State, Federal and Tribal Fishery Agencies Joint Technical Staff

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Idaho Department of Fish and Game
Nez Perce Tribe
Oregon Department of Fish and Wildlife
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US Fish and Wildlife Service
Washington Department of Fish and Wildlife

Agencies and tribes review comments – Bonneville Power Administration Summer Spill Analysis

The technical staffs of the state and federal and tribal fishery managers have attended the regional forum meetings at which the Bonneville Power Administration (BPA) presented their "Summer Spill Analysis". We have also reviewed the spreadsheet and power point slides that were posted on the TMT web site for the regional forum. The conclusions of our review are summarized in the following points. A detailed discussion of each point follows our summary conclusions.

Conclusions

- The "Summer Spill" analysis has been presented verbally, with power point slides. A spreadsheet was posted. However, BPA has not prepared a written document explaining the analysis, hypothesis, assumptions, parameters and most importantly how technical comments regarding the limitations of the SIMPAS model, previously distributed from the fishery agencies and tribes, have been addressed in this analysis. The agencies and tribes have requested a written manuscript of this analysis, complete with assumptions and supportive data based upon the scientific literature and reserve the right to provide additional comments when the written document is provided.

- The "Summer Spill Analysis" is an inappropriate application of the SIMPAS model. The agencies and tribes have advised the region on several occasions regarding the limitations of the simple spreadsheet SIMPAS model. (see attached correspondence, Appendix A). SIMPAS ignores uncertainty and risk, and does not provide confidence intervals for each model parameter. The NOAA Biological Opinion specifically discusses the limitations of SIMPAS as it pertains to prediction of adult returns and delayed mortality. The BPA impact analysis results utilizing SIMPAS are highly uncertain and do not provide a robust foundation for fish passage management decisions.

- SIMPAS assumptions regarding transportation operations and benefits present serious potential for underestimating impacts on ESA-listed Snake River fall chinook.
- The offset analysis and predicted benefits from the proposed offsets are highly speculative without a supporting empirical analysis. There is a high level of uncertainty associated with the predicted benefits of offsets, so that the predicted benefits are unlikely to occur. In addition, in specific cases, the proposed offsets are not additional to those hydrosystem mitigation measures that are established as part of a separate mitigation agreement, such as those included in FERC license agreements. As such the agencies and tribes do not believe that there is adequate technical basis to support the projected benefits of the BPA proposed offsets. The predicted benefits of the proposed offsets are extremely optimistic, and uncertain. The offsets also assume that the current measures being implemented under the Biological Opinion are adequate to avoid jeopardy of listed stocks. Whether this is true will be unknown for several years after the 5 and 8 year check-in points; these check in evaluations may indicate that additional mainstem measures may be necessary to avoid jeopardy and insure survival of ESA listed stocks.

- Predation on juvenile salmonids by northern pikeminnow will likely increase in the absence of spill, adding to the number of salmonids required to be saved by any "offset" measure. Therefore, estimates of the number of salmonids that would be additionally consumed if summer spill was reduced could be large, and would likely not be offset by the relatively small increase in exploitation rate assumed in the offset proposal.

- The analysis failed to consider and include increased summer flow as a potential offset that is supported by fish passage data. Flow augmentation is a potential offset that could provide real time mitigation for impacts based on empirical research (Connor et al. 2003). Despite this potential, it and other options were not considered in this document.

- The BPA analysis is based upon an incremental benefits approach, analyzing spill for fish passage, independently of other measures and cumulative impacts. This is contrary to the ecosystems approach included in both the Northwest Power Planning Council Fish and Wildlife Program and the NOAA Biological Opinion and an ecosystem approach recommended in Return to the River (ISG 1996). The assessment of recovery and rebuilding is based upon a suite of measures, which compliment and interact with each other to achieve the overall goal. Therefore it is inappropriate to analyze protection measures individually against cost or recovery and rebuilding criteria. In considering the entire suite of measures in the Biological Opinion NOAA attempted to balance risks and benefits of measures. The elimination or reduction of spill should not be considered without a full evaluation of the entire suite of measures in the Opinion and other mitigation programs, allowing consideration of other measures that will balance the impact of reduced spill. These issues should not be addressed one by one but in the context of the entire NOAA Biological Opinion and other mitigation and protection programs for listed and unlisted stocks. In that way a complete analysis on the impacts to listed stocks recovery and unlisted stocks will be possible.

- The BPA analysis is presented in a narrow context of incremental benefits, average conditions and individual mitigation measures. This approach underestimates potential impacts by failing to recognize that adverse impacts are cumulative both within years and across years in life cycle terms. A single average year analysis does not provide an adequate basis for management decisions.

- BPA has presented an incomplete technical analysis regarding the impacts of a potential reduction in summer spill, and technical analysis supporting the predicted benefits of the proposed offsets are extremely uncertain. This results in a high level of uncertainty for decisions that consider the effects of reducing summer spill.

Written Analysis

Although BPA requested written comments on the "Summer Spill Analysis" they did not provide a written manuscript documenting the analysis. BPA gave detailed and summarized verbal presentations with Power Point visual aids describing their analysis. In the verbal presentation BPA responded to questions regarding the analysis by repeatedly stating that caveats associated with their analysis that could be lost in the application of the results by policy makers. This is an accurate observation, which can be avoided by presenting the caveats, and limitations in writing. Verbal presentations always differ with each presentation and with the questions asked by various audiences, this results in many different impressions of the analysis, supporting data, and results. A written document creates a definitive and common basis for response by all parties, without the vagaries and variability that results from verbal presentations.

SIMPAS - Serious application limitations for management decisions

The NMFS 2000 BIOP recognizes the limitations in the use of SIMPAS and caveats results because the model does not account for the potential effects of various fish passage options (such as spill) on forebay passage in terms of reducing delay, residence time, and predation. NOAA has clearly recognized the limitations of SIMPAS:

- "The juvenile survival rates … are based on juvenile passage studies only and cannot be used to infer the likelihood of adult returns." (NMFS Biological Opinion. Dec 21, 2000. Appendix D. page D-9.)

SIMPAS analyses are woefully inadequate in its assessment of risk and uncertainty. Each of the SIMPAS model parameters has uncertainty (i.e., confidence intervals) and potential biases associated with them, which are completely ignored. Multiplying several estimates together, (propagation of errors) each with their own uncertainty and bias, makes for a very wide range of possible (and very plausible) survival rates. There is also significant uncertainty in the migration timing and population sizes used in the BPA analysis. The BPA analysis disregards these important uncertainties, making application of the analysis to assessing risk to the affected fish populations extremely difficult.

The SIMPAS model predictions of adult returns are greatly influenced by the lack of parameters such as delayed mortality, which affect adult returns. The BPA analysis did not consider a range of potential scenarios. Even with the serious limitations of SIMPAS, BPA could have evaluated a greater range of management scenarios. For example, Bouwes (2004) illustrated that even utilizing SIMPAS, with all of it's limitations, including realistic parameters, such as delayed mortality results in large increases in fall chinook when a spring-like spill program in the summer is considered. Obviously, it is the range of potential outcomes that is most important for good decision-making, not just the point estimates of central tendency that were provided by BPA. The BPA analysis fails to provide ranges of potential outcomes that account for: model uncertainty, migration timing uncertainty, population size uncertainty, flow uncertainty, ocean conditions uncertainty, SIMPAS parameter uncertainty, and mitigation measure uncertainty. Ignoring uncertainty in these type of assessments is counter to the internationally adopted precautionary approach to fisheries management.

In the analysis presented, each of the SIMPAS parameters is assumed to be constant over time. This clearly results in an oversimplification and underestimation of mortality. In the rare cases that actual parameter estimates are used in SIMPAS, these estimates come from research conducted during early summer. Passage (reservoir and project) survival of summer migrants in August is consistently lower than July and these temporal differences are not addressed in the BPA analysis.

The analysis has failed to describe how a reduction in summer spill will affect the probability of recovering ESA-listed stocks. The analysis fails to match offset measures with the stocks that will be impacted.

