as multiples (e.g., 5.7). We understand what the authors are doing, but consistency would be better. One could use 83.2% and 570%, or 0.83 and 5.70; either would be consistent and fine.

Differences in counts among dams (tabulated in Table 44, which lacks a label and caption) are discussed in the text because these differences provide information about the distribution of adult returns within the basin. To facilitate this useful discussion, it might be worthwhile to graph the distribution of each species or size grouping (i.e., each column in Table 44) by river segment demarcated by successive dams; this could be done with a bar graph in which the height of a bar for each river segment is simply the count at the dam forming the downstream boundary minus the corresponding count at the dam forming the upstream boundary.

The table on pages 102 and 103 needs a number (presumably it is Table #44) and a caption. We note that the two tables on page 104, also need captions, and they are different from each other and those on pages 102 and 103. They probably need separate numbers. For the tables on 102 and 103, it would be useful to have percentage figures for the jacks. Because jacks are a different age than adults, the question arises whether we also should be tallying them against their own birth cohort, rather than only the run they come back with. That would be tricky reporting, but there is growing suspicion that the "jacking rate" may be changing, perhaps in response to hydrosystem reality and/or to changing climate. The matter is dealt with at some length in the Memoranda section, and a flag to that material would be good. At the moment, one could presumably dig that information out of these tables, but perhaps even a graphic in that form would be useful. The matter is going to become important in the near future.

For the steelhead table on page 104, it might also be of interest to present the estimated kelt numbers and percentages, either referenced to their birth cohort, to their run group, or both. There is growing interest in life-history evolution in all of these species, but particularly in steelhead, as the "situation" changes requiring that this presentation be disentangled in the near future.

Table 45 seems to show a trend in the temporal length of the spawning run, and that is of interest (if it is happening), relative to changing climate and (possibly) hydrosystem and hatchery management. A full-blown statistical test is out of place in this report, but perhaps a few passing comments would be in order. In that vein, although the [1%, 90%] interval has appeared in previous FPC reports, in looking at the subsequent plots, the [1%, 90%] interval does not seem an obvious choice in preference to [10%, 90%] or [5%, 95%]. Even in view of the asymmetry of most return time distributions, the cumulative plots suggest that bracketing the median with a symmetric interval would reduce the temporal noise from the unpredictable lengths of the tails.

The following statements (p. 110) appear inconsistent, "The 2009 adult and jack summer Chinook counts at the four Snake River projects increased when compared to both the 2008 counts and the 10 year averages. The 2009 LGR adult summer Chinook count of 14,482 was only about 64% of the 2008 count and was 1.3 times greater than the 10 year average."

The bimodal run time distribution for Coho argues for at least the possibility of a mixture of separate population distributions. All of the curves go up and down to some extent, but there is a fairly large temporal offset between the two peaks. Are the fish in those two run periods from the same place, or is there geographic variation in run timing that we have not codified previously?

The following first sentence seems inconsistent with the remaining sentences (p. 134), "The removal of the 25 sea lions between 2008 and 2009 did not reduce the overall salmonid consumption estimate in 2009. The 25 sea lions that were removed accounted for 22% of all of the individual salmonids catch events. These same sea lions were present more days and consumed more salmonids per capita each year compared to the other pinnipeds at Bonneville Dam, indicating that the removal program successfully targets individuals that are most likely to stay longer and consume more salmonids (Stansell, et al. 2009)." Did new recruits replace the removed animals? If so, this should be mentioned.

Figures 52 and 53, along with Table 50, argue that something dramatic changed for Steelhead in 2009. The report documents it nicely, but a comment is in order. What are some possible causative factors? A benign ocean? A benign river? Spill? A short permissible spawning period for that year? Are there additional possibilities?

Run timing – Spring Chinook adults are arriving quite a bit later than decadal average for 2008 and 2009, but the jacks are not. They are coming with the later running adults. Meanwhile, Summer Chinook adults are arriving earlier and the jacks much earlier than decadal average. What does all of that mean? These data need further discussion. Is it possible that climate change is involved? We see on page 157 that Fall Chinook are released into the Snake earlier than had been the case in earlier years. Again, the presentation is showing the patterns, but one needs to be able to connect the dots.

Editorial Notes
In the second sentence in the first paragraph on page 120 the word "then" should be "than."

On page 122 it is not clear why Chinook are mentioned in the Pink and Chum Salmon section.

Figure xx on page 123 should be Figure 54. Also on page 123 the reference to Brostron et al. contains a typographic error.

On page 143, Tables XX and Figures YY need numerical inserts.

Table 52 contains years 1987-2009 rather than 1979-2009. Figure 62 contains a portion of the data in Table 52 rather than the same data as claimed in the text. Similarly the text claims that Figures 63, 64 and 65 contain the same data as Tables 53, 54 and 56.

Columbia River Basin Hatchery Releases
This section is very clear and quite helpful, but it raised some issues that would profit from additional attention. Specifically:

Non-anadromous releases are not presented in the report. Non-anadromous fish are not within the mandate of the Fish Passage Center, but the information is important and becoming increasingly useful. There were various places in the report where attention was directed to web-site sources for additional material not presented here. That link to other material was helpful. In that same vein, a redirection of the users interested in non-anadromous releases to an appropriate source of such information would be an appropriate way to bridge this gap.

The section on below-Bonneville releases is a very much appreciated and valuable addition.

We note that there is no marking of the resulting progeny for (typically marked) hatchery-reared adults, which were released into spawning areas for "natural" production. For egg and fry releases in general, there is no marking. It would be good to be able to gain some sense of the number of PIT-tagged fish released from the hatcheries, but completely unmarked releases make any subsequent performance tracking an estimation exercise fraught with difficulties. Again, while marking is not the responsibility of FPC, subsequent evaluation is, and the annual report might include a comment to the effect that marking of important (particularly experimental) releases would be advanced by some form of marking technique that does not require "handling." Otolith marking is mentioned in one case; stable isotope analysis has some attractions, given a hatchery diet; non-destructive parental genotyping in the hatchery might serve admirably for such releases (see references in ISRP/ISAB 2009-1).

Major hatchery production and release changes and trends are nicely reported but not interpreted. Regional strategic planning would be advanced if the readers had an understanding of whether the strategic hatchery management decisions that underpin cumulative release changes of this magnitude are the net consequence of myriad local decisions, based on strictly local criteria, or whether there is some coordinated strategy. A few general comments on the overall reason(s) for "why" such large changes are occurring might be helpful, if feasible.

Appendix A – Memoranda

The memoranda in this appendix and the information and analyses contained therein form the portion of the FPC annual report that is most amenable to, and would potentially benefit the most from, selected ISAB review. A review of the FPC responses indicates that they are carefully prepared. The quarterly report dated April 14, 2009 provided a useful overview of activities.

The memoranda provide an edifying glimpse of the range of FPC activities and are full of valuable information. Some of them address fairly controversial matters such as recent NOAA concerns over BiOp-mandated early spill for 2010. That matter came before the ISAB (independently) in 2010, and is an example of an FPC report on a "controversial topic" that would have warranted ISAB examination, jointly with its consideration of the original report. Though an independent assessment was certainly in order, it would have been good to have both reports to examine simultaneously. It will be important in the future to flag such reports for coordinated and timely ISAB attention, rather than in retrospect.

Appendix I – Technical Letters

The technical letters also contain valuable information, but they are voluminous enough that they preclude useful review in the short "comment period." ISAB review of technical letters would be beneficial in only those few instances where significant scientific analyses conducted in the letter are called into question. A review of the 2009 letters shows that most of them are joint, interagency technical-team letters, implying that at least some level of consensus has been reached; their analyses are mostly summarized and not typically suited to ISAB Review.

Appendix J – Maps.

Most were very good for project reporting, but some (J-5 and particularly J-7) showed many smaller tributaries, for which no information was presented. The visual aids should contain only necessary information.

In the Adult Fish Passage section, references to maps in Appendix K should refer to Appendix J.

It appears that maps 6 and 8 in Appendix J are identical.

Additional comments:
The transportation conversions in Appendix G served as a reminder that it would be useful to have the transported fish sorted in a way that would give us T_1, T_2, T_3 when TIRs are computed, instead of the current practice of lumping them into a single back-calculated T cohort, for comparison with the IR cohort. That would require more work, but it would be good to know whether it would be better to transport from all three projects or just from one of them.

On page 1 and A-88 the word “repot” was used rather than “report.”

The font size used in Appendix F creates a challenge to the reader. If possible a larger font size would be appreciated.