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DEPARTMENT OF
FISH AND
WILDLIFE
FISH DIVISION

ADREC/MAINSTEM-01/COMMENT GIORGI PAPER/07

Mr. Mark Walker
Northwest Power Planning Council
851 SW 6th Avenue, Suite 1100
Portland, Oregon

Re: Comments on Giorgi et al. Report

Dear Mr. Walker:

The Oregon Department of Fish and Wildlife (ODFW) has reviewed the report "Mainstem Passage Strategies in the Columbia River System: Transportation, Spill, and Flow Augmentation" prepared by Giorgi et al., BioAnalysts Inc. for the Northwest Power Planning Council (Council) and submits the following comments. We request that these comments along with the attached Joint Technical Staff memorandum comments developed by ODFW, Columbia River Intertribal Fish Commission, Idaho Department of Fish and Game, U.S. Fish and Wildlife Service, and Washington Department of Fish and Wildlife be considered by the Council when it develops its mainstem amendments to the Columbia Basin Fish and Wildlife Program (Program).

The stated purpose of the Giorgi et al. report is to review transportation, spill, and flow measures in the National Marine Fisheries Services' 2000 Biological Opinion for the Federal Columbia River Power System (Biological Opinion) to aid the Council in their upcoming mainstem rulemaking for the Program. Specifically, the report was to address the following issues:

1. What does the scientific literature inform us regarding the benefits, shortcomings, or risks associated with each passage strategy, and as compared to other passage options?
2. Which aspects of the scientific information are in dispute?
3. What are the critical uncertainties attending each strategy?
4. What is being, or could be done to reduce uncertainty and disputes?

John A. Kitzhaber
Governor



MAR 21 2002

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Our overall assessment of the report, which is detailed in the following sections, is that it did not entirely meet the purpose of the review. The authors in certain instances selectively used and misinterpreted data and results from key studies they cited. They also failed to include several important studies that have direct bearing on the topics they discuss. As a result, the report does not present the full range of scientific opinion on several of the key issues it considers. Consequently, the Council should seek the scientific opinion of other scientists on the issues addressed by the report and put the reports' findings and conclusions in proper context as they apply them in the mainstem amendment process. To assist the Council with this task, we provide our interpretation of the information we consider relevant to transportation, spill and flow.

General

The report would have benefited from a discussion of how transportation, spill, and flow measures fit in the Biological Opinion's long-term recovery strategy. The Biological Opinion relies heavily on offsite mitigation because of the limited recovery potential of current mainstem passage measures. The report summarizes and tries to draw conclusions from what it characterizes as incremental analyses of the benefits of transportation, spill, and flow. This approach to measuring benefits has been the subject of much scientific scrutiny and debate. The fishery agencies and tribes have previously provided comments to the Council on the shortcomings of incremental analyses as bases for making decisions on mainstem fish passage measures.

The report states that its primary focus is on the "new era of evaluation" that reflects contemporary operations and state-of-the-art mark/recapture technology (post-1993). Contrary to the authors' contention, much of the information collected prior to 1993 has contemporary application and helps us understand how stocks historically performed under a wide range of environmental conditions (i.e. "retrospective" type analyses).

Transportation

Transport/In-river Ratios (TIR)

The report concludes there is a transportation benefit for hatchery spring chinook and steelhead from Lower Granite and Little Goose dams (i.e. $TIR > 1.0$). It also concludes there is no discernable transportation benefit for wild spring chinook or steelhead from Lower Granite and Little Goose or for wild or hatchery spring chinook or steelhead from Lower Monumental or McNary because either $TIR < 1.0$ or there are insufficient adult returns for statistical analysis.

The report should explain that although TIR for Snake River hatchery chinook exceeded 1.0 for some years from these studies, it does not necessarily mean that transporting fish is preferable to inriver migration because none of the studies were done with optimal inriver passage conditions where adequate flow and spill were provided to improve inriver survival. ODFW has previously commented to the Council on these experimental design deficiencies that seriously limit application of results from NMFS' transportation studies to management decisions. These experimental design issues coupled with the lack of any statistically significant data available for wild chinook and steelhead leads to our conclusion that the relative survival of transported and in-river fish remains a generally open question in need of further investigation. This conclusion is the basis for ODFW's "spread the risk" approach to river management where no more than 50% of juvenile salmon and steelhead are transported or left in-river.

The report should also emphasize that TIR is only part of the picture. The more important question is "Despite their survival relative to each other, do either transported fish and or in-river fish survive to spawn at rates and produce progeny necessary to ensure their survival and promote recovery?" As discussed below, survivals of transported and inriver fish are substantially below survival standards established for recovery.

Smolt to Adult Ratios (SAR)

The report concludes that recent (post-1996) SAR's for Snake River spring chinook are substantially higher than in earlier years and approach and exceed the Plan for Analyzing and Testing Hypotheses' (PATH) recovery threshold. The report concludes that smolt-to adult survival through the Federal Columbia River Power System may not limit recovery when marine-based survival exceeds a certain threshold.

The report incorrectly cites a 2% SAR value as necessary for recovery. It also interprets the observed SAR's listed in the tables as indicative of an improving trend that approach or exceed recovery thresholds.

A 2% SAR is not "the base threshold level that PATH identified as necessary to ensure a high probability of recovery for Snake River spring/summer chinook" (pg. 14). The report should explain that there are three SAR values associated with spring chinook survival and recovery, each representing a median value to meet one of three separate benchmarks of the jeopardy standard. To meet the standard all three benchmarks must be attained.

The 2% SAR value cited in the report is that needed to meet the 100-year survival benchmark of the standard. This is the least rigorous of the three benchmarks because its value is set assuming that the 24-year survival benchmark will be met and that remedial measures will be fully implemented within 100 years. The more relevant SAR value to the discussion in the report is the 24-year survival benchmark of the standard. This benchmark is set by weighing the recent performance of the stocks and takes into account that remedial measures will not be fully implemented in the near term. Its SAR value is 6%. Finally, the SAR value necessary for recovery, as measured by the 48-year recovery benchmark of the standard, is 4%.

The report should also more accurately interpret and discuss the SAR in its tables. In one of six years (1999) and for one of eight groups (hatchery spring chinook transported from Lower Granite) the SAR exceeds 2% (2.37%). In 1999 and other years, none of the other groups have an SAR equal to or greater than 2%. The report should also discuss earlier (1988-99) SAR data as provided in the Joint Technical staff memorandum that SAR's of Snake River spring/summer chinook rarely exceeded 2% and averaged only .75% for the 12 year data set. In contrast, a downriver spring chinook stock (Yakima River) had an average SAR of 2.75% for 1988-98 (data not available for 1999 a year with high survival) that illustrates impacts of Snake River dams on survival rates.

Differential Delayed Effects (D-Estimates)

The report concludes that delayed differential effects relative to in-river migrants are consistently evident for transported fish (i.e. more transported fish die proportionally after release downstream from Bonneville than in-river fish). However, the report further concludes that the magnitude of D regularly exceeds survival of juveniles in-river (V_c), so the survival of transported fish (through return as adults) still exceeds that of in-river migrants.

TIR, not the value of D relative to V_c , is the appropriate measure of the relative survival of transported versus in-river fish. D is a model estimate derived from TIR and is intended to measure, for life-cycle analyses, the relative mortality of transported and in-river fish from the time they enter Bonneville tailrace to when they return as adults to Lower Granite. D relative to V_c is not an empirical measure for evaluating transport benefits. D relative to 1.0 is useful in evaluating whether transported fish die, or are otherwise lost (as strays, etc.) at a greater rate than in-river fish after they pass Bonneville. The National Marine Fisheries Service (NMFS) and the state and tribal scientists agree D most likely falls between 0.5 and 0.75.

Spill

The report suggests that information acquired prior to the 1990s on the survival of salmon and steelhead that pass projects over spillways is not relevant today because operations and configuration differ significantly now than as recently as a decade ago.

Although there have been some changes, and in most instances, improvements in operations and configuration associated with spill, it's a stretch to characterize them as substantial relative to the operations and configuration investigated prior to the 1990s. Many of the observations from earlier studies are not only relevant today, but support current study results.

Effects of Flow Deflectors on Survival through Spillways

Although the report concludes the weight of evidence indicate spillways are the safest passage routes at dams, it suggests that survival through spillways is 1-3% less for projects with flow deflectors than without. However, it points out this may not represent a net decrease in survival at projects with flow deflectors because the detectors reduce total dissolved gas (TDG) by 10-20%, which may have its own survival benefit.

Although the report acknowledges that reductions in TDG due to flow deflectors may more than offset any direct mortality caused by the deflectors, it drops the discussion because the authors "have not encountered an analysis of this tradeoff in the general literature on this topic". Rather than drop the discussion, the authors should have consulted the fish and wildlife managers to explore whether and how the tradeoff could be characterized in the report.

Effects of Volume Spilled on Survival through Spillways

The report suggests the collective evidence for six balloon tag studies it examined suggest that some survival benefits may be associated with lower spill levels.

The report draws the conclusion that some survival benefits may be associated with lower spill levels based on three of the six studies examined. The other three studies indicated there was no difference in survival between the lowest and highest spill level tested. In addition, two of the three studies cited as conclusively demonstrating lower survival at higher spill volumes were conducted at The Dalles. These two studies are still the subject of an active scientific debate over the validity of the experimental design and the results.

ODFW and the Washington Department of Fish and Wildlife have raised questions on the decision by NMFS to reduce spill at The Dalles from 64% to 40% based on the fact that study results were inconsistent and not valid statistically.

Population-level Responses to Spill

The report concludes that "The collective information indicates that spillways appear to be the safest passage route." However, with regards to the NMFS evaluation of limited spill that occurred in 2001, the report states that NMFS makes "a compelling argument" that the increased survival at John Day during spill in 2001 may be a result of stock-specific changes related to time of year (temporal) and not spill effects. It cites NMFS' observations that an increasing trend in survival over time was evident during May before spill began. It also states that assessments of spill at McNary, The Dalles and Bonneville in 2001 were less clear. It concludes that it is unlikely that any experiment could be designed to definitively measure the incremental benefits of spill to survival.

The report should emphasize that the weight of evidence, including analyses by the Fish Passage Center (FPC) and NMFS, indicates spill is beneficial on a population level. For the 2001 migration season, NMFS presents evidence (changes in collection efficiency) that a lesser proportion of fish were routed to the powerhouse and bypass system of John Day during spill than when there was no spill. The report should explain that this likely resulted in improved survival, i.e. passing over the spillway significantly reduces mortality relative to turbines and bypasses, and reduces migration travel time (less delay at each dam).

The report should also more critically review NMFS' study design. Separating marked fish into several stock-based groups and three blocks (pre-spill, spill, and post-spill) greatly reduced sample sizes and increased variances among groups. Low sample sizes in the post-spill group (the FPC showed that only 8% of fish migrated during this time period) were the principle reason why no statistical differences in survivals were found between blocks. Because the proportion of each group traveling downstream was similar over time, and each group had similar survivals during pre-spill and spill periods, there is no biological or statistical reason not to pool the groups, as did the FPC. For example, FPC demonstrated that when all yearling chinook PIT tag releases are aggregated into two blocks (pre-spill and spill), survivals from McNary tailrace to John Day tailrace was significantly higher after May 21 in 2001 coincident with initiation of spill at John Day.

Finally, the report should better explain the reasons why there was no discernable difference between spill and no spill at McNary Dam. Besides effects of passage

conditions in the lower Snake River, the low volume of spill (15 kcfs) and intermittent schedule (spill every other day) at McNary failed to significantly change the proportion of fish routed to the powerhouse and bypass system. As a result, much fewer fish passed over the spillway than would under a full Biological Opinion spill program. This resulted in a small, likely undetectable, survival benefit at the project that could be attributed to spill.

Flow

Flow and Survival of Juvenile Salmon and Steelhead

The report relies exclusively on survival estimates “acquired” since 1993 to characterize flow and survival relationships through the Federal Columbia River Power System. It concludes that there is no demonstrated relationship between flow and survival for spring/summer chinook. It concludes that only extremely low flows affect steelhead survival. It concludes that flow likely influences fall chinook survival, but only as part of a complex of factors that include water temperature and turbidity.