Reliance on transportation

The BPA SIMPAS analysis relies on unfounded benefits of transportation of smolts therefore potentially seriously underestimating the impact of reduced spill on listed Snake River fall chinook

The BPA analysis assumes maximization of transportation of fall chinook juvenile migrants. This assumption and the failure to incorporate delayed mortality results in the potential underestimation of the impact on listed Snake River fall chinook. Little is known about the effects of screen bypass and transportation on fall chinook (Williams et al. 2003). Studies to evaluate the effect of screen bypass and transportation on fall chinook salmon juveniles have only recently begun. Currently there is no data indicating that screen bypass and transportation provides an adult return benefit over allowing fish to migrate in-river. In fact, there is limited data suggesting that screen bypass and transportation may be more harmful than beneficial. For example, the NOAA Fisheries Technical memorandum on the effects of the FCRPS on salmon populations (Williams et al. 2003) states that for Snake River fall chinook the D-value of 0.2 used in the 2000 BiOp is reasonable, albeit highly uncertain. The Williams et al. 2003 Technical memorandum also reports that 50% of Snake River PIT-tagged fall chinook adult returns were not transported as juveniles, yet the SIMPAS spreadsheet estimates that currently only 15% of Snake River fall chinook juveniles arriving at Lower Granite Dam are not transported. This discrepancy with field information should be addressed. In addition, approximately 70% of these PIT-tagged adult returns from non-transported fall chinook juveniles were not detected at a collector project. When and how these undetected in-river fall chinook juveniles migrated is important, because available data suggests, that they are returning at a much higher rate than transported fall chinook. The SIMPAS parameters utilized regarding transportation of fall chinook do not reflect realistic potential implementation of the reduction of the summer chinook transportation program, which could significantly change the predicted impacts on Snake River fall chinook related to the proposal to reduce spill. Bouwes (2004) (Appendix A) utilizes SIMPAS with realistic parameters and illustrates that eliminating transportation of fall chinook and implementing a spring like spill program in summer months could provide significant increases of listed Snake River fall chinook.

SIMPAS predicted impacts are consistently biased low

In 2001 NMFS recognized that these direct survival estimates were too optimistic for the low flow conditions that were expected in 2001. SIMPAS dam impacts are biased low because differences in survival from reach estimates are attributed to reservoir mortality. SIMPAS survival estimates do not correspond with historic stock performance (see Agencies and Tribes, April 20, 2001 letter, APPENDIX A). Even with full implementation of the BiOp spill program, recovery targets have not always been achieved. In part this is because the Biological Opinion allows the passage spill and flow targets to be relaxed in the event of BPA declared power system or fiscal emergencies.

This SIMPAS analysis does not account for the additional mortality that would be imposed by spill reductions and the subsequent impact on probability of achieving recovery for ESA listed stocks. Considerable evidence suggests that "extra mortality" and delayed mortality is related to earlier hydrosystem passage experience (Budy et al. 2002). The use of SIMPAS ignores this critical finding and completely discounts the delayed impacts of eliminating spill on population viability and recovery.

For example, to illustrate limitations of SIMPAS discussed in the previous paragraphs, we compared empirical data available for spring chinook against SIMPAS predicted results for spring chinook. The following comparison clearly shows that using SIMPAS to predict adult impacts from reduced spill will probably seriously underestimate the true impacts of reducing spill (Figure 1).

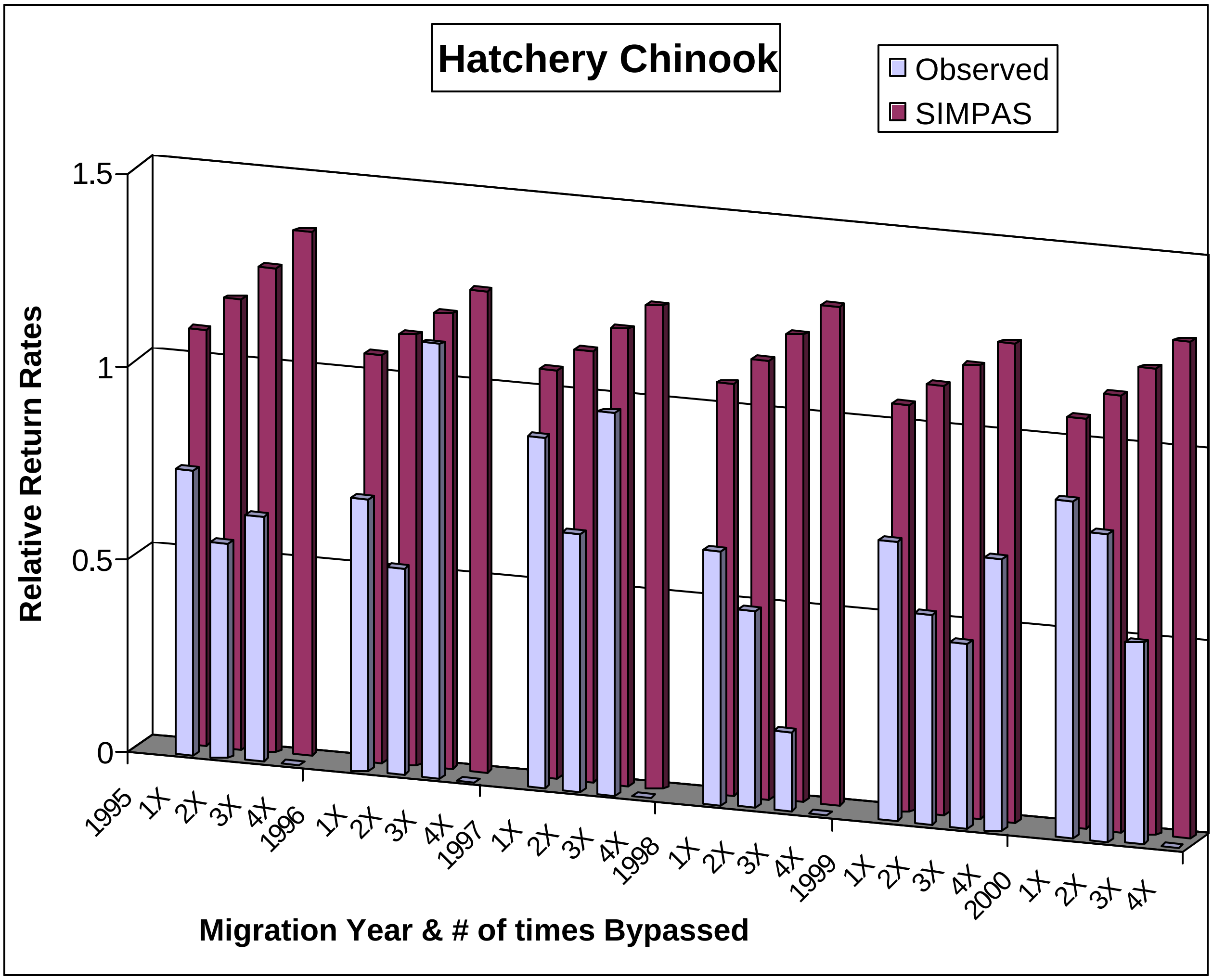

Figure 1. The observed bypassed PIT-tagged hatchery chinook salmon adult return rates relative to non-detected smolts reported in the NOAA Fisheries Technical Memorandum on the effects of the FCRPS on salmon populations (Williams et al. 2003; Figure 22.), compared to the direct survival (SIMPAS) predictions of these relative adult return rates.

This figures shows the observed adult return rate of PIT-tagged hatchery spring/summer chinook smolts relative to the NOAAF estimates for the non-detected smolt group (light blue bars), and the SIMPAS prediction of these relative adult return rates (dark red bars). Hatchery spring/summer chinook salmon smolts were selected for this evaluation of SIMPAS's adult return predictive ability because they are the species, run, and rearing group with the best PIT tag data set, and there is currently no comparable data set for Snake River fall chinook. From these empirical results, two important points concerning using SIMPAS to predict impacts to fall chinook from summer spill reductions are clear. SIMPAS does not accurately predict adult returns rates. In this example, SIMPAS consistently over estimated the adult return rates (is positively biased) relative to the observed values for the various in-river groups (Figure 1).

BPA did not consider the mortality rate associated with adult fall back through turbines under a no spill condition.

CRITFC has estimated that 1500 additional adults would be lost due to mortality of fallback through turbines and bypass system instead of through the spillway, which has a much lower mortality for fallbacks than turbines, or the bypass systems. BPA did not consider adult fallback in their analysis.

The SIMPAS analysis does not consider impacts on genetic diversity of the no-spill option

Genetic diversity is also a factor that was not discussed in the analysis. The juvenile migrants that will be impacted will be the tails of the run, which represent unique characteristics that may not be present in the bulk of the run. By increasing the impact to this portion of the run, we run the danger of reducing the genetic diversity for these stocks of fish as discussed by the Independent Scientific Group, "Return to the River" (ISG 1996). In addition, Tiffian et al. (2000) noted that the middle and late segments of the Hanford juvenile fall chinook migration contributed the majority of the older and larger age-class adults to, 1) in-river and ocean harvest and, 2) back to the spawning grounds. These larger age class fish represent greater fecundity and ability to successfully spawn. It is precisely the critical element of this extremity of the stock composition that would be impacted by reduction or cessation of summer spill through the Lower Columbia dams. It is extremely difficult if not impossible to mitigate for this. We have seen no suggestion about mitigation that would help offset this potential loss of genetic diversity. None of the mitigation identified in the offset committee adequately address this impact.

Tiffian, K.F., D.W. Rondorf and P.G. Wagner. 2000. Physiological development and migratory behavior of subyearling fall Chinook salmon in the Columbia River. North American Journal of Fisheries Management. 20:28-40

<u>White Sturgeon</u>:

White sturgeon currently spawn in dam tail-races, where their eggs incubate for approximately two weeks prior to hatch. The Dalles and John Day reservoir white sturgeon populations are chronically under-recruited due to physical characteristics of tailrace channel morphology (wide shallow channel), which limits water velocities. We expect that interruption of spill likely would have a negative impact on spawning success for white sturgeon, particularly at John Day and McNary dams during cooler water years when water temperatures have not exceeded 18^{o}C. The more natural aspects of spill, particularly 24h spill, emulate natural river conditions, stimulating spawning activity by adults and protecting deposited eggs from a host of predators. The constant flows during spill provide protection for the eggs by physically displacing many predators from the spawning areas.

<u>Pacific Lamprey:</u>

The BPA evaluated potential summer spill reduction is also likely to decrease survival of out migrating juvenile lamprey via increase impingement rates on submerged bar screens (SBS) and increased turbine passage. Juveniles not impacted on SBS that pass through the turbine units would have an increased risk of predation by birds and fishes as a result of being moved to the water's surface from the turbine boil. Studies have shown that about half of radio-tagged adult lamprey do not pass over a single dam, thus adult passage through mainstem projects is currently marginal; any decline in attraction flows will or increase in turbine fallback would exacerbate this situation. Empirical information indicates that adult lamprey pass dams though low velocity flows on the side of spillgates, cessation of spill would eliminate this passage route, which could be critical.

PROPOSED OFFSETS ARE INADEQUATE

Northern Pikeminnow Management Program Heavy-Up

The objective of this offset is to decrease predation on juvenile salmonids through increased harvest of northern pikeminnow. Northern pikeminnow are currently harvested by a sport-reward fishery as part of the Northern Pikeminnow Management Program (NPMP). It is proposed that the most logical and feasible approach to increase fishery performance would be to increase the reward structure, using a temporary increase implemented in 2001 as a model. Based on results from the 2001 "heavy-up", it is hypothesized that an increased catch of 20,000 to 40,000 fish can be reasonably expected in 2004. It is further hypothesized that such an increase in annual harvest would represent a 1 percent to 2 percent increase in exploitation rate, and would result in savings of 0.7 to 1.4 million juvenile salmonids across the projected lifespan of the northern pikeminnow caught. Savings in 2004 would be far fewer (number not specified, but analyses giving the lifespan total yield within-2004 estimates of about 100,000 to 200,000 juvenile salmonids saved.

Such analyses fail to consider (1) confounding factors affecting exploitation rates, (2) longer-term trends in seasonal exploitation rates, (3) variation inherent in all exploitation rate and predation estimates, (4) affects of a "heavy-up" on human behavior, and (5) direct effects of discontinuing spill on predation. We begin our comments with a brief refresher on the NPMP. We then address each of the five points in order.

Northern Pikeminnow Management Program Refresher

The goal of the NPMP is to reduce predation on juvenile salmonids through sustained harvest of northern pikeminnow. The NPMP is based primarily on four premises: (1) development of the Columbia River basin hydropower system has increased fish predation on out-migrating juvenile salmonids, (2) northern pikeminnow are responsible for the overwhelming majority of this predation, (3) population dynamics and behavior of northern pikeminnow facilitate relatively large reductions in predation from relatively low exploitation, and (4) compensation by surviving northern pikeminnow or other predators is unlikely. Support for these premises is based on 20 years of predation research in the Columbia River basin.

The primary control mechanism for the Northern Pikeminnow Management Program is the cumulative effect of exploitation, which systematically reduces the number of older piscivorous individuals through time. Northern pikeminnow are long-lived and slow growing, and become increasingly piscivorous with age. Salmonids are generally an important diet component only for large, old individuals, and consumption rates of juvenile salmonids by northern pikeminnow increase as size increases. As would be expected with a previously unexploited population such as northern pikeminnow, the biggest relative benefits (in terms of population re-structuring) were realized in the first few years of the program. Sustained exploitation now serves mainly to maintain the new population structure; substantial increases in exploitation greater than 1-2 percent would be necessary to increase benefits by further restructuring the northern pikeminnow population.

Two questions commonly asked about the benefits of the NPMP are (1) do northern pikeminnow feed mostly on dead salmonids, thereby making actual benefits less than estimated, and (2) do remaining northern pikeminnow compensate for removals by increasing consumption, growth, fecundity, etc.? Estimates of predation losses are relatively unbiased by consumption of dead or injured juvenile salmonids (Beamesderfer et al. 1996). Petersen et al. (1994) marked and released live and dead salmonids into a tailrace in a 10% dead proportion (similar to turbine mortality) and found that 22% of the marked salmonids subsequently recovered from northern pikeminnow were dead before release. If dead fish constitute 22% of northern pikeminnow prey near dams, dam effects extend 10km upstream and downstream, and 69% of predation occurs in that zone (Petersen 1994), then 85% of the estimated predation would be on live fish (1-(0.69x0.22).

Rieman and Beamesderfer (1990) concluded that compensation by surviving northern pikeminnow was unlikely because (1) fecundity is much lower than fecundity of species considered resilient, (2) growth is slow and mortality low compared with other species, and (3) density-dependent growth was not obvious. Knutsen and Ward (1999) and Zimmerman et al. (2000) reported that northern pikeminnow compensation has not been observed to date.

Confounding Factors Affecting Exploitation

On first glance, harvest data from 2000-03 (the period in which the minimum size for reward fish has been approximately 200 mm fork length) appears to support the argument that the 2001 "heavy-up" increased catch and exploitation rate (Table 1).

Table 1. Catch and exploitation rate of northern pikeminnow in the sport-reward fishery, 2000-03. Minimum reward size was reduced from 250 to 200 mm fork length in 2000.

Year	Catch	Exploitation Rate (95% Confidence Intervals)
2000	189,054	10.9% (6.8% - 16.8%)
2001	240,894	15.5% (10.0% - 25.0%)
2002	200,445	10.6% (5.8% - 19.6%)
2003	195,974	10.5% (8.1% - 14.4%)

Catch and exploitation rate differ little among 2000, 2002, and 2003, but are notably less than exploitation in 2001, when rewards were significantly increased on July 10. However, relatively large confidence bounds preclude statistical differences among years.

Exploitation rates for fish >250 mm fork length (minimum size until 2000) were 11.9%, 16.2%, 12.3%, and 13.0% for 2000 through 2003. Again, exploitation was highest in 2001, although the difference was not as great, and exploitation varied more among other years.

The increase in catch and exploitation in 2001 is at least partially explained by the environmental conditions that lead to the "heavy-up" (i.e., low river flow). Information collected since 1995 indicates that exploitation of northern pikeminnow (>250 mm) by the sport-reward fishery is highly correlated with river flow (mean gage height below Bonneville Dam) during the fishery (Figure 1). The analysis is limited to fish >250 mm to ensure consistency among years.

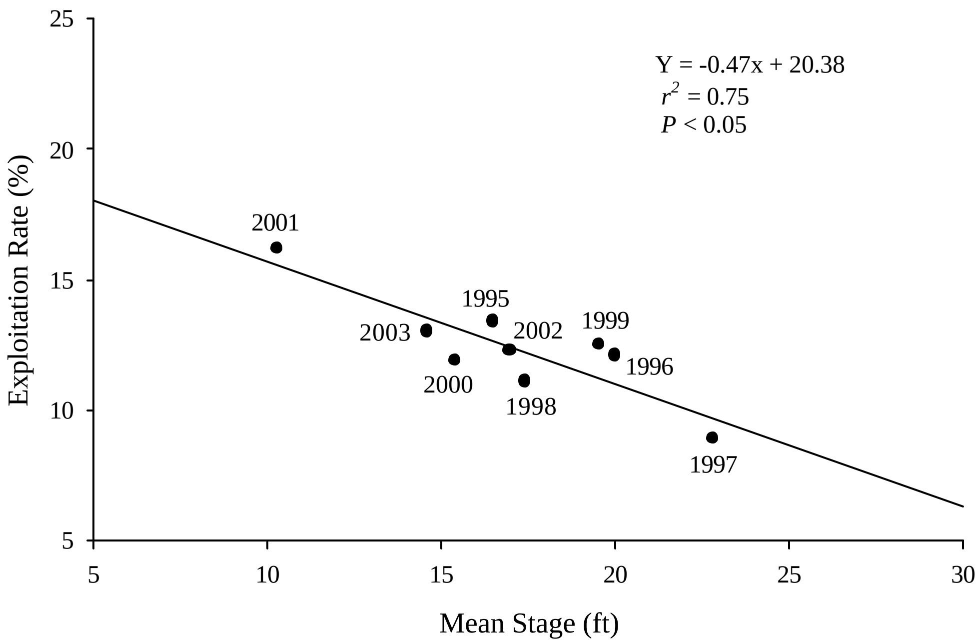

Figure 1. Relationship between sport-reward exploitation and mean gage height below Bonneville Dam during the fishery season, 1995-2003.

Although variation should be considered when using this information to make specific recommendations, it is apparent that differences in flow alone, and not increases in rewards, could account for exploitation in 2001 being approximately 3% higher than exploitation in 2000, 2002, and 2003 (observed differences in point estimates ranged from 3.2% to 4.3%). Exploitation rate in 2001 was slightly higher than would be predicted from the relationship (Figure 1); however, this is also true for 1995, 1996, and 1999.

As explained previously, the most important factor in changing the size and age structure of the northern pikeminnow population is exploitation rate, not total catch. Catch may be affected by variations in northern pikeminnow year-class strengths, but exploitation rate estimates are not. Catch totals also include northern pikeminnow caught illegally (e.g., out of the project area), but exploitation estimates do not. We have found that catch is not a reliable predictor of exploitation rate (Figure 2; P > 0.05).

Long-Term Trends in Seasonal Exploitation Rates and Catch

Benefits of the 2001 "heavy-up" are attributed by BPA to increased catch and exploitation rate after July 10, when rewards were increased. An examination of exploitation rates before and after July 10 for all years since 1995 does not support this argument. Although we found no apparent relationship between exploitation rates before and after July 10 (Figure 3; P > 0.05), exploitation after July 10 was always less than that before July 10, and the seasonal change in 2001 was

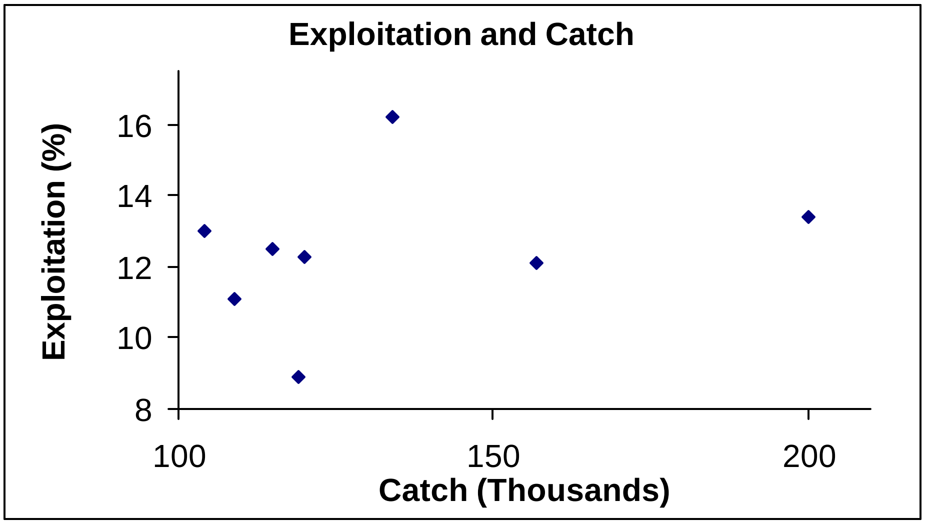

Figure 2. Relationship between catch of northern pikeminnow (>250 mm) and exploitation rate, 1995-2003.

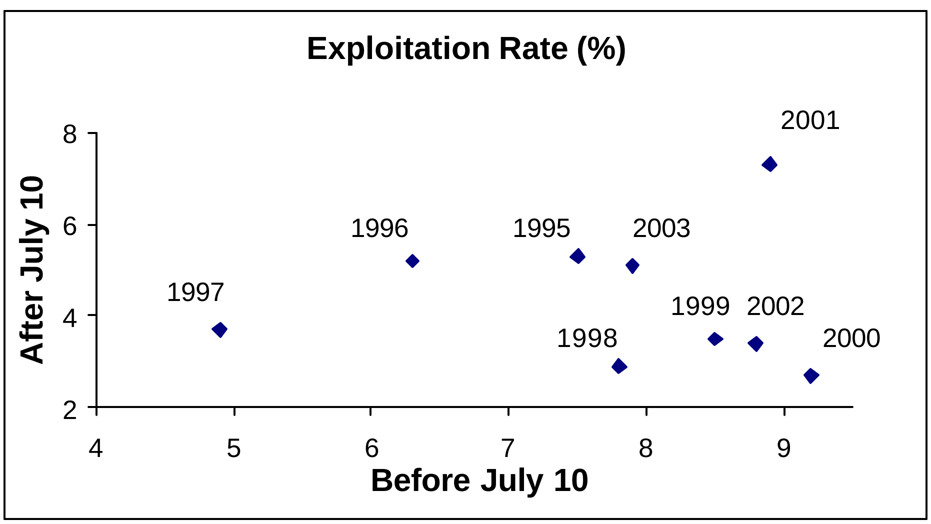

Figure 3. Relationship between exploitation rate on northern pikeminnow before and after July 10, 1995-2003. Although not included here, confidence limits around each point are relatively wide, and similar in proportion to those in Table 1.

similar to that in many other years. Exploitation after July 10 in 2001 appears much greater than would be expected based on 1998-2000 and 2002 data; however, the pattern of exploitation in 2001 is similar to that observed from 1995-97 and in 2003. Differences in flow among years with seasonal similarities in exploitation patterns (Figures 1 and 3) further exemplify the difficulty in attributing changes in exploitation to a particular cause.

We also found no significant relationship between catch of northern pikeminnow before and after July 10 (Figure 4; $P > 0.05$). Examination of the information indicates that the seasonal change in 2001 was similar to that in most other years. The relationship between catch before and after July 10 in 2001 was similar to that from all years except 1995 and 1997.

Variation in Exploitation Rate and Predation Estimates
An objective of the "heavy-up" is to increase exploitation rate on northern pikeminnow by 1 to 2 percent. Confidence limits around estimates of exploitation are much wider than this (Table 1), making it unlikely that such an increase can be detected with any confidence. Confidence limits for all years overlap, even when the point estimate for a year such as 2001 is compared to years of consistent exploitation such as 2000, 2002, and 2003.

The goal of the NPMP is to change the size (age) structure of the northern pikeminnow population to reduce the number of large, piscivorous individuals, and thereby decrease predation on juvenile salmonids. Evidence indicates that the size structure has been altered somewhat (Figure 5). Although reduced in number, large piscivourous northern pikeminnow are still present, indicating that substantial increases in exploitation may result in some further decreases in predation.

An increase of 1-2 percent is not substantial enough to realize any detectible reductions in predation. Results from a model developed by Friesen and Ward (1999) indicate that long-term (15 year duration) exploitation rates of 12%, with lower and upper bounds of 8% and 16% (observed bounds are actually greater than these) result in estimates of predation ranging from 60% to 87% of predation prior to implementation of the NPMP. Increasing exploitation to 13%, with corresponding bounds (8.7% to 17.3%) results in predation estimates of 58% to 86% of prior levels. Differences between the two estimates are indistinguishable.

Affects of a "Heavy-up" on Human Behavior
As mentioned previously, catch totals include northern pikeminnow caught illegally. As rewards increase, the incentive to harvest fish outside the project area and turn them in for rewards increases. The 2001 reward increase led to a large increase in angler fraud (Eric Winther, Washington Department of Fish and Wildlife, personal communication). Such fraud makes it difficult to assess the actual affect of increased rewards on the northern pikeminnow population within the project area.

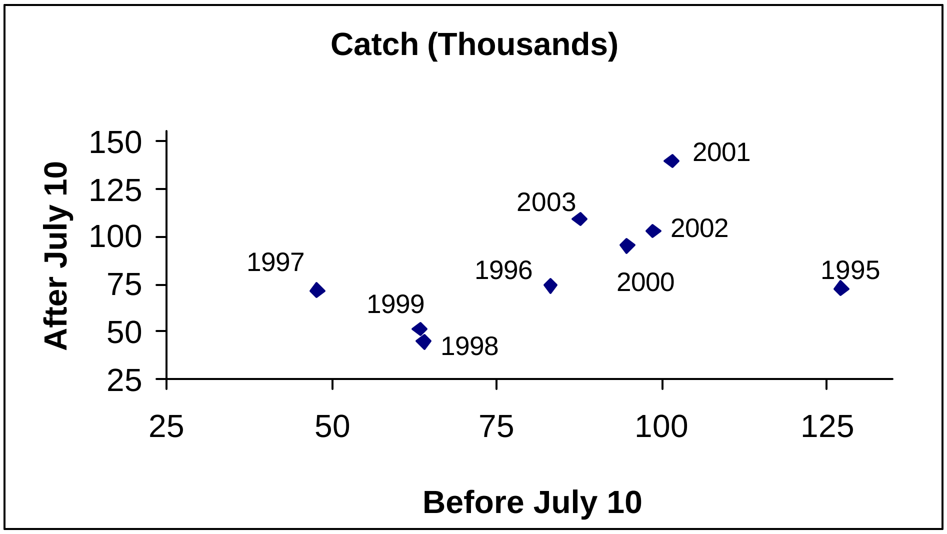

Figure 4. Relationship between catch of northern pikeminnow before and after July 10, 1995-2003.

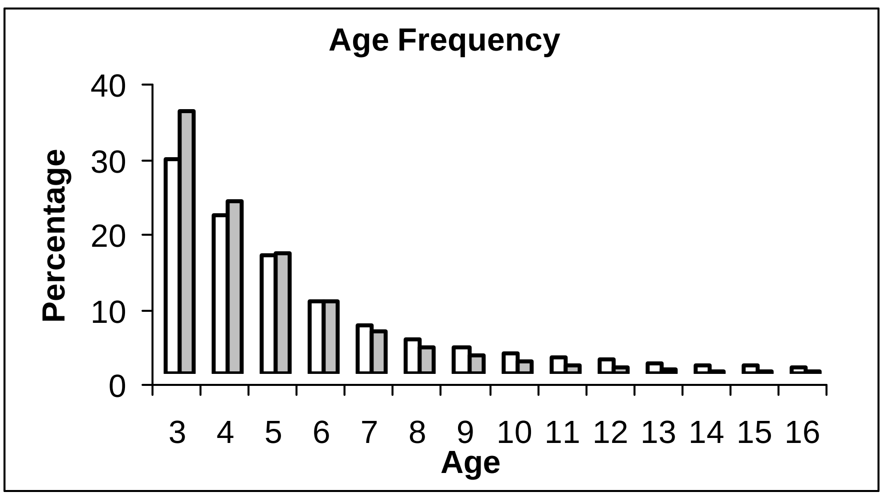

Figure 5. Estimated age structure of northern pikeminnow in the Columbia River before implementation of the NPMP (white bars) and after sustained implementation (gray bars).

Direct Effects of Discontinuing Spill on Predation

Predation on juvenile salmonids by northern pikeminnow will likely increase in the absence of spill, adding to the number of salmonids required to be saved by any "offset" measure. Faler et al. (1988) found that northern pikeminnow in the tailrace below McNary Dam remained in protected shoreline areas when discharge rates were high (e.g., during spill), but moved close to the dam and the juvenile bypass outflow area when discharge rates were low. Trends in movement of northern pikeminnow were similar between short-term (short closures of the spillway) and long-term (spring flows vs. summer flows) changes in water velocity. Faler et al. (1988) noted that predation by northern pikeminnow at fish passage facilities may be reduced by providing high water velocity. Reducing predation in these near-dam areas is critical, because Ward et al. (1995) estimated that 33% of all predation by northern pikeminnow occurred in tailrace boat-restricted zones.

Laboratory findings (Mesa and Olson 1993) support the hypothesis that discharge and water velocity will affect predation by northern pikeminnow. Based on northern pikeminnow swimming performance, Mesa and Olson (1993) found that water velocities >100 cm/s may exclude or reduce predation by northern pikeminnow near Columbia River dams. High velocities also increase migration rates of juvenile salmonids near dams (Berggren and Filardo 1993), which may reduce encounter times between predators and prey.

Zimmerman and Ward (1999) discussed observed effects of spill on predation. They compared predation on juvenile salmonids by northern pikeminnow between pre-NPMP years (1990-92) and years after implementation of the NPMP (1994-96). Zimmerman and Ward (1999) speculated that large reductions in observed predation (44-91%) relative to reductions predicted by a model (14-38%; Friesen and Ward 1999) may be at least partly attributable to spill levels at dams. Total discharge and volume of water spilled averaged higher from 1994-96 than during 1990-92.

Any estimate of the actual number of juvenile salmonids lost that can be attributed to discontinuing summer spill is fraught with uncertainty. The following premises however, are based on peer-reviewed findings:

- The un-exploited northern pikeminnow population may have consumed approximately 16 million juvenile salmonids per year (Beamesderfer et al. 1996)
- The NPMP has resulted in an approximate 25% reduction in predation (Friesen and Ward 1999; 4 million smolts saved annually),
- Approximately 33% of predation occurs in near-dam tailrace areas (boat restricted zones) during low-spill years (Ward et al. 1995)
- Information from Zimmerman and Ward (1999) indicates that spill may reduce this predation by at least 50%
- Predation is greater in the summer than spring (Ward et al. 1995; Zimmerman and Ward 1999)

Therefore, estimates of the number of salmonids that would be additionally consumed if summer spill was reduced could easily reach 1 million, and would likely not be offset by the relatively small increase in exploitation rate assumed in the offset proposal.

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Ward, D. L., J. H. Petersen, and J. Loch. 1995. Index of predation on juvenile salmonids by northern squawfish in the lower and middle Columbia River, and in the Lower Snake River. Transactions of the American Fisheries Society 124:321-334.

Zimmerman, M. P., and D. L. Ward. 1999. Index of predation on juvenile salmonids by northern pikeminnow in the lower Columbia River basin from 1994-96. Transactions of the American Fisheries Society 128:995-1007.

Zimmerman, M. P., T. A. Friesen, D. L. Ward, and H. K. Takata. 2000. Development of a systemwide predator control program: indexing and fisheries evaluation. Oregon Department of Fish and Wildlife. 1999 Annual Report to Bonneville Power Administration, Portland, Oregon.

Smallmouth Bass Control

The objective of this offset is to decrease predation on juvenile salmonids through removal of smallmouth bass. It is hypothesized that large smallmouth bass (> 200 mm) may consume one juvenile salmon per day in some seasons and areas, and that control by removal is very feasible with sanction by fishery managers. Proposed methods for removal include agency electrofishing, a bass derby in Lower Granite Reservoir, and manipulation (short-term drawdown) of Lower Granite Reservoir. Success of these methods are potentially limited by (1) the biological benefits of removals (likelihood of decreasing predation), (2) feasibility of implementing active removals of a popular gamefish, and (3) logistics of manipulating a reservoir to control smallmouth bass. We limit our comments here to the biological benefits of removing smallmouth bass.

Background

Smallmouth bass are found throughout the lower Columbia and Snake rivers; however, smallmouth bass density is generally lowest below Bonneville Dam, intermediate in Columbia River reservoirs, and highest in Snake River reservoirs (Zimmerman and Parker 1995). Abundance in Columbia River reservoirs and below Bonneville Dam is far lower than abundance of northern pikeminnow (Beamesderfer and Rieman 1991; ODFW, unpublished data). Because of differences in abundance and consumption rates, predation on juvenile salmonids by smallmouth bass is minimal compared to predation by northern pikeminnow (Rieman et al. 1991; Vigg et al. 1991; Ward and Zimmerman 1999; Zimmerman 1999).

Abundance and Density

Beamesderfer and Rieman (1991) found that on average, abundance of smallmouth bass (>200 mm) was less than 40% that of northern pikeminnow (>250 mm) in John Day reservoir. Only in reservoirs of the Snake River, particularly Lower Granite and Little Goose reservoirs, does abundance of smallmouth bass approach or exceed that of northern pikeminnow (Curet 1993; Zimmerman and Parker 1995; ODFW, unpublished data).

Consumption

A few studies have found smallmouth bass to be major predators of juvenile salmonids in the Columbia and Snake Rivers (Curet 1993; Tabor et al. 1993), but these are generally limited to localized areas. Comprehensive studies in the Columbia River basin indicate that smallmouth bass eat few juvenile salmonids relative to northern pikeminnow

(Rieman et al. 1991; Ward and Zimmerman 1999; Zimmerman 1999). Results from Tabor et al. (1993) were limited to a small area of the Hanford Reach, and Curet (1993) studied predation in Lower Granite and Little Goose reservoirs, where smallmouth bass are very abundant. Ward and Zimmerman(1999) and Zimmerman (1999) collected data from numerous sites throughout the Columbia and Snake rivers, and Rieman et al. (1991) published information from an extensive multi-year study of John Day Reservoir. Consumption rates approaching or exceeding one juvenile salmonid per day were limited to times of peak migration in very few areas (Zimmerman 1999). Ward and Zimmerman (1999) found consumption of juvenile salmonids by smallmouth bass to be zero in 74 of 104 estimates. Consistent evidence of predation on juvenile salmonids was found only in the upper reach of Lower Granite Reservoir in spring, and in the forebay of John Day Reservoir in summer.

Smallmouth Bass Population Dynamics and Behavior

Unlike northern pikeminnow, smallmouth bass possess a number of characteristics that may further limit the benefits of a removal program. Smallmouth bass grow relatively quickly, are not especially long-lived, and become piscivorous at a young age (Ward and Zimmerman 1999). Salmonids are generally not the most important diet component for any size or age group of smallmouth bass (Zimmerman 1999). Smallmouth bass vulnerability to most fishing gears decreases with size (Beamesderfer and Rieman 1988), instead of increasing with size like northern pikeminnow.

Potential Benefits of Removing Smallmouth Bass

Removing smallmouth bass is not an efficient way to increase survival of juvenile salmonids. Relatively low abundance will make removals of large numbers difficult. Relatively low consumption rates result in the benefit per fish removed being minimal. Population dynamics and behavior of smallmouth bass further decrease the likelihood of removals resulting in increased survival of juvenile salmonids.

References

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Curet, T. S. 1993. Habitat use, food habits, and the influence of predation on subyearling Chinook salmon in Lower Granite and Little Goose reservoirs, Washington. Master's Thesis. University of Idaho, Moscow.

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Tabor, R. A., R. S. Shively, and T. P. Poe. 1993. Predation on juvenile salmonids by smallmouth bass and northern squawfish in the Columbia River near Richland, Washington. North American Journal of Fisheries Management 13:831-838.

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Ward, D. L., and M. P. Zimmerman. 1999. Response of smallmouth bass to sustained removals of northern pikeminnow in the lower Columbia and Snake rivers. Transactions of the American Fisheries Society 128:1020-1035.

Zimmerman, M. P. 1999. Food habits of smallmouth bass, walleyes, and northern pikeminnow in the lower Columbia River Basin during outmigration of juvenile anadromous salmonids. Transactions of the American Fisheries Society 128:1036-1054.

Zimmerman, M. P., and R. M. Parker. 1995. Relative density and distribution of smallmouth bass, channel catfish, and walleye in the lower Columbia and Snake rivers. Northwest Science 69:19-28.

Commercial Harvest Reduction

BPA has proposed the commercial harvest reductions as an offset without presenting any management specifics or technical analysis.

Technical Considerations

Not enough information is given in the Description of Proposed Action or the Methods section of the Offset Action 3 document to determine how the estimates of " benefit to Columbia River fall Chinook escapement may range between 1,000 and 6,000 adults at an estimated economic value (market value * 2x multiplier) of $125,000 to $275,000" were calculated. There is no information identifying which commercial fisheries were targeted for reduction to save summer spill affected stocks nor how those fishery reductions would be implemented (e.g., reduce overall quotas, buy out individual fishing permits, implement time and area restrictions, or some combination thereof). Without this type of detail, it is impossible to judge whether this offset alternative has any chance of delivering the projected outcome of increased bright fall Chinook back to the Columbia River. There are a number of issues that can be identified that suggest substantial caution must be taken into account concerning the reliance on benefits accruing back to escapements from fishery restriction actions, especially those that are targeted at mixed stock fisheries distant from the escapement area.

Intervening fisheries, unless strictly controlled, often degrade the "savings" from prior targeted fishery reductions. This would be most problematic if the fishery impact reductions were targeted for the S.E. Alaska commercial fisheries, the most distant fisheries. Secondly, if the plan is to buy out individual fishing permits within a fleet, latent fishing power among other fishermen within the same fleet can often negate any perceived savings unless overall quotas are also likewise reduced by the average harvest capacity of the bought out permits. Even when time and/or area management actions are used as the vehicle for fishery impact reduction, there is often a compensatory response when fishing is again allowed, resulting in reduced overall savings from calculated values.

The State of Alaska Department of Fish and Game and the Alaska Trollers Association have both sent letters in strong opposition to the Action 3 Offset proposal. Both point out that the Pacific Salmon Treaty is predicated on honoring current commitments of responsible harvest management and habitat protection rather than finding ways to offset and mitigate relaxation of habitat protection actions (e.g., the reduction in the summer spill program). Under the Aggregate Abundance Based Management (AABM) framework of the Pacific Salmon Treaty, Columbia River bright fall chinook are one of the key stock components. Any significant reduction in survival of the bright fall chinook stock, and corresponding reduced stock abundance, could have a direct effect in reducing allowable harvest quotas in the AABM fisheries. If the SE Alaska troll fishery is targeted for further reductions as an offset to provide "equivalent " escapement back to the Columbia River, this fishery would suffer a double dose of restrictions to mitigate the summer spill reduction action.

Relaxation of habitat protection actions stand in sharp contrast to the tenants and commitments of the U.S. government in the implementation of the Pacific Salmon Treaty, especially as it relates to the Habitat and Restoration section of the Treaty (Attachment E). Attachment E states, "… the Parties agree: 1) To use their best efforts, consistent with applicable law, to: a) protect and restore habitat so as to promote safe passage of adult and juvenile salmon and achieve high levels of natural production, b) maintain, and as needed, improve safe passage of salmon to and from their natal streams, and c) maintain adequate water quality and quantity…" The Pacific Salmon Treaty language is quite clear that safe passage, at a minimum, must be maintained, and if possible improved. In this regard, any action that relaxes habitat protection for "safe passage" is in direct conflict with U.S. commitments under the Treaty. Therefore, it appears that any proposed actions dealing with summer spill reductions must, at a minimum, be "survival neutral" and that the concept of mitigation offsets to account for reduced survival is in direct conflict with the Pacific Salmon Treaty language. It is strongly recommended that the proponents of the summer spill reduction program and all affected parties review the tenants and commitments of the U.S. government under the Pacific Salmon Treaty, to clearly understand what may and may not be supportable under the law, before any final action is taken on changing the current summer spill program. There is no basis for the predicted benefits of commercial harvest reductions and therefore they cannot be considered adequate to offset the impacts of reducing spill particularly on Hanford Reach fall Chinook. The following points illustrate a few of the fishery management realities that BPA did not consider in their proposed harvest offset which make the predicted benefits improbable.

- Delivering more adult chinook to the river is not going to result in more fish if in-river conditions are insufficient due to low water flows reducing the survival of progeny of the returning adults.

- Alaska's harvest of chinook salmon is managed according to the abundance based management provisions of the bilateral Pacific Salmon Treaty. These treaty agreements were approved by NOAA Fisheries in their Biological Opinion. There is no need or obligation to further alter fishing regimes.

- Fishermen in Alaska do not hold harvest rights to fish; there are no annual fishing quotas or rights that can be bought to result in a lower harvest. Permit buyback, even if it was something that was desired in the troll fishery--which is unlikely and impossible before the upcoming season. Fewer permits does not translate into a lower harvest as catch numbers are established under the abundance-based management provisions of the Pacific Salmon Treaty to which Alaska remains committed.

- Alaska's harvest of ESA fish is extremely small. Reductions in Alaska's harvest would have a negligible affect on ESA listed stocks.

Hanford Reach
Consistent with the other impact and offset analyses, there is no written documentation describing the methods and assumptions that were used in this analysis, only spreadsheets without sufficient supporting data or rationale. .

There is no detailed explanation of how the starting population estimates were derived. Grant PUD has defined their Juvenile Fall Chinook Protection Program for spring operations 1999-2003 and Grant PUD is expected to continue these operations in 2004. In 2003 they failed to meet even their own program criteria 48% of the time. The Juvenile Fall Chinook Protection Program criteria have not universally been determined to be adequate by all of the fishery co-managers. Assessment of the impact of fluctuations has been limited due to imprecision and small spatial coverage (limited to the middle third of the Hanford Reach). Because the impact assessment has been limited to the middle third, estimates of the full impacts of Priest Rapids fluctuations may have been biased.

The Hanford Reach Fall Chinook Program limits daily flow fluctuations within a 24-hour period but does not address between day decreases in discharge and will not totally eliminate losses when discharges are reduced during decreased load demands on the weekends. The between day impacts can be substantial if large daily reset operations are needed to meet criteria for the following day, which often occur. These resets occur during early morning hours when juvenile fall chinook are quietly holding in shallow near shore areas. Recent USGS research indicates that juvenile salmon are particularly vulnerable to stranding and entrapment impacts during nighttime periods. Therefore it is highly probable that potential benefits from implementing the fall chinook flow program will be less than predicted by the action agencies.

- **The Hanford Reach offset represents double-counting of a mitigation measure.** The Hanford Reach mitigation offset proposed by BPA was previously negotiated as a component of the Grant County PUD FERC license renewal agreement. The Hanford Reach offset is therefore cannot be considered an additional measure since it already exists as part of the Grant County settlement..
- **The impact comparison of pre- versus post-Juvenile Fall Chinook Protection Program is erroneous and invalid**. Completely different sampling methods were used in the two time periods (1998 and 1999-2003). Due to the limitations of the 1998 sampling program, a completely different sampling program was developed for 1999-2003. Because both the biological sampling and the affected area calculations are not consistent across the two time periods, any comparison between the two is erroneous and invalid.
- **Omission of the high stranding estimate for 2001 is inappropriate and groundless.** Fish stranding and entrapment in the Hanford Reach are due to fluctuations in discharge volumes at Priest Rapids Dam. If there were no fluctuations (regardless of flow volume), then no stranding and entrapment would occur. By ignoring the high mortality estimate due to stranding and entrapment in 2001 (approximately 6.9 million fry), the BPA analysis ignores the large impact year and focuses instead on the small impact years. Incidentally, the large 2001 impact occurred while Grant PUD was operating under their Juvenile Fall Chinook Protection Program.
- **This is not an offset, as the operation described has been underway for the past five years.** Grant PUD has defined their Juvenile Fall Chinook Protection Program for spring operations 1999-2003 and Grant PUD is expected to continue these operations in 2004. In 2003 they failed to meet even their own program criteria 48% of the time. The Juvenile Fall Chinook Protection Program criteria have not been fully endorsed by all of the fishery co-managers.

McMichael, G.A. and eleven coauthors. 2003. Subyearling chinook salmon stranding in the Hanford Reach of the Columbia River. Batelle-Pacific Northwest Division Report, PNWD-3308, 245 pp.

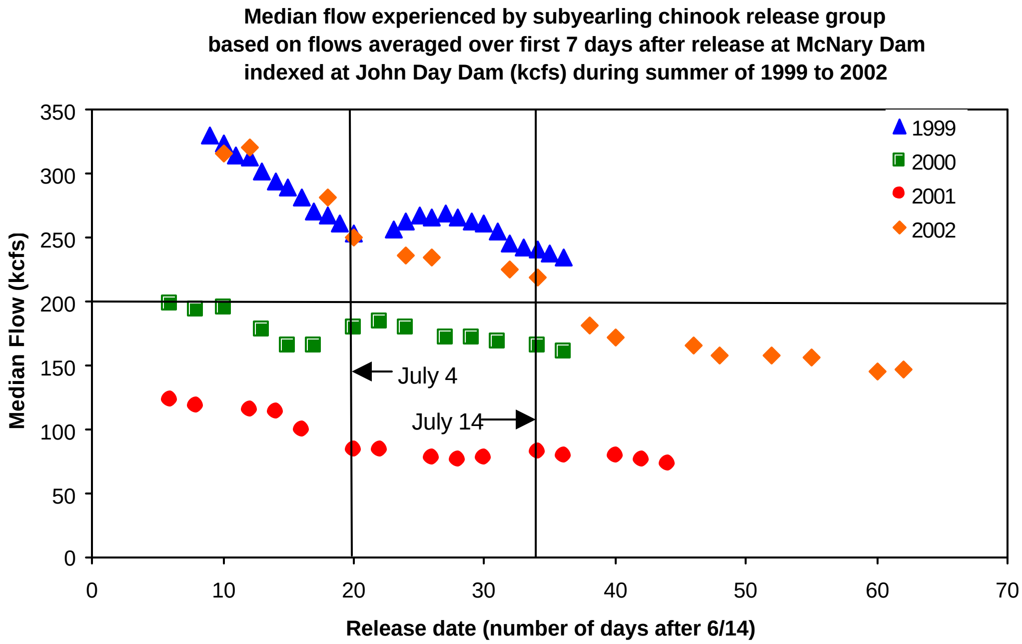
BPA did not consider flow augmentation as an offset for reductions in spill although this offset is clearly supported by the empirical data.
Flow augmentation is a potential offset that could provide real time mitigation for impacts based on empirical research (Connor et al. 2003). Despite this potential, it and other options were not considered in this document. Offsets and reductions in BIOP measures should be considered as an integrated ecological program, balancing measures and impacts and benefits in a cohesive program. In this way the interaction of measures, cumulative impacts and impacts on unlisted and listed stocks can be considered in the same decision analysis. The incremental analysis of individual measures and offsets precludes the holistic decision analysis that is required.

The following analysis is presented in the context of the BPA Summer Spill impacts and offsets. The following analysis presents the empirical data, which shows that increasing summer flows to at least 220 kcfs in the lower Columbia River will accelerate the passage of fall chinook through that reach. By shifting the passage distribution to earlier the adverse impact of reducing spill in the late summer could be reduced. Increasing summer flow represents a realistic real time offset to the BPA proposal to reduce the implementation of the summer spill protection measure included in the Biological Opinion.

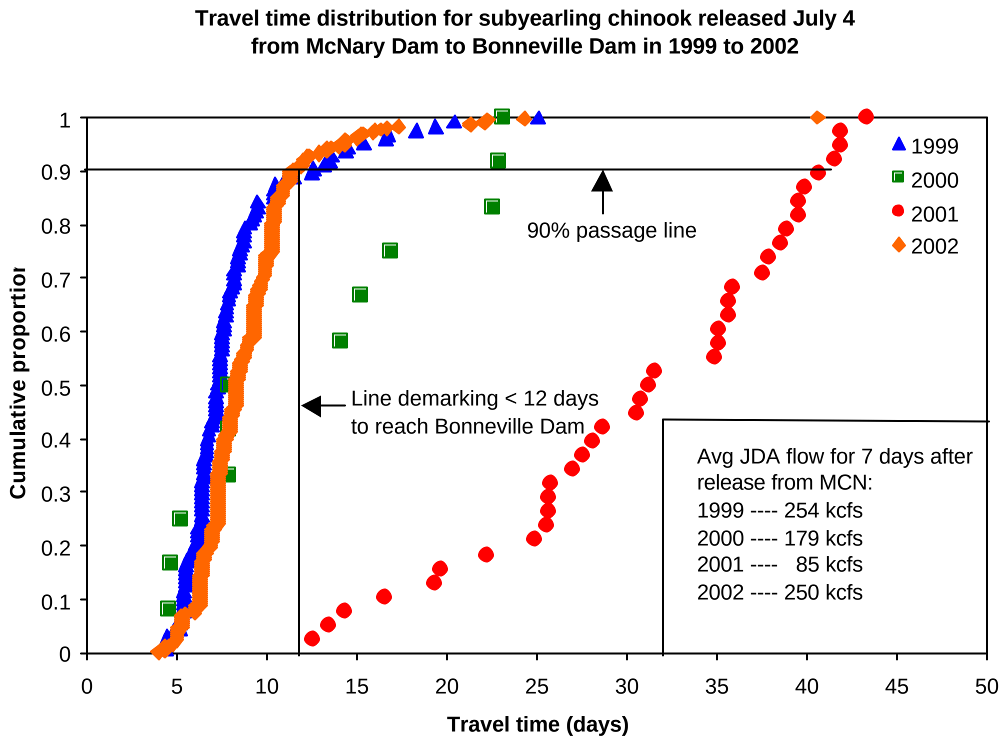
- A flow-travel time relation for subyearling chinook migrating from McNary Dam to Bonneville Dam was documented through multivariate regression analyses utilizing run-at-large subyearling chinook collected and PIT tagged at McNary Dam by NOAA and detected again at Bonneville Dam.
- Three predictor variables, reciprocal of flow, fish length at tagging, and release (serial) date, together explained 44% of the variation about the smolt travel time data. Travel times were shorter as flows increased, fish lengths increased, and release date (number of days after June 14) increased. Based on the standardized coefficients (std coef in table) of these three predictor variables, the greatest proportion of the variation about the smolt travel time data was "explained" by the flow-related predictor variable.

Effect	Coefficient	Std Error	Std Coef	Tolerance	t-test	Prob
Constant	16.136	0.5994			26.9	<0.001
1/Flow	1644.662	23.5905	0.659	0.889	69.7	<0.001
Length	-0.119	0.0057	-0.191	0.960	-20.9	<0.001
Serial date	-0.094	0.0061	-0.147	0.867	-15.3	<0.001

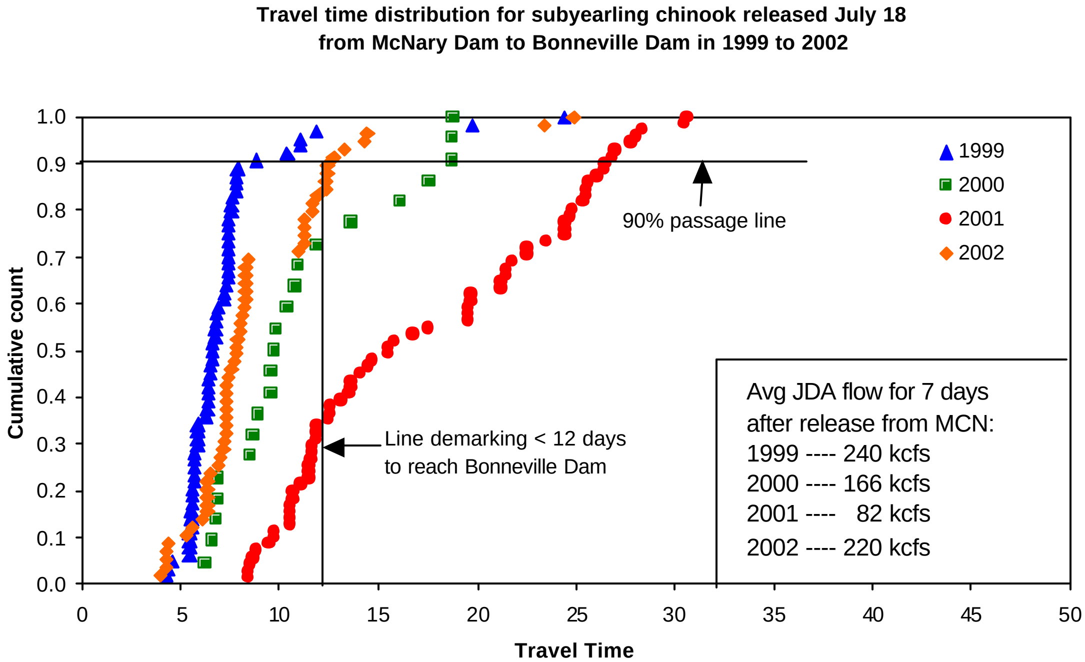
- Flows were averaged over a 7-day period following release at McNary Dam and indexed at John Day Dam to reflect the flow experienced by a release group during its first week of migration in the lower Columbia River. For the PIT tag releases from McNary Dam in 1999 to 2002, the average flows experienced by subyearling smolts in July were above the BiOp 200 kcfs minimum in July of 1999 and 2002, but below that minimum in 2001 and 2000.



- Travel time estimates were generated for two groups of fish released at McNary dam. The first group was released in early July (July 4) and the second group was released in late July (July 18). The early releases were compared to each other over four years with varying flows. The late releases were compared to each other over the same years of varying flows.
- The early July groups of sub-yearling chinook had shorter travel times in the higher flow years of 1999 and 2002. These shorter travel times resulted in an earlier passage distribution of 90% of the smolts at Bonneville Dam than in the years of lower flows.



- Similar to the results of the early migrating groups, the late migrating release groups of sub-yearling fall chinook had shorter travel times in the higher flow years of 1999 and 2002 and therefore, an earlier passage distribution of 90% of the smolts at Bonneville Dam than in the years of lower flows.



Note: Horizontal jump in cumulative at 0.7 in 2002 is due to an apparent equipment problem at Bonneville Dam Powerhouse 2 detectors during period of July 27- 28. The result is a shifting to the right of the cumulative curve above 0.7 in a magnitude more than actually occurred that year.

- Flows above 220 kcfs in 1999 and 2002 have resulted in 90% passage of PIT tagged subyearling chinook released from McNary Dam in early July and in late July to pass Bonneville Dam within 12 days of initial release. Flows below the BiOp minimum of 200 kcfs in 2000 in the 166-179 kcfs range resulted in the 90% passage of PIT tagged subyearling chinook being 1.5-2 times longer than in 1999 and 2002. The extremely low flows of 2001 in the 82-85 kcfs range resulted in the 90% passage at Bonneville Dam being over 2-3 times later than in 1999 and 2002.

Budy, P., G.P. Thiede, N. Bouwes, C.E. Petrosky, and H. Schaller. 2002. Evidence linking delayed mortality of Snake River salmon to their earlier hydrosystem experience. North American Journal of Fisheries Management 22:35-51.

Connor, W.P, H.L. Burge, J.R. Yearsley, T.C. Bjornn. 2003. Influence of flow and temperature on survival of wild subyearling fall Chinook salmon in the Snake River. North American Journal of Fisheries Management 23:362-375.

APPENDIX A

Consists of the following documents:

UMATILLA INDIAN RESERVATION • SHOSHONE-BANNOCK TRIBES • WASHINGTON FISH & WILDLIFE • SALISH KOOTENAI TRIBES • NATIONAL MARINE FISHERIES SERVICE • YAKAMA INDIAN NATION • IDAHO FISH & GAME • WARM SPRINGS RESERVATION • BURNS-PAIUTE • KOOTENAI TRIBE • SPOKANE TRIBE • MONTANA FISH, WILDLIFE & PARKS • COLVILLE RESERVATION • OREGON FISH & WILDLIFE • NEZ PERCE TRIBE • KALISPEL TRIBE • U.S. FISH & WILDLIFE • SHOSHONE-PAIUTE TRIBE • COEUR D' ALENE TRIBE

COLUMBIA BASIN FISH & WILDLIFE AUTHORITY

October 16, 2002

Mr. Frank L. Cassidy, Jr.
Chairperson
Northwest Power Planning Council
851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204

Dear Mr. Cassidy:

We recognize that the Northwest Power Planning Council (NWPPC) is presently reviewing new recommendations for the Fish and Wildlife Program Amendments. As you proceed with that review several tools will be used to evaluate the efficacy of proposed actions. Within that context we urge the NWPPC to consider our previous comments regarding the use of the SIMPAS model in determining the impacts of specific hydrosystem alterations (see Joint Technical Staff comments to the NWPPC, April 20, 2001). We are alerting the NWPPC that reliance on a single passage model such as SIMPAS is not appropriate determining which fish passage options should be implemented. We agree with the recommendation of the Independent Scientific Advisory Board (ISAB) to the NWPPC, that it is not appropriate to develop a long-term management plan on the basis of SIMPAS analysis. Management alterations of the magnitude being considered by the NWPPC should be approached in a much more scientific manner as recommended by the ISAB.

The SIMPAS (simulated passage) spreadsheet model was initially developed by the National Marine Fisheries Service staff to evaluate potential actions for the 1995 FCRPS Biological Opinion. This model was subsequently used for generating point estimates of potential actions associated with the 2000 FCRPS Biological Opinion. The following comments describe the serious limitations of utilizing the SIMPAS model and must be considered within a management context:

- Many passage models have been employed over the years as a tool to compare alternate scenarios in a qualitative sense. Using the models beyond this application in a relative sense is inappropriate. The relations and point estimates used in these simple passage models are far too simple to adequately capture the complexity of salmonid survival relations and are, therefore, inappropriate as the primary basis for management decisions

- The NMFS 2000 BIOP recognizes the limitations in the use of the SIMPAS model and caveats SIMPAS results because the model does not account for the potential effects of various fish passage options (such as spill) on forebay passage in terms of reducing delay, residence time, or predation.

- The SIMPAS model was not designed to make inferences about the likelihood of adult returns (see Caveats to SIMPAS Modeling Results NMFS 2000 BIOP). This is due, in part, to the fact that SIMPAS simulations were not designed to include delayed hydrosystem mortality, i.e., "extra" mortality. This class of models has limited application for realistically predicting the overall effects of an action on salmon survival.

- SIMPAS is calibrated to reach survival estimates from primarily high flow years. Even the lowest flow year in the data set used extrapolations for a shorter reach in 1994. In 2001 NMFS recognized that this direct survival estimates are too optimistic for low flow conditions expected in 2001.

- A key concern is that although SIMPAS assumes NMFS' BIOP values of delayed mortality for transported fish ('D') it does not explicitly consider delayed hydrosystem mortality that is common to both transported and in-river migrants. SIMPAS survival estimates do not simulate historic stock performance.(see April 20, 2001 letter)

- Considerable evidence suggests that the source of "extra" mortality, which occurs in the estuary and early ocean, is related to earlier hydrosystem experience, i.e., delayed hydrosystem mortality (Budy 2001; Sections 3.3.1.1. and 3.3.1.2. in ODFW 2000). Evidence from the literature suggests numerous mechanisms that would explain this delayed mortality in relