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Scoping for the Independent Scientific Advisory Board Review of Fish Passage Center Products

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Review recommendations

1. Scientific review by the Independent Scientific Advisory Board (ISAB) is recommended only for selected Fish Passage Center (FPC) products. Review for administrative, oversight, or an editorial purpose is not appropriate.

2. Products should be considered for review when new analyses are introduced, when new conditions or data bring old analyses into question, and when consensus cannot be reached in the region on the science involved in the product. Memoranda in response to special inquiries and technical letters are often appropriate for review consideration.

3. Products that warrant review could be identified by any combination of the FPC Oversight Board, the FPC staff, the ISAB Administrative Oversight Panel, and the ISAB.

4. When possible ISAB reviews would be conducted during the public response period following release of the draft FPC and CSS annual reports.

5. Council staff and ISAB Ex Officio member, Jim Ruff, will serve as the ISAB liaison to the FPC and FPC Oversight Board to facilitate timely reviews as required throughout the year.

6. For each review an ISAB subgroup will be selected from the full Board based on areas of expertise and availability.

7. ISAB review comments shall be linked to the corresponding FPC product on the FPC web site and the ISAB web site.

Background

On December 18, 2009, the Fish Passage Center Oversight Board asked the Independent Scientific Advisory Board (ISAB) to "review the 2008 Fish Passage Center and Comparative Survival Study (CSS) Annual Reports and based on that review, provide recommendations to the Board on how to organize a useful regular review of Fish Passage Center products."

This review is intended to address recommendations in the Northwest Power and Conservation Council's 2009 amendments to the Columbia River Basin Fish and Wildlife Program. The Program calls 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 ISAB to organize a regular system of independent and timely science reviews of the Center's analytical products. The Oversight Board determines the requirements for peer review of analytical products.

The ISAB's workload is reviewed and approved by the ISAB's Administrative Oversight Panel (ISAB partners) consisting of the Council Chair, the Director of the Northwest Science Center (in consultation with the regional administrator), and a representative from the Columbia River Indian Tribes (currently CRITFC's executive director). To finalize a review approach, the ISAB will need to consult with its Administrative Oversight Panel.

Due to the limited time allowed, this review is not an in-depth review of the latest FPC and CSS annual reports. Nevertheless, during this scoping exercise the ISAB identified some areas of the annual reports where clarification is needed. Thus, in addition to considering how to organize a useful regular review of FPC products, this document includes some suggestions for FPC consideration of possible improvements to annual reports in general.

Questions of interest

1. What FPC products should be reviewed on a regular basis?
2. What types of the within year analyses/technical memoranda (e.g. spill benefit, sockeye, and jack memos; appendices A and I) could benefit from review and how should these reviews be structured?
3. Are data collection protocols, methods of analysis, and reporting of results satisfactory?
4. What modifications or additions to existing FPC products would benefit the Columbia River Basin Fish and Wildlife Program?

Past reviews

Over the past 14 years the ISAB and the Independent Scientific Review Panel (ISRP) have participated in numerous, iterative reviews of Fish Passage Center and CSS products. These products fall into four categories:

1. *proposals* for Fish and Wildlife Program funding (see appendix to ISAB&ISRP 2007-6)
2. *progress reports* (Ten-Year Retrospective Summary Report review (ISAB&ISRP 2007-6))
3. *technical memoranda* containing analyses of particular issues, with ISAB review specifically requested (Biological Effectiveness of 2005 Summer Spill; ISAB 2006-1), and
4. *general analysis* of hydrosystem passage data that were presented to the ISAB to inform reviews of key research and management issues such as in-river versus transportation of juvenile salmonids (ISAB 2008-5), latent mortality (ISAB 2007-1), reservoir operations (ISAB 2004-2), and flow augmentation (ISAB 2003-1).

In general, these proposals and analyses have fared well, and particular areas were identified that needed improvement. The products were informative and have generally profited from review, although certain elements were not recommended for continuation.

Review alternatives

ISAB involvement in review of FPC products could encompass several possible alternatives:

- *Status quo* – past results and plans for future actions described in project proposals could be reviewed every 3 to 5 years by the ISRP. Retrospective summary reports could be reviewed as requested. Specific technical analyses might be reviewed as part of ISAB reviews of key scientific issues related to fish passage. Analyses by others, such as NOAA, also might be used during those reviews.
- *Regular annual review* – this would build on the status quo, but would establish a regular ISAB review of the scientific elements of the FPC and CSS annual reports. Technical memos would be reviewed as appended to the annual reports.
- *Periodic review of selected technical memos* – under this alternative the ISAB would review specific FPC products in draft form or shortly after release, with the understanding that the ISAB review would be posted and the FPC would provide a response to ISAB concerns. Identification of products that warrant review could be made by any combination of the FPC Oversight Board, the FPC, the ISAB partners, and/or the ISAB. These reviews could be in addition to the status quo and/or the regular annual review.
- *Regular review of technical memos* - the ISAB could be on notice to review all scientifically reviewable technical memos and products. The FPC and ISAB would need to work closely together to schedule these reviews, as turnaround time is typically very limited.

Under any combination of these alternatives, however, the ISAB could name a member to serve as a liaison to the FPC and FPC Oversight Board, and the ISAB could establish a formal mainstem/fish passage peer review group that is prepared to review FPC analyses on short notice.

Overall comments

There is a definite need for in-depth peer review of Fish Passage Center (FPC) products, but there are difficulties to be considered if the ISAB takes on this challenge. The assessments done by the FPC rely heavily on creative statistical approaches that are less than obvious, and there is often divergence of opinion among scientists and managers in the region on the best approaches to use, creating ongoing controversy over the validity of some FPC results. Independent evaluation by the ISAB could require substantial time commitments of the ISAB members with relevant expertise. This represents a potential staffing/time problem that should be considered before committing to routine review of FPC products. Guidelines to identify particular products to be reviewed should be reassessed after a trial period of reviews. Developing a robust review process should involve an iterative discussion between the FPC Oversight Board, the ISAB's Administrative Oversight Board, the ISAB, and the Fish Passage Center.

Review of some sections of the FPC annual reports would be a good start and could be done every year. These sections are identified later in this review. The more potentially controversial

FPC products are the Memoranda, which often are needed by the end-users within a short timeframe, but which may have policy implications. The issue becomes how to screen these memoranda, and whether to attempt to review them before or after they are released. One way to deal with the timeliness issue would be for the ISAB to perform a post-hoc review whenever a product proves to be contentious, or if a review is requested. The ISAB comments could then be appended to the original document along with any FPC response. This could provide, when needed, counterpoint and balance to the original conclusions.

If ISAB reviews are to be conducted on a short timeframe, it would be necessary to identify a specifically tasked sub-group that can respond on short notice and timely coordination will be necessary.

If desired the ISAB could comment on the annual report in the spirit of generally moving the science along and/or suggesting alternative material to include in the annual report, alternative methods of presentation, and suggestions for deleting material. This activity could be scheduled during the public comment period for the annual report.

Comments on the Fish Passage Center Annual Report

FPC Executive Summary

The executive summary would be more effective if it contained adequate information to provide perspective on reported outcomes. For example, a brief comparison with past years would provide a useful perspective when reporting findings such as flow targets not being met in two cases. It also would be useful to consider the relative departure, both positive and negative, from flow targets for all key periods to provide a perspective of the success of flow management. Flows and precipitation may be near average, but substantial variability appears to exist spatially and temporally. It is of interest to know if the flow targets are met consistently or if they are met more or less frequently at some times or at some locations.

I. Water Supply

Review recommendation
The Water Supply portion of the report does not appear to contain any particularly controversial interpretation of information. This section is primarily a report on river flows, dam storage, and compliance with the BiOp requirements. Flows are put in a recent historical context for precipitation, 1971-2000, and runoff ranked for 1990 to 2008. This is essentially a reporting of data with limited analysis other than computing averages and making comparisons with historical data. Much of the section is related to dam operations and compliance with mandates so there is little need for critical review. Unless the ISAB is involved in defining additional, useful metrics for long-term reporting, there appears to be no compelling reason for the ISAB to review this portion of the report other than informing ISAB members about the character of water supply in individual years.

Suggested modifications

The material is largely a summary of other records and analyses provided by water supply and flow recording efforts. With that purpose in mind it would help to consistently document or provide links to source information. The sources are inadequately defined in several cases and some methods or measures used for derivation or summary are not clear or consistent. There are also inconsistencies between information reported in the text and that shown in tables. Better referencing, clarity, and consistency in methods and reporting could make the report more useful, enhance credibility, and strengthen general conclusions.

Although the structure of the report and the statistics selected may be required, there may be ways to improve the utility of some of the summaries. For example, the report uses aggregated means as criteria for defining fish passage monitoring and flow objectives. The report does not generally consider or discuss data variability that could help with understanding the importance of departure in observed conditions from the objectives. Presumably variation is important in any conclusion about meeting or failing to meet objectives. The variability also could have important implications for specific stocks or migration timings.

The general summary of annual flow, and the comparison among years, is useful and important to maintain. The use of an annual flow statistic however, obscures potentially important information about seasonal variation in flow. In this section it is clear that flows at Lower Granite and McNary departed strongly from flow objectives early and late in the season. In the future it might be useful to track and present some higher resolution seasonal flow statistics to help consider the implications of both upstream flow management and climate change such as anticipated earlier peak flows and lower summer base flows. The flow year was near average, but was the timing of flow and the availability of water near average throughout the season? Does that variation hamper flow management or biological potential?
Additional referencing for the sources of information for elevations and referencing the appendix for the System Operating Requests (SORs) should be included. A record of meetings and forecasts might be included as well.

In the present format, temperature data also are summarized with a relatively coarse resolution involving daily or longer time period means. Temperature is limited to observations associated with Dworshak and Lower Granite seasonal temperature control. Given the potentially important biological and ecological implications of variability in temperature and flow at shorter time scales and throughout the system, it might be useful to consider including additional and higher resolution information on both in future efforts. With the current need for data related to climate change, it would seem reasonable that the FPC assemble a more extensive report of precipitation, runoff, and snow pack with both spatial distribution and temporal variation on a monthly or even weekly time scale. These data are available elsewhere, so it would require collection of little or no new data. At the same time it would provide researchers easy access to information regarding shifts in peak flows, shifts from precipitation as snow to rain, and a more spatially explicit view of the impact of climate change on the Columbia River Basin. This may be beyond the scope of current FPC direction but might be worth some discussion in light of increasing concerns about climate change, food webs, and environmental flows.

Specific Comments

P1. 1st paragraph. "Water year was *near or above average* throughout the basin". Actually it appears that the basin as a whole (at the Dalles) was below average and that the subbasins summarized ranged from 87 to 130%. The ranks are on either side of the median. Perhaps an important question is whether the range is important to summarize. It could be useful to consider what terms like "near" imply… is a 13% to 30% departure (or 8% overall) biologically meaningful?

Table 1. The specific link to the source information is helpful and should be done elsewhere as well.

Figure 1. It would be useful to provide a link to the CRITFC Hydro Program and the documents used to generate the information summarized here. A search of the CRITFC site did not produce this information. More detail on the nature of the measurements would also help. The text suggests that precipitation is somehow summarized "above" the reference point, but wording in the figure heading implies precipitation at "select locations." A water supply analysis would presumably summarize precipitation across the contributing watershed. It would be helpful to clarify the nature of the data and use consistent terminology.

P. 3 and Table 4. Although the snowpack did increase overall the ranges and means differ from those suggested in the text, depending on how the increase is calculated. For example, the late season increase in individual basins ranges from 1% to over 200% while the averages are between 14% and 58%. The major point, that snowpack increased late in the season, is supported, but the presentation and table need to be consistent and accurate. It is interesting that the snow water accumulations do not seem to match the patterns in precipitation. Some mention or explanation of this observation would be useful, particularly when there is need to draw some connection between patterns of precipitation, water supply, and actual observed flow.

Table 5-6, Figures 6-7. The Priest Rapids and Lower Granite data are presented in different formats while McNary data are presented both in tabular averages and as seasonal patterns. Consistency would help avoid confusion. Do the biological flow objectives referenced in Table 5 reflect any uncertainty or variability in the flow measurements? For example, the flow objectives show a stable discharge throughout the two windows, but an unregulated flow will vary substantially with climate and discharge patterns across the basin. Is it possible to consider whether the observed flows are meaningfully different than the objective, especially given the variability in both? Presumably there is some guidance on measuring the flow departure that could be referenced here to provide useful context. It also appears that departure is seasonally quite substantial at both McNary and Lower Granite, but that is not discussed. Is a simple average biologically meaningful or is it important to break this down to finer resolution to consider how, when, and why the objectives are or are not met? Again it would be useful to reference the sources of the information.

P. 13. Dworshak operation references and sources of information would be helpful. It appears that the resolution of the outflow and temperature data may be sub-daily. The resolution of the information could be defined in the figure heading or referenced for the information source.

In general, it appears that the presentations offered represent an eclectic collection of information various users have requested in the past, from time to time and project by project. That may serve the needs of particular users well, but it comes across in the report as a collection of odds and ends. Some effort to standardize reporting for the annual report, for each of the projects, would seem to be in order and timely. There will always be requests for one-off reports, and the FPC responds quickly and well to those voluminous requests, but the annual report should be crafted for an audience interested in the larger temporal and spatial patterns within the region.

II. Spill Management

Review recommendation

This section has two parts (A and B). Part A is related to spill and has five sections: (1) an overview of the history of spill agreements since 2004; (2) a section on spill planning and operations, including a table detailing 2008 Agreement spill levels (court-ordered); (3) spill and other issues related to releases of Spring Creek Hatchery Tule Fall Chinook; (4) a series of reports by individual dam on specific 2008 spill operations in relation to river flows and court-ordered spills and (5) a brief summary and conclusions section. Part B is related to gas bubble monitoring and data reporting for 2008, and has three sections: (1) overview, (2) results and (3) a brief discussion.

This section is presented in a fairly straightforward and easy to understand format. The table of 2008 Agreement Spill Levels usefully depicted the court-ordered spill, and Figures 10-18 for individual projects clearly showed where spills met, did not meet, and exceeded required levels. Graphical representation of project specific flow and spill operations constitute much of the remaining material in this section. This portion is primarily a report on flow and spill levels at each project and does not require ISAB review.

A good example of a place where ISAB input may be valuable is summarized on pages 22-23 of the Annual Report (even though it occurred outside of the spill season). The study by Haeseker and Wills (2008) was used in SOR 2008-1 to justify the preference for spill over the corner collector for Spring Creek Hatchery Releases. According to the Annual Report "the SOR request was discussed at the Technical Management Team… but no consensus could be reached. It eventually went to the Executive Committee for discussion. (Page 23)." In reviewing technical details of the paper by Haeseker and Wills (2008) we note that one point of logical contention might be the reliability of the data leading to the specifics of the SOR. The SAR for fish released during spill was 18% higher than the SAR for smolts released during the corner collector operation, but the results were not statistically significant. Bayesian analyses took it a step further, suggesting a high probability of a significant difference. However, this result for the single year of study data did not consider a large range of other factors that could have affected the SAR, including smolt size and condition as well as riverine, estuary, and oceanic factors. No evidence was provided to indicate that the Haeseker and Wills (2008) study that prompted SOR 2008-1 was reviewed.

Subsection B reports on gas bubble data and monitoring of gas bubble trauma (GBT). Sampling and monitoring issues may arise that would suggest periodic review of the protocols and analyses

used to evaluate levels of GBT. For example on page 34 it was noted that some data were eliminated from the database because the data were determined to be unreliable.

Suggested modifications
In the spill section, data collection protocols were not really detailed. For the body of the Annual Report, it is not necessary to do so. It would be desirable, however, to have references to the sources of the technical protocols cited (and put in the literature cited section at the end of the document). In that way, the documents can be accessed as needed.

III. Smolt Monitoring

Review recommendation
The Smolt Monitoring Program is one of the FPC's core missions, and includes collection, organization, and analysis of smolt passage and survival data, and distribution of those data and analyses to end-users via the FPC website and written documents. This is an indisputably useful service, and is used by agencies, tribes, university scientists, NGOs, and others within and outside of the region.

The smolt monitoring program at the dams is a large part of FPC operations and a critical part of managing the hydrosystem. The smolt monitoring program is an entity unto itself and might need a standing committee involving biologists, hydrologists, and statisticians. Changes in hydro operations seem to be made on the fly. Is there a danger of a major disaster if a mistake is made?

Numerous aspects of the monitoring program are amenable to periodic ISAB review, such as effectiveness of removable spillway weirs (RSWs); usefulness of the smolt monitoring program in the tributaries when traps have to be taken out irregularly due to flash floods and debris hazards; utility of smolt migration timing data; and efficiency of the program.

The report presents many comments on apparently significant differences in smolt survival within and among years or between dams that are not supported in the text by either statistical analyses or reference to appropriate documentation. There are also many comments about whether or not smolt passage over a particular dam or in a particular year was "problematic" without sufficient explanation of for whom or why the passage was problematic.

The population index discussed on page 43 is described in a technical memorandum available at the following link on the FPC web page; www.fpc.org/smolt/juvenile_popindex/35-08.pdf. Results sometimes show major differences between the population index and the passage index. It is not clear if the model developed for the population index has been peer-reviewed. If not, peer review would be appropriate.

Criteria for eliminating data such as on page 60, "The criteria were to reject survival estimates if standard errors for any dam to dam segment within the reach exceeded 0.2" need to be justified.

Section F. "Travel Time and Survival Analyses" (pages 54-75) is a key section that would benefit from detailed review of the assumptions and results of the multiple regression analyses. Statements such as, "Given the relatively low spill proportions in 2008 it follows that survival

was below average." on page 69 imply a cause and effect relationship that is quite difficult to justify in an observational situation.

Section H, Evaluation of the estimated 2008 reach survivals for yearling Chinook in the lower Columbia River between McNary and Bonneville dam, uses an information-theoretic approach (Akaike information criterion, AIC) to rank alternative models for describing survival of Chinook salmon and steelhead in different river reaches. Because the information-theoretic approach requires some judgment calls, this is a good example of an exercise in data interpretation by the FPC that could benefit from external peer review.

Suggested modifications
Including information on fish when they are handled for tagging or other purposes would be a very useful addition to survival tables. These data should include, at a minimum, length and weight.

Recent evidence shows a high rate of smolt mortality in the lower river/estuary. Connections between the smolt monitoring program and efforts in those reaches should be strengthened.

Efforts at uniformity of presentation would be helpful. For example, results are presented as proportions in one sentence and as percentages in the next. Differences are presented in absolute differences in one sentence and as a proportionate change in another sentence. Editing would greatly improve the report. The entire Annual Report could be improved by providing definitions for technical terminology. Not all readers know, for example, what the criterion is for a fish examined at a fish passage facility to be considered "descaled", or the definition of "spillway passage efficiency." Once prepared, a glossary could be included in each new annual report with little effort except to occasionally add new definitions similar to the list of commonly used acronyms in Appendix L.

This section contains examples where tables are misidentified in the text and mistakes are made such as identifying a CV of 0.24 as being associated with a low precision value >25%. Also, justification for using 25% as a cutoff for low precision should be justified.

Lamprey passage at dams such as Bonneville was not reported in the main report. Apparently FPC maintains lamprey passage data, as shown in their response to a request from the Oregonian (Appendix A). Lamprey are a species of concern, so annual reporting might be worthwhile. Likewise counts of kelts were not documented. A section covering miscellaneous species that are enumerated at the dams could be useful.

IV. Adult Fish Passage

Review recommendation
Forecasts of adult returns are based largely upon jacks from the same brood year. In some years and for some species, forecast and realized run sizes are widely divergent, for example those for spring/summer Chinook and sockeye. Investigation of strategies for improving forecasts should be initiated, including ISAB review of methods to forecast run sizes.

The marine mammal section is devoted to litigation related to trapping and killing of sea lions at Bonneville. This material is interesting but not useful in estimating the impacts of sea lions and harbor seals on returning adults (see Tackley et al. 2008; Stansell et al. 2009). An assessment of the numeric impact of pinnipeds on returning salmon and what happens when the pinnipeds are removed would be useful. Such assessments would be appropriate for review.

A special enquiry presented on pages 101 and 102 involves a comparison of adult mortality on the upper Columbia versus the Snake River. The reply states that the differences were not significant, but additional tabular information should accompany the statement or be cited and available in an appendix. There are other special requests that warranted special highlighting in the report. As a general rule, any request that is worthy of highlighting in the annual report should be treated with the understanding that if it is worth mention, it is worth presentation. Relevant links to appendix pages or reports should be provided for special requests. Special enquiries are good candidates for reviewable material.

Also on page 101, the report indicates that the adult mortality estimates from NOAA's Draft BiOp were adjusted for estimated harvest and straying rates but the FPC staff did not adjust adult mortality to account for harvest or straying. Justification for not collecting the harvest and straying rates used by NOAA for FPC analysis should be provided.

Suggested modifications
The literature cited is useful and the links to papers are especially appreciated.

The reader is reminded at several points to view comparisons against the decadal average with caution, due to BiOp-mandated changes in harvesting. However, the report does not indicate precisely what the reader is supposed to watch out for. Are this year's numbers biased upward, downward, irrelevant, or misleading, considering such changes in practice? In the interest of clarity, it would help to provide more elaboration.

The harvest section should include the percentage of the run harvested by species, stock, and hatchery versus wild. It may be important to know what percentage of the runs are counted within the counting period in Table 42 if run timing shifts to earlier or later runs, as indicated for some runs in Section I.

Counts of other species such as lamprey, shad, and sturgeon should be mentioned in the text.

Since presence or absence of adipose fins are noted at the counting windows, percentage of hatchery vs. wild fish for salmonid run sizes would be informative to see if they are correlated.

An evaluation of major factors controlling water temperatures in the river would be useful. Information on how releases from dams, such as Dworshak Dam, affect downstream and reservoir temperature would be useful if presented in this section or referenced here.

Significant shifts in run timing are shown in Figures 39, 40, and 46. It would be useful to see measures of variation around the 10-year averages to gauge the extent of deviation of aberrant

years. Tentative explanations for shifts in run timing that are supported by data should be presented. Changes in run timing for hatchery and wild fish should be compared.

In the tables with adults and jacks, tagged and non-tagged, hatchery and wild counted it would be useful to have proportions of each category reported. Such separation would be graphically useful, particularly for the time trends.

Statements such as the following, which appears on page 109, need correcting, "The 2008 count at McNary Dam of 101,869 was 1.78 times greater than the 2007 count of 57,172. When compared with the 10-year average count of 109,202, the count was about 93.4% of the 2008 count." The statement seems to be claiming that 109,202 is about 93.8% of 101,689, when the reverse is intended. Another example from page 126 states, "The 2008 wild steelhead count of 105,093 was about 1.30 times greater then (sic) the 2007 count of 320,931."

On page 110 it is noted that, "It was stated that the mini-jacks being observed in the Mid-Columbia River in 2008 were likely late arriving hatchery summer Chinook that were released as yearlings above PRD and WAN in the spring of 2008." As a general rule the annual report should identify who made such statements and what evidence is provided to support the claims.

Including a map showing how the upriver run partitions out into the various basins, illustrating losses along the way would be useful. The information is provided in the text, but it is hard to see the larger picture. A map similar to one showing the fate of Bonaparte's army on its march to Russia and back as presented by Tufte (1990) would be very effective.

Note that the Fitzpatrick 2009 paper refers to Chinook not steelhead.

V. Sockeye/Fall Chinook Adult Returns

Review recommendation
In Section V, FPC staff document large adult returns of sockeye and Chinook salmon in 2008. They also attempt to explain these large returns by analyzing changes in reach survival and migration time, in-river conditions, and the magnitude of hatchery releases.

The section includes 6 Tables and 4 Figures that summarize data for 2008 relative to trends over the last 10 years. The section also includes 2 Tables and 3 Figures that summarize results from statistical analyses, and which help to substantiate conclusions in the report. In this respect, Section V offers considerably more scope for ISAB review than some other sections of the Annual Report. This section deserves special consideration for possible ISAB review.

Suggested modifications
Statistical analyses with supporting tables and figures are used to support conclusions in the text that the large adult returns in 2008 are associated with favorable in-river conditions for juvenile migration in 2006 and 2007. However, a number of (minor) deficiencies and missed opportunities could undermine the defensibility of these conclusions. These include:

- No explanation is given for what was weighted in the regression analyses. Presumably the weighting was an attempt to address unequal sample sizes used to estimate river reach survival probabilities.

- A logistic regression (i.e., logit transformation of survival probabilities) would have been more appropriate than either of the regressions performed. The untransformed regression seems inappropriate, for the reasons stated, and presumably is only included to show that log transformation does not greatly change the results.

- There is considerable discussion (on page 136) of how spill percent changed at John Day Dam (JDA), yet it remains unclear how (or whether) spill at JDA is thought to have affected survival rates from Rock Island Dam (RIS) to JDA. Presumably any beneficial effect of increased spill percent at JDA would be evident in improved survival in the next reach, i.e., after passing JDA. On the other hand, perhaps increased spill percent at JDA affected the *reliability of the estimate* of survival in the RIS to JDA reach. More explanation is required to clarify the significance of changes in spill percent at JDA.

- Contrary to the claim on page 137, the numbers of sockeye salmon smolts emigrating from the Okanagan River are estimated annually based on hydroacoustic surveys of Osoyoos and Skaha lakes conducted by the Okanagan Nations Alliance. The following data were provided by Dr. Kim Hyatt (Fisheries and Oceans Canada, Pacific Biological Station, Nanaimo, BC): Hatchery fry plants to Skaha Lake have accounted for less than 10% of the total number of smolts migrating down the Okanagan River. The total smolt migration from the Okanagan River was estimated at 2.0 million in 2006 (7.3% from Skaha) and 1.6 million in 2007 (8.1% from Skaha). Thus, the total smolt migration was considerably larger in 1999, 2002, and 2003 (estimated at 3.8, 2.9, and 2.1 million, respectively).

The large return of adult sockeye to the Mid-Columbia in 2008 is attributed to a combination of (1) good in-river conditions (low water transit time and increased spill percent at McNary and John Day dams) resulting in increased reach survival of juveniles in 2006, and (2) increased hatchery output in 2006 and 2007. The large return of adult sockeye to the Snake River in 2008 is attributed to a combination of (1) good in-river conditions (low water transit time in 2006 and high spill percent in 2006 and 2007) resulting in increased reach survivals of juveniles in 2006 and 2007, and (2) low transportation proportions in 2006 and 2007. The FPC conclusions seem plausible, but other factors might have played an even larger role. It is difficult to understand how the reported increases in reach survival (no more than 2-fold in the Snake River, or 2.7-fold in the Mid-Columbia, for any year excluding 2001) could alone explain increases in adult returns of 15 times and 3.6 times the 10-year average in the Snake and Mid-Columbia rivers, respectively. Increased hatchery production (fry plants to Skaha Lake) alone cannot account for the larger returns to the Mid-Columbia because this component contributed less than 10% of the total smolt migration, and total smolt production was as high or considerably higher in 1999, 2002, and 2003. Insufficient consideration is given to the possible role of increased marine survival in combination with improved freshwater survival.

The large return of fall Chinook to the Snake River in 2008 is attributed (implicitly but not explicitly) to increased hatchery releases in 2006. In this case, the analyses do suggest that the

increase in hatchery production is adequate, other things being equal, to account for the increase in adult returns. Although summary data and statistics are provided to support conclusions, these data are not complete enough to repeat the analyses described in this section. For example, sample sizes used to compute the reach survivals are not indicated. As suggested above, Canadian estimates of sockeye smolt production from Skaha and Osoyoos lakes are available and should be considered in any comparable analyses in the future. A more comprehensive analysis would also include analyses of smolt-to-adult returns and explicit consideration of the possible role of marine climate conditions.

The practice of reducing the window of time in order to improve reliability of estimation of environmental variables may cause biased results that should be noted and investigated (see page 138).

As a general practice the effect of potentially influential observations should be investigated and reported when interpreting data presented such as those in Figures 55 and 56.

VI. Columbia River Basin Hatchery Releases

General comments
The hatchery release chapter in the FPC report is fairly routine, simply describing hatchery release data. The FPC hatchery release database seems to differ from that maintained by the Pacific States Marine Fisheries Commission (PSMFC) in that the FPC database provides inseason reporting, whereas the PSMFC database relies upon annual data provided by agencies. PSMFC's primary charge is related to Coded Wire Tags (CWTs) and associated releases, but PSMFC does provide hatchery releases not associated with CWTs when provided by agencies (sometimes the data are incomplete). The FPC database is much less comprehensive than the PSMFC database, which has separate records for each release and many more database fields.

ISAB review and comment on the hatchery release section of the FPC report are not recommended on a regular basis. However, the ISAB should make use of the online availability of the report as it does contain very useful and timely information that is relevant to the big Columbia River Basin picture.

Specific comments
On page 148, the report states that fry releases are excluded but the meaning of fry releases should be defined more clearly.

Although the FPC is not responsible for the area below Bonneville, Table 60 should include the below Bonneville zone. On page 149, the report states that there were 1.46 M salmonids released below Bonneville Dam, mostly by WDFW, but those fish are not tallied further. Some arrangement should be made to include them and their fate in the database. A complete perspective of hatchery production throughout the entire basin is needed including fry that will migrate in the year after release.

Most of the text describes whether hatchery releases were higher or lower than previous years. It would be worthwhile to provide a table listing the cumulative release goal by species, life stage,

and river zone so the users can track the overall goal for each zone and how total hatchery production relates to the goal.

It would be useful to list releases by subyearling/yearling stages and "fry" that would likely migrate during the following year. These life stages will behave differently in the river and will have different survival rates.

The ISAB previously identified interactions between juvenile hatchery and wild salmon as a key uncertainty in the basin. Release dates of hatchery fish are described by FPC. To what extent do release dates of hatchery fish overlap with wild fish migrations? Also it is not clear how well the different life stages released were separable in the database or in tabular form.

In the database, the comment field specifies the percentage of fish receiving a CWT or other type of mark (also see Appendix F). Hatchery marks are the key tool used to separate hatchery vs. wild salmon. The percentages of smolt that leave the hatchery tagged versus untagged should be indicated in the tallies, hatchery by hatchery and date by date. It would be worthwhile to provide the percentage of fish receiving each mark type in a separate column in the database so that the number of each mark type and unmarked fish can easily be calculated. Presumably the reported percentage of fish receiving marks is based on sampling of fishes at the hatchery. Note that when mass marking initially began in Puget Sound some hatcheries were simply assuming 100% of the fish received a visible fin clip—which was not accurate.

There are presently no estimates of total hatchery vs. wild adult salmon separated by species in the harvests and spawning escapements in the Columbia River Basin. Estimation is complicated because only a portion of hatchery salmon is mass-marked with a fin clip or tag. Production of hatchery versus wild salmon in the basin is an issue that confronts all of the management agencies, not just the FPC. This type of information would be useful for evaluating production and productivity of both wild and hatchery stocks. The agencies do maintain production estimates for some of the salmon Evolutionarily Significant Units (ESUs), but not all.

The annual report by ODFW/WDFW, "Status Report: Columbia River Fish Runs and Fisheries, 1938-present" was a valuable compilation of current and historical data. Unfortunately, this compilation ended in 2002 or so. Although some tables are still maintained, it would be worthwhile to bring this document back into production, or at least to update the Excel data tables and make them available on the web.

Appendix A – Memoranda & Other

Review recommendation

An examination of all of the appendices and memoranda for technical content indicated that there are several areas related to spill and salmon migration that could usefully be reviewed as needed. Not all memoranda in Appendix A warrant ISAB review, but it may be useful for the ISAB to review memoranda and their technical responses when new analyses are introduced, when new conditions bring the old analyses into question, and especially when consensus cannot be reached on the science.

The situation where ISAB evaluation may be most useful is when newly established statistical relationships between spill and fish (mortality etc.) are used either to justify SORs or in contentious spill decisions. ISAB input may be especially useful when consensus among entities regarding the science behind spill decisions or proposed decisions cannot be obtained. Nearly all of these relevant areas will be in the technical details often appearing in the appendices, as scientific documents and memoranda, rather than in the summary portions of the report.

Suggested modifications
The Appendix contains interesting and useful analyses. A concern is that documentation of these memoranda for the historical record may be "lost" because the title of the memoranda are not prominently identified and referenced.

There is a statement from page A-9, to the effect that: "These results indicate that a very small proportion (<15%) of surviving hatchery fall Chinook holdovers overwinter above LGR. Therefore, it is likely that a significant proportion of hatchery fall Chinook partially migrate through the hydrosystem before overwintering somewhere in the hydrosystem." Data on holdover Chinook, also known as reservoir-type Chinook, are important and have been published in the primary literature by authors such as Connor et al. (2005) and mentioned by ISAB. However, there are no references to these other studies in the FPC report. The interpretation of results would benefit from comparison to other studies.

Appendix I – Technical Letters

Review recommendation
On occasion ISAB review of selected technical letters would be valuable. Selection criteria could be similar to that used for identifying memoranda in Appendix A.

Appendix J – Maps

Suggested modifications
The maps showing the recent adult counts by species at each dam in relation to the recent 10-yr average are good, easily understood summaries. A link to a clickable map with all the major dams on it with links to information such as who operates each dam, who monitors the smolts, a summary of smolt transportation that year, and adult counts by species would be very useful.

Appendix K – Web Statistics and Data Requests Summaries

Suggested modifications
This appendix provides an effective summary of access by users of several online databases and documents. An additional index of how useful the compiled data actually are might further document FPC contributions. Such an index might report acknowledgement from users in scientific papers, reports, and studies. It is interesting that the primary user of the FPC online database is Colorado with more than double that of any Northwest state and California. This summary begs for an explanation.

Editorial note

The writing in some sections of the annual report is rough; in some places the intended meaning is obscured. In some cases tables and appendix references are incorrect causing confusion and frustration. Further editing would greatly improve the report

Comments on 2009 CSS Annual Report

The report is very nicely written and clear, an improvement over previous reports. Both the procedures and the logic for them are apparent. This report continues the improvements made in the 10-year retrospective report in giving a much more enlightening view of the CSS project.

Review recommendation

Much of the data presentation, analyses, and interpretations in the 2009 CSS Annual Report have recently received extensive ISAB/ISRP review. When new analyses are introduced they often appear in FPC memoranda prior to inclusion in the CSS annual report. Portions of the annual report that have not been previously reviewed should be reviewed when new analyses are introduced, when new conditions bring the old analyses into question and when consensus cannot be reached on the science involved. In Chapter 5 use of a random-effects model where the true effect size is assumed to vary from study to study qualifies as a new methodology that should be reviewed. Unfortunately, the ISAB timeline for this review does not allow for a complete evaluation of that strategy at this time.

Suggested modifications

ISAB/ISRP-2007-6 had suggested that the fish transported from LGS and LMN not be lumped with those from LGR, as a means of assessing whether it makes any difference from which project transportation begins. It is clear from the delivery and Eq. [2.1] that CSS has chosen not to do that separation. Although CSS has "adjusted" for S_2 and $S_2 \bullet S_3$ in its treatment of fish transported from LGS and LMN, respectively, these fish are still being lumped with those transported from LGR. There are sample size considerations involved, but it would still be useful to be able to evaluate the efficacy of allowing the smolts to "run the river" for that extra project or two, before transportation. Allowing for in-river mortality, the question is whether beginning transportation at LGS or LMN, instead of at LGR will improve subsequent survival and precision of homing on the journey from BON outward and back upriver. The ability to compare $SAR_{LGR \rightarrow LGR}$ for fish transported from LGR with those transported from LGS, with those transported from LMN, along with those tagged and returned to the river at LGR (C_1) and those that "run the river" without handling (C_0) would be beneficial. Using Eq. [2.1], which probably does have lower error of estimation, to compute the "collective experience with transportation" should be continued, but evaluation of the finer details is needed if the overall results presented here are any guide.

The model fitting section involves many transformations and data manipulations that may or may not be necessary. Furthermore selection of parameters to estimate such as the median of log transformed observations and examination of only one model fitting criterion, R^2, is not making the best use of statistical tools developed for that purpose.

For the log-linear modeling tables, presentation of both R^2 and AIC_C values would be useful. The plots of the *Z*-values have considerable scatter. That may be a scale issue, but the plots do not inspire any explanatory confidence.

Additional justification of Z as a useful statistic is needed. Z gives an instantaneous mortality rate. This is useful as long as the fish's experience in fairly uniform over the period considered. However, if there are intervals where the probability of death differs widely, these may bias the result. Take, for example, the passage through dams. If the time passing through a dam is much riskier than the time spent in the river or reservoirs and if the time passing through dams is always more or less the same, then the experience of passing through the dam plays a larger role in the calculation of Z than when fish travel time is shorter. As a result, the Z value increases even when the instantaneous rate excluding the dams is the same and the risk passing through the dams is the same. Project to project survival rates which may include varying mortality risks but are not confounded by incorporating varying time spans or survival through segments of the life history provide a more informative mortality rate and appear to be more useful measure of the fish's experience.

The results from added spill for 2007, relative to 2005, are encouraging. Clearly, if there is virtually no water to spill, as in 2001, then the decision to transport fish is influenced. Interpretations of results that are not significant should be stated carefully. For example on page 72 the statement, "It appears that since transport SARs were only significantly greater than in-river SARs in 2 years for PIT-tagged wild Chinook and Dworshak Hatchery Chinook smolts, and post-BON mortality of transported fish was not significantly less than post-BON mortality of in-river fish, then transportation provides no greater survival advantage over allowing wild Chinook and Dworshak Hatchery Chinook to migrate in-river." Note that "no significant difference" does not translate as "NO effect."

On page 77 the observation that TIRs decrease as in-river survival S_R increases seems obvious because TIRs are defined in terms of the reciprocal of S_R.

In chapter 5 the meta-analyses for TIR and D provided an interesting overview of these statistics. The results are not surprising, but it seems a worthy exercise. Chapters 6 and 7 provide a detailed look at success of fish in specific segments of their migration and in the ocean as well as more detail on the composition of the run. The biological processes involved in D, remain a challenge but it is useful to separate survival estimates for the BON to BON segment and for the BON to LGR segment and display them by return year.

The logistic modeling is extended from the CSS 10-year report to include hatchery and wild steelhead. Chapter 6 also provides the available information on the observations of straying fish and calculates a straying rate for in-river and transported outmigrants. Estimation and interpretation of D and straying are often contentious so a complete review may be necessary at some point in time.

Analyses in Chapter 7 address the extent to which wild Snake River spring/summer Chinook and steelhead population aggregates may be meeting the NPCC (2009) biological objectives. Although the primary objective in this chapter is to update the long-term SAR data series for

CSS study fish, there are a few issues that may need more attention, such as partitioning first year ocean survival from SARs and comparing SARs estimated from fish that are pre-assigned to a strategy prior to release to SARs estimated from fish that are not pre-assigned to a strategy prior to release.

Chapter 8 is a work in progress responding to a recommendation by ISAB/ISRP that the CSS conduct a comprehensive study to determine why the PIT-tagged Snake River wild spring/summer Chinook are producing lower SARs than the unmarked wild Chinook. Chapter 8 notes that because of the challenges inherent in estimating run-reconstruction SARs and properly characterizing the statistical precision of those SARs for unmarked wild Chinook, it remains unclear whether run-reconstruction SARs are or are not lower than PIT-tag SARs. No ISAB review of this ongoing work is recommended at this time, but a future review of more complete work could be useful.

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