The report does a good job explaining the biological rationale and mechanisms for flow augmentation, i.e. why increases in water velocity increases migration speed and, in turn, survival, and why keeping water temperature in a safe range for salmon and steelhead maximizes survival. However, the report subsequently limits its conclusions based on recent NMFS analyses, which regressed per-project survivals dating back to the 1970’s and flow. NMFS found that none of the regressions were statistically significant and concluded that these findings demonstrate that there “is little support for a survival-flow relationship...”. However, NMFS did not explain that it is difficult to detect statistically a flow-survival relationship using historic per-project survivals because the estimates were based on different tagging methodologies (early years were based on freeze brands and recent data based on PIT tags) and reflected survival past a different number of projects each year (range of 2-7 projects). Using historic per-project survival estimates tends to reduce the variability between years (e.g. excluding steelhead survival in 2001, survivals for chinook and steelhead ranged from .85 to .95 during 1993-2001) and reduce the ability to detect a flow-survival relationship. It also poorly characterizes the survival conditions in a given year because it doesn’t measure survival over the entire reach through which juvenile fish migrate. For example, NMFS found that survival of yearling chinook from Lower Granite to Little Goose in 2001 was high (94%) despite the fact that flows were second lowest on record. When this estimate is expanded over a longer reach (Lower Granite to Bonneville) system survival is estimated to be 68%. This is 2.5 fold higher than what NMFS measured directly for this reach. The same holds true for other

system survivals derived from per-project survivals reported by NMFS. This consequently masks the true variability in survival over the season between years and decreases the likelihood of detecting any changes in survival related to changes in flow.

Evaluating the effects of flow on survival using longer reach survivals, as was done in the FPC analysis, allows use of a wider range of survivals and flow conditions and makes it easier to detect flow vs survival relationships. For example, although longer reach survival data using PIT tags is limited to recent data sets, FPC was able to demonstrate a more marked effect of low flows in 2001 on survival than reported by NMFS for both chinook and steelhead when Lower Granite to McNary (1995-2001 data) and Lower Granite to John Day (1999-2001) reach survivals were used (see Figures 2-4 in the FPC report). Survival of juvenile spring/summer chinook and steelhead in 2001 were lower (57 and 16%, respectively) than 1995-2000 (both over 65%) due to lower flows (<50 kcfs in 2001 vs 85-150 kcfs 1995-2000).

The FPC analysis corroborates findings of analyses used to establish NMFS' Snake River spring flow objective that flows less than 85 kcfs results in high mortality of Snake River spring/summer chinook. Spring flows in 2001 were substantially below (<50 kcfs seasonal average) the flow objective of the 2000 Biological Opinion.

Flow-survival relationships in the Biological Opinion showed that survivals of Snake River spring/summer chinook were consistently low when Snake River flows were below 85 kcfs. The report should acknowledge that the data presented by FPC support the 2000 Biological Opinion minimum spring flow objective of 85 kcfs for the Snake River and that low flows as occurred in 2001 can significantly reduce survival of both yearling chinook and steelhead.

Conclusions and Recommendations

Based on our review of the available literature including that reviewed by Giorgi et al., we have made the following conclusions regarding the survival benefits and risks associated with transportation, spill, and flow measures prescribed by NMFS' Biological Opinion. These are presented for the Council to consider when it develops mainstem amendments to the Fish and Wildlife Program.

1. The Council should exercise caution in using the report's findings and conclusions because the authors do not present the full range of scientific opinion on the key issues related to the effectiveness of transportation, flow, and spill mitigation programs being implemented under NMFS' Biological Opinion. The Council should

- seek and use findings and conclusions from the state and tribal fish managers on transportation, flow, and spill.
2. The Council should recognize the report's findings and conclusions do not put into context how short-term transportation, spill, and flow measures being implemented under the Biological Opinion fit into the long-term strategy for recovery that includes offsite mitigation measures to improve early freshwater survival. Attempts by the authors to incrementally analyze the benefits of transportation, spill, and flow measures do not accurately or precisely evaluate their magnitude and nature because they oversimplify the complex relationships and interactions among the array of factors affecting fish survival. Also, any estimates of benefits of mainstem passage measures represent only a portion of that necessary under the suite of measures being implemented under the Biological Opinion to avoid jeopardy of the listed stocks.
 3. The Council should recognize the significant uncertainty of the survival benefits of transportation, specifically for wild fish, and especially given that significant improvements to inriver passage conditions are still possible. The weight of evidence at this time does not support the hypothesis that transported fish survive significantly better than inriver fish, nor does it indicate that either passage strategy results in survival great enough to ensure the recovery of listed fish.
 4. The report affirms the basis for the Biological Opinion spill program that spillway passage is the preferred passage method for juveniles based on the body of research that demonstrates that juvenile survival is highest through spillways and spill reduces forebay delay. The Council should recognize the limitations in NMFS' analyses used to evaluate benefits of limited spill and emphasize the weight of evidence that spill up to dissolved gas and adult passage constraints is beneficial even under low flow conditions as persisted in 2001.
 5. The Biological Opinion minimum flow objective for the Snake River during spring is based on studies that demonstrate that mortality of spring/summer chinook is consistently low at flows less than 85 kcfs. The Snake River summer flow objective is based on the finding that survival of fall chinook is low at flows less than 50 kcfs. Analyses presented by the Fish Passage Center showed that survival of yearling chinook and steelhead can be significantly reduced when flows are below 85 kcfs as occurred in 2001. The report concluded based on NMFS' analyses that a flow-survival relationship does not exist for spring migrants, however these analyses used historic per-project survivals that masked the true variability in survival within and between years and decreased the ability to detect changes in survival related to flow.

Mr. Mark Walker
March 20, 2002
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The Council should recognize the body of evidence not included in the report that indicates a positive and significant relationship between flow and fish survival.

We appreciate the opportunity to provide these comments.

Sincerely,

A handwritten signature in black ink that reads "Raymond R. Boyce". The signature is written in a cursive style with a large, prominent 'B'.

Raymond R. Boyce
Columbia River Coordination Program
Interjurisdictional Fisheries Management
Fish Division

Attachment: Joint Technical Staff Memorandum on Giorgi et al. Report

c: Eric Bloch, John Brogoitti, Karl Weist (OR-NPPC)
Ed Bowles, Steve Williams, Guy Norman, Tony Nigro

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Joint Technical Staff Memorandum

CRITFC IDFG ODFW USFWS WDFW YIN

March 19, 2002

Mr. Mark Walker
Northwest Power Planning Council
851 SW 6th Ave., Suite 1100
Portland, Oregon 97204

Dear Mr. Walker:

The technical staffs of the Columbia River Intertribal Fish Commission, the Idaho Department of Fish and Game, the Oregon Department of Fish and Wildlife, the Confederated Tribes and Bands of the Yakama Nation, the US Fish and Wildlife Service and the Washington Department of Fish and Wildlife have reviewed the report entitled, "Mainstem Passage Strategies In the Columbia River System: Transportation, Spill and Flow Augmentation", prepared by Giorgi et al, BioAnalysts, Inc. for the Northwest Power Planning Council. We offer the following comments on the report for the NWPPC consideration in the current fish and wildlife program amendment process.

The report summarizes study results conducted to date and offers general conclusions regarding spill, flow and transportation passage strategies and uncertainties associated with each of those strategies. Giorgi et al. rely in part on a manuscript in draft by Zabel et al. and on a NMFS manuscript (Sandford & Smith in press), which has not been available for review. Extensive technical comments have been provided to NMFS on the NMFS Zabel et al. draft, (attached) which directly relate to their application in the report prepared for the NWPPC. NMFS has not yet addressed the technical comments on the Zabel et al. draft. These technical comments would also apply to Giorgi et al. The following points summarize our detailed technical review and discussion.

- ❖ We agree that spill is the safest and best means of project passage for juvenile salmonids.
- ❖ We agree that there is a flow travel time relationship for downstream salmonid migrants.
- ❖ The narrow focus of emphasis on incremental benefits of short term passage RPAs obscures the real predominant management issue of the long term rebuilding of listed and unlisted stocks of anadromous fish.
- ❖ The treatment of survival relative to spill and flow is incomplete and can only be utilized within a limited context. The narrow focus and selective incorporation of information do not support management decisions regarding these passage strategies. However, by incorporating a broader scope of analyses from recent PIT tag information support is strengthened for flow and spill as protective measures for listed populations.
- ❖ The uncertainty regarding the transportation passage strategy is only partially addressed.

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General Comments

In general the Giorgi et al. report supports the short term RPAs included in the NMFS Biological Opinion and the current operation of the FCRPS, but the Giorgi et al. summary does not include adequate discussion of uncertainty of the present short-term passage strategies of achieving long-term recovery of listed stocks. The Giorgi et al. report emphasis on incremental analyses of the benefits of short-term passage strategies obscures the uncertainty of accomplishing recovery in the long term. The Giorgi et al. strategy document does not recognize the fact that the NMFS Biological Opinion relies heavily on off-site mitigation. Short-term passage strategies with the present hydrosystem configuration included in the Opinion are unlikely to achieve recovery unless highly optimistic assumptions about potential offsite mitigation can be achieved for habitat and hatcheries.

The authors fail to portray the poor status of salmon stocks in the Snake and Upper Columbia River. There is no mention of the fact that spring/summer chinook stocks typically fail to replace themselves with recent recruit/spawner averages (geomeans R/S) well below one. The authors do not cite recent works that have estimated probability of extinction or time to extinction. For example, Oosterhout and Mundy (2001) calculated the time to extinction for Snake River spring/summer chinook stocks to be on average approximately 18 years. The replacement rates for upper Columbia River spring chinook stocks are also extremely low (Ford et al. 2001).

Giorgi et al. are selective in their use of available analysis and emphasize incremental benefits analysis. State and tribal fishery managers have previously provided comments and concerns regarding the shortcoming of incremental analysis and its inappropriateness in fish passage management decisions. Discussions of the incremental benefits of the present fish passage mitigation RPAs do not address the question of long-term recovery in a life cycle context. Giorgi et al. are selective in the presentation of information, excluding alternative analysis and neglecting to illuminate recent findings such as the adverse impact of repeated project bypass passage. In addition some CSS study conclusions were not included which would affect the context of the discussion of the transportation passage strategy.

Regarding the discussion of spill, we agree with the overall report conclusion that spill is the safest and most effective means of passage at the projects and that spill affects smolt travel time. In the discussion of spill and survival in 2001, Giorgi et al. discuss findings from the Zabel draft. Again, extensive comment was provided to NMFS, which would apply to the report. A clear benefit of spill was observed during the 2001 migration. This along with other spill passage data provide an indication that spill for fish passage should be provided in all flow years, including years when the Biological Opinion flow target is not met. The Giorgi et al. report does not address the issue of summer spill in the Snake River. This is an issue that is planned for study.

We agree that current transportation studies indicate that delayed mortality appears to be occurring on both wild and hatchery fish that are transported. We agree that the data indicates that transportation at all present sites may not be advisable given present results. In addition, the report relies on a NMFS transportation manuscript that is not yet available to the public and the Comparative Survival Study status report, which is available to the public. Since the NMFS manuscript is not available it is difficult to comment on the Giorgi et al. use of those results. However, Giorgi et al. were selective in their use of the CSS study results, omitting mention of some of the other key findings regarding the impact of transportation on wild stocks and the failure to meet the 2%-6% return rate requirement to achieve recovery.

Giorgi et al. address flow augmentation and conclude that flow is directly related to smolt travel time, which accurately reflects regional scientific agreement. Giorgi et al. rely heavily on the draft Zabel et al. 2001 manuscript in other aspects of the flow survival discussion. The comments provided by the state and tribal salmon managers on Zebel et al. (attached) apply to the Giorgi et al. document. Giorgi et al. conclude that there is no flow survival relationships on the basis of the Zabel et al per-project survival analysis of freeze brand and PIT tag data combined. There are significant technical problems with this approach, which extrapolates short reach survival to the whole hydrosystem, which tends to overestimate survival for the whole hydrosystem passage corridor. Because project reservoirs differ in length and survival is not estimated over the same number of reaches, comparisons over an average per project survival will not be consistent because the unit of comparison varies. A comparison over an average per mile survival will be more consistent because a mile is a unit that is constant. We can expand the average survival per mile to length of the hydrosystem, which is also constant, to characterize how changes in water travel time affect survival through the hydrosystem. These components of the Giorgi et al. report should be considered cautiously.

Specific Comments

Executive Summary

p. vii. "...reaching SAR levels in 1999 that approach and in some cases exceed the 2% minimum recovery threshold... This suggests that neither transport nor inriver migration conditions may be a bottleneck to recovery, when marine-based survival is at some adequate level": PATH identified the 2%-6% SAR range as the range within which Snake River spring/summer chinook stocks should fluctuate, rather than just reach occasionally. The suggestion that neither transport nor inriver survival is a bottleneck to recovery in good ocean years is inappropriate without supporting life cycle modeling, and contrary to results of the PATH modeling. The PATH FY98 report (Marmorek et al. 1998, p. 41) actually concluded, "...median SARs must exceed 4% to achieve complete certainty of meeting the 48-year recovery standard, while meeting the 100-year survival standard requires a median SAR of at least 2%."

p. x. Premises for flow augmentation: The diagram describes the premise for flow augmentation, however the report does not adequately identify that inriver survival of smolts within the hydrosystem is only a part of the issue. While the report emphasizes only inriver survival (through portions of the hydrosystem) vs. flow, analyses of SARs or life cycle survival (adult recruits per spawner) are needed to capture the hypothesized full effect of flow on survival. This is because water velocity affects fish migration speed, affecting the cumulative exposure to stressors, synchrony of estuary arrival with the smolt's physiological state, and smolt condition (sufficient energy reserves necessary for survival in the saltwater). The NMFS whitepapers (NMFS 2000) present considerable evidence that SARs and life cycle survival are correlated with flows and velocities experienced by smolts during their migration through the hydrosystem, and should be referenced in this report.

Transportation

The authors discussion of the transportation passage strategy does not adequately illustrate the significant uncertainty regarding transportation. Significant available information regarding the transportation information is not included in the report. The report correctly indicates that transportation results to date from Lower Monumental and McNary dams raise the question of continuing transportation at those sites. The report does not adequately address the data available regarding the transportation of wild fish. Those results indicate that transporting wild fish does not provide a benefit over in-river migration when adequate spill and flow are provided for in-river migrants.

Delayed mortality is the reason that the benefits of transportation are less than originally hypothesized when compared to in-river migrant mortality. Extra mortality of in-river migrants due to the hydrosystem is not discussed in the report but NMFS Biological Opinion RPA actions were developed to address this issue.

Although Giorgi et al. refers to the lower SARs of fish passing through bypass systems, this result is utilized as an argument for transporting fish. However, the bypass systems at the collector projects are primarily designed and operated to collect fish for the transportation program. Giorgi et al. fails to recognize this as a component of the transportation program and a potential factor in transportation returns.

The authors highlight limited individual hatchery group returns that are near the minimum 2%, hypothesizing on this basis that the ocean and not the hydrosystem is the limiting factor on adult returns. Salmon stocks throughout the northwest benefited from good ocean conditions in 1997 through 1999. The effects of the hydrosystem, passage through four additional dams, are evident when smolt to adult returns of Snake River versus Yakima River fish are compared relative to the 2% to 6% recovery range. This comparison indicates the likely magnitude of the impact of the hydrosystem even in years of good ocean conditions.

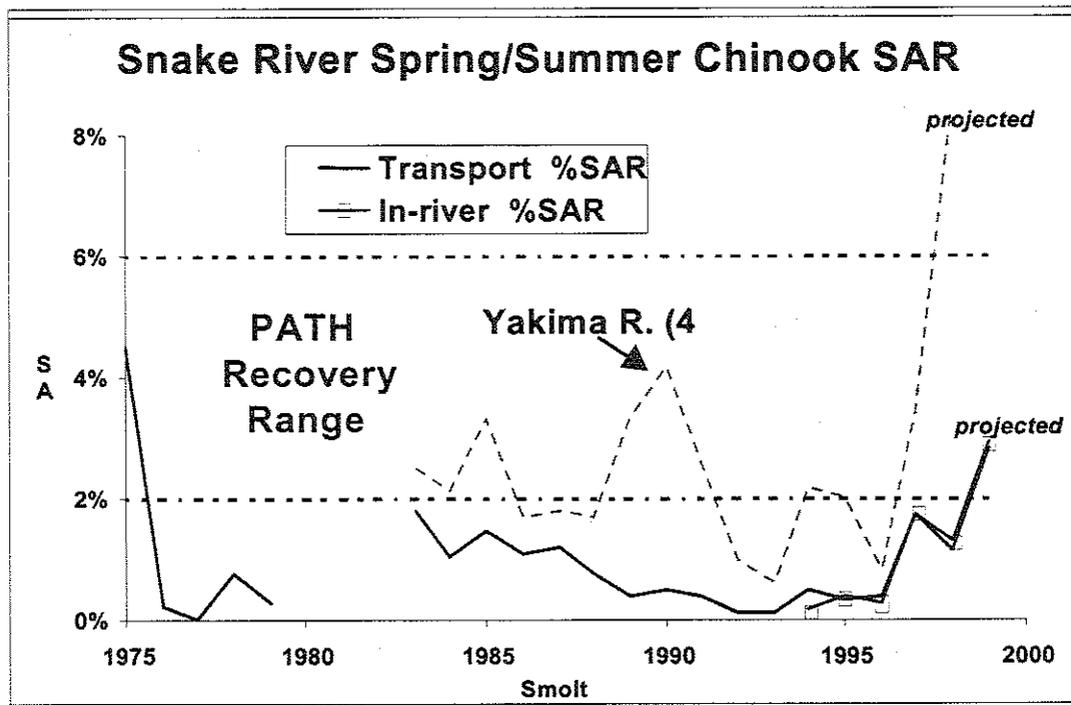


Figure 1. Smolt-to-Adult-Return (SAR) rates for Snake River spring/summer chinook stocks and for Yakama River Spring Chinook.

As indicated in Figure 1, Snake River spring/summer chinook rarely meet or exceed the two percent minimum suggested by PATH. Although they migrate past four dams, the Yakama stock often meets or exceeds the minimum. From 1988 through 1999, the average SAR for the Snake River fish was 0.75 percent as compared with 2.75 for the Yakama fish for 1988 through 1998. (Note: No data for the Yakama stock in 1999) Figure 1 illustrates the potential drawback of comparing only the SARs of transport and inriver migrants.

p. 7. Test $D < V_c$: This proposed hypothesis test is redundant with and less direct than a test of $TIR > 1.0$. The primary purposes of estimating D are to document a portion of delayed hydrosystem mortality (if $D < 1$, transported smolts incur more delayed mortality than in-river fish), and for use in life cycle modeling to evaluate effectiveness of alternative management options with respect to survival and recovery of listed species. Also, caution needs to be used for V_c values, particularly when expanding per project rates. The per project method tends to overestimate survival rates.

p. 7. Discussion on D: The report should clarify that D is only part of the delayed mortality picture. Evidence also exists for delayed hydrosystem mortality to inriver fish (termed "extra mortality" in PATH and the BiOp). There is evidence of substantial delayed mortality among the inriver migrants that overlays the relative comparisons represented in Ds and TIRs (Schaller et al 1999; Deriso et al. 2001; Budy et al. 2002).

p. 8-9. TIR ratios from LGR and LGO only: The report's emphasis on TIR ratios from LGR and LGO is somewhat misleading. The overall effectiveness of the transportation program *relative to inriver passage* is best reflected by overall TIR ratios (T_0/C_0). [TIR estimates for fish transported from all dams- T_0]

p. 11. Hatchery chinook transported from LGR and LGO have yielded TIR estimates greater than or equal to 1.0: Note that this does not apply to all hatchery stocks (e.g., Dworshak). Again, T_0/C_0 is the more appropriate metric to report for TIRs to reflect overall relative effectiveness of the transportation program.

p. 15. Figure 6: The plotted geometric mean (0.60) for inriver control hatchery chinook appears to be incorrect.

p. 15-17. Intra-annual changes and SARs, TIRs and Flow: The review is incomplete on these topics. The report cites two NMFS studies that did not identify a relationship between SARs or TIRs and flows. However, no reference was made to the NMFS whitepaper (NMFS 2000), which presented substantial correlative evidence between adult return success and inriver flow and velocity conditions. In addition, PATH retrospective analyses showed a significant relationship between water travel time and the differential stock

performance ("mu") of Snake River and downriver stocks (Deriso et al. 1996; 2001). Since dam completion, Snake River stocks survived only about 1/3 as well as downriver stocks, and the performance gap narrowed in high flow years and widened in years of poor flows. (Schaller et al. 1999; Deriso et al. 2001)

p. 17. Differential delayed effects (D-estimates): The range of D's given in the first paragraph (wild chinook 0.63-0.73; wild steelhead 0.52-0.58) were only from NMFS estimates for the BiOp, and should not be attributed to Bouwes et al. (2001). Wild chinook D estimates reported by Bouwes et al. were somewhat lower than the NMFS estimates, equaling 0.57 for 1994-1999, and 0.51 excluding 1994. Also, V_c until recently cannot be measured directly and needs to be estimated by expansion. This makes it difficult to determine if V_c differs significantly from D.

p. 17. "The key issue is whether D differs significantly from V_c " (inriver survival): We disagree with this inference. This implies that TIR is all that matters, which is counter to both the PATH and BiOp analyses and conclusions. Testing of TIR is best done directly, rather than using D and V_c . D alone is useful to demonstrate a portion of the total delayed mortality effect from the hydrosystem, but is only part of the delayed mortality picture. If $D < 1.0$, transported smolts die at a greater rate in the estuary/ocean than their inriver counterparts. Further, both D and delayed mortality of inriver fish ("extra mortality") are influential in determining effectiveness of alternative management options (NMFS 2000; Marmorek et al. 1998).

p. 19-20. Collectively D estimates suggest that differential delayed effects are nearly always indicated for transported fish of either species, as indicated by dominance of values < 1.0 . However, that is not necessarily bad, if $D > V_c$: The first sentence is accurate. Problems with the inference in the second sentence are addressed above.

p. 20. Quantitatively robust estimates of SAR, TIR and D requires increased PIT tagging (which may be impractical) and relying on improved natural cycles with larger adult sample sizes: Should note that Comparative Survival Study (CSS) will increase sample sizes in 2002-2004 migrations to improve precision of estimates. Also, analysis of SARs requires a long time series incorporating both good and poor natural cycles.

p. 21. Mechanisms contributing to delayed differential effects for transport: The report only addressed delayed mortality for transported smolts relative to inriver migrants, but neglected the delayed mortality that inriver smolts may suffer as a result of the hydrosystem ("extra mortality"). The PATH weight of evidence process (Marmorek and Peters 1998) and Budy et al. (2002) and Schreck (2002) presented substantial evidence for the occurrence of and mechanisms for delayed hydrosystem mortality.

p. 25-26. Summary of TIRs for LGR, LGO, LMN and MCN: The equivocal transport results for wild fish from all dams, and hatchery fish from lower dams tend to support a spread the risk approach, given current hydrosystem configuration and RPA actions. There is little evidence that either transportation or inriver passage routes have been resulting in adequate SARs for survival and recovery (Bouwes et al. 2001). Either transport or inriver SARs need to be improved substantially and consistently, before one passage route could be favored under RPA conditions.

p. 25. "...reaching SAR levels in 1999 that approach and in some cases exceed the 2% minimum recovery threshold... This suggests that neither transport nor inriver migration conditions may be a bottleneck to recovery, when marine-based survival is at some adequate level": This statement is not supported by existing life cycle survival analyses. See above comment on this statement in the executive summary at page vii.

Spill

We agree with the general conclusion that spill is the safest and most effective route of passage for downstream migrants. Our comments on the Zabel analysis of the benefits of spill in 2001 are attached. Past studies have shown that studies of incremental benefits of spill are not useful in management considerations because they are difficult to conduct with sufficient precision to determine incremental effects and small differences in survival or passage efficiency. In addition project-by-project spill studies do not capture the cumulative effects of spill on juvenile survival, survival to adult and travel time. Giorgi

et al. discussed The Dalles spillway survival study but declined to incorporate discussion of the significant technical and analytical issues with those results and their application. (The Dalles spillway survival study comments, http://www/fpc.org_docs.htm)

p. 33. Use of models to evaluate spill options, reference to NPPC (2001) staff issue papers as an example: The report should also reference joint technical staff comments by the region's fishery agencies and tribes on the severe limitations of this particular application (available at http://www/fpc.org/fpc_docs.htm).

p. 36. "Based on these data, we conclude that spillways are the safest passage routes at dams where these types of evaluations have been conducted": This statement is well supported and should also be referenced at p. 41-42 in relation to the NMFS 2001 study and hypotheses explaining the pattern of increased survival during the spill period at John Day Dam.

p. 41-42. NMFS 2001 spill analysis and temporal survival patterns: The final report should also reference the Fish Passage Center comments (Feb. 28, 2002) on the draft NMFS 2001 analysis, pointing out that these temporal patterns in previous years also coincided with periods of higher spill and/or flow. Given that spillway passage routes are the safest (see above), there is a strong biological mechanism to explain the observation of increased survival during the spill period at John Day Dam in 2001 (and previous years).

p. 48. NPPC 2001 staff analysis of spill scenarios: As noted for page 33, the report should also reference joint technical staff comments by the region's fishery agencies and tribes on the severe limitations of this particular application.

p. 61. Two aspects to biological window, ecological/environmental condition of estuarine and marine waters and physiological preparedness for smolts to adapt to seawater: Additional mechanisms that should be mentioned in this section include altered fish condition due to migration delay (depleted energy reserves) and chronic or accumulated stress from delay and multiple dam passage (Marmorek and Peters 1998; Budy et al. 2002). Years of high flow and spill tend to reduce migration delay, promote passage by less stressful routes (spillways), and conserve the smolt's energy during migration (Congelton, COE Transport and Delayed Mortality Workshop, Feb. 2002). These effects likely would be manifest outside the hydro system during estuary and early ocean rearing. Yet the report sections 3.1 and 3.2 generally ignore adult return data in favor of reach survival estimates. The report should reference the NMFS (2000) white papers to document the existing correlations between SAR and recruit per spawner information and flow or water velocity during the smolt migration.

Flow Augmentation

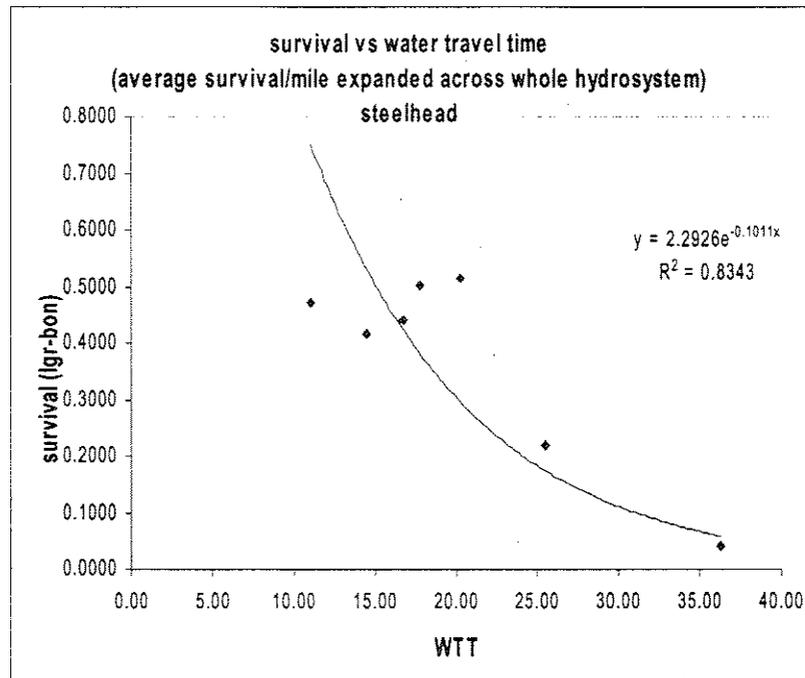
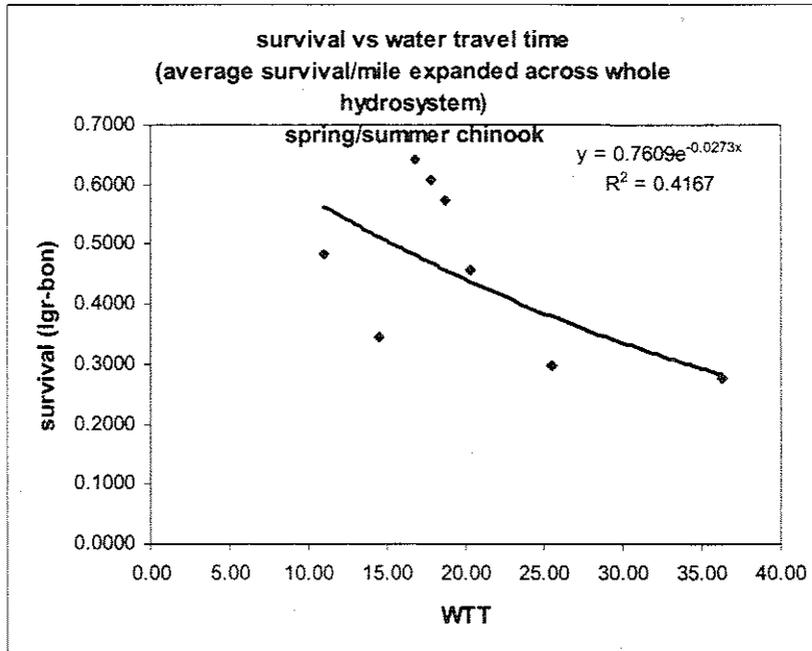
The Giorgi et al. report discussion on flow augmentation as a passage strategy discusses travel time and limits discussion of survival and flow for spring chinook to a per project analysis from Zabel et al. Our specific comments on the Zabel et al. draft are attached. The selective inclusion of information and analysis on flow and survival precludes other analysis that provides additional insight and basis for management decisions. Giorgi et al. did not include information from the PATH Retrospective Report on Spring Chinook (Marmorek, 1996) which suggested a strongly flow dependent survival relationship. In addition alternative analysis should be incorporated to provide a broader base for future fish passage management and mitigation decisions. In addition Giorgi et al. refers to summer flow augmentation regarding juvenile fall chinook migrants as "equivocal". Giorgi et al. neglects to include recent available studies that provide strong evidence that flow augmentation is clearly beneficial for juvenile fall chinook migration rate and survival.

For spring migrants, an alternative analysis to that performed by Zabel et al. also shows benefits of higher flows. If survival per mile is regressed against average water particle travel time and average proportion spilled over the length of the migration season a significant relationship is observed for both spring/summer chinook and steelhead. Survival estimates for yearling chinook were from CSS (Bouwes et al 2001) in 1994-2000 and NMFS (Zabel et al. 2001) in 2001; steelhead survival estimates were from NMFS whitepapers for 1994-1999 and NMFS (Zabel et al. 2001) in 2001. Stepwise regression results for spring/summer chinook indicated survival per mile was moderately dependent ($r^2=0.54$; $p<0.04$) on a combination of water travel time and spill (interaction term). Stepwise regression results for steelhead indicated survival per mile was strongly dependent ($R^2=0.98$; $p<0.005$) on water travel time, spill and the interaction of spill and water travel time. These analyses bring an additional facet to the consideration of

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flow augmentation as a passage strategy. The following plots show that flow is an important component for steelhead and spring/summer chinook survival through the hydrosystem.



P 65. Recent investigations: Giorgi et al suggest that strong correlation among the predictor variables flow., water temperature, turbidity and fish size confound the ability to identify the factors that affect downstream migration rate of fall chinook salmon smolts. Giorgi et al. do not include a recent analysis to determine the factors affecting downstream migration rate of wild Snake River fall chinook salmon smolts (Connor 2001). In the Connor analysis the predictor variables release fork length, release water temperature, flow and distance traveled in riverine habitat were not correlated. Year-by-year (1995 to 2000) multiple regression models indicated that these four variables explained from 62 to 86 % of the observed variability in downstream migration rate (N range 119 to 569; all P values <0.0001). Downstream migration rate was predicted to increase as flow increased. Connor (2001) concluded that migration rate will increase as flow increases provided when prerequisites for seaward migration are met, and fall chinook salmon are behaviorally disposed to move downstream.

p. 67-68. NMFS per-project survival vs. flow analysis: The FPC Feb. 28, 2002 comments on NMFS 2001 draft report point to serious flaws with the per-project survival analysis. The per-project survival estimates may be very misleading because they are derived from differing length reaches in different years. In 2001, per-project survivals for short reaches would have grossly overestimated survival through the entire hydrosystem (FPC 2002). An alternative means of comparing survival among years, using the data sets with consistent reaches over years did demonstrate a relationship between flow and reach survival (FPC 2002). Also as noted above, reach survival are not expected to reflect the full influence of flow or water velocity on survival. The report does indicate the correlation between travel time and flow for yearling chinook salmon, and the possibility that other benefits may accrue from swifter migration at higher flows, and research efforts to investigate such mechanisms. The report should also reference the NMFS (2000) whitepaper that document the existing correlations between SAR and recruit per spawner information and flow or water velocity during the smolt migration.

p.70. Snake River fall chinook salmon

Giorgi et al suggest that strong correlation among predictor variables, flow, water temperature, and turbidity confound the ability to identify the factors that affect survival of fall Chinook salmon smolts. In a recent analysis to determine factors affecting survival of wild Snake River fall Chinook salmon (Connor 2001), the predictor variables flow and water temperature were not correlated and both variables entered into a multiple regression model fit to describe survival., Flow and temperature explained 92.3% of the observed variability in survival (Years 1998-2000; N=12 within year replicates; P <-0.0001). Based on this regression model, survival was predicted to change by approximately 3% with each change of 100 m³/s in flow when temperature was held constant. The change in survival was approximately 7% for each 1°C increase or decrease in temperature when flow was held constant. Connor (2001) concluded that flow and temperature assert their influence on survival simultaneously.

p. 72 Flow Augmentation evaluations

Two analyses were available prior to the submission of the Giorgi et al review to the NWPPC. The first analysis was based on multiple regression, and the results indicated that downstream migration rates for Snake River fall chinook salmon would decrease from 0.1 to 0.2 km/day if summer flow augmentation was not implemented from Dworshak Reservoir and reservoirs upstream of Brownlee Dam (Connor 2001). This translates to the average fish taking from 1 to 5 days longer to pass Lower Granite Dam without the aid of summer flow augmentation. The second analysis was also based on regression modeling and it indicated that summer flow augmentation increased survival of fall Chinook salmon smolts up to 24 percentage points (Connor 2001). Connor (2001) concluded that summer flow augmentation increases migration rate and survival of fall chinook salmon smolts passing downstream in Lower Granite Reservoir.

p. 80. "Flow effects on smolt survival based on PIT tag estimates acquired since 1993 provide the most relevant data set for characterizing smolt survival dynamics through the impounded mainstem Snake and Columbia rivers": This is a highly questionable statement since it ignores the delayed effects due to migration delay, synchrony of smolt arrival into the estuary, and overall impacts of stress and bioenergetics on ultimate survival to adult. In addition to evidence in the NMFS (2000) whitepapers mentioned above, the PATH results indicated that stock performance was related to the water travel times experienced during the smolt migration (Deriso et al. 1996, 2001). This information was also summarized in the joint technical staff memos on the NPPC 2001 migration issue paper (available at http://www/fpc.org/fpc_docs.htm).

p. 81. "In the Snake River, the NMFS PIT tag-based survival estimates acquired since 1993 form a strong foundation for examining and defining such [flow-survival] relationships": The reach survival estimates form only a partial basis for such examination and definition (see above comments).

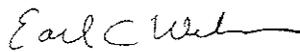
P81 and 82. Critical Uncertainties On pages 81 and 82, Giorgi et al wrote that absent a well-designed experiment, we would likely be left with the equivocal results we now have. This conclusion contrasts with the conclusion presented by the Independent Scientific Advisory Board on April 27, 2001 (ISAB 2001): "Flow augmentation should continue, largely because Connor's studies show benefits for wild fish and the NMFS studies show high correlation of flow and survival in a designed study."

p. 82. "A multi-faceted, comprehensive evaluation of the biological benefits and risks associated with flow augmentation is advisable. Wherever possible, quantitative analyses should be undertaken. The effort will require physical and smolt passage modeling": Should include life-cycle modeling to evaluate full effects of flow on survival.

Conclusion

To conclude the Giorgi et al. report represents a well-organized but incomplete summary of recent studies, although many specific components of the report should be considered within a limited context in fish passage management determinations. The challenge for the region is the prioritization of research opportunities to management decision check points to arrive at definitive actions and long-term decisions. The Giorgi et al. report does not present any compelling new information, which would cause us to question the flow and spill measures in the Biological Opinion. In fact, our analyses of the most recent PIT tag information and analyses for fall chinook by Connor (2001), strengthen support for flow and spill measures as effective in protecting listed salmon and steelhead populations. Thank you for the opportunity to provide comments. We hope they will be helpful in the Program amendment process.

Sincerely



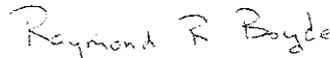
Earl C. Weber
Columbia River Intertribal Fish Commission



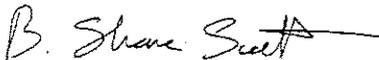
Steve Parker
The Confederated Tribes and Bands of the Yakama
Nation



Stephen Pettit
Idaho Department of Fish and Game



Ron Boyce
Oregon Department of Fish and Wildlife



Shane Scott
Washington Department of Fish and Wildlife



Howard Schaller
U.S. Fish and Wildlife Service

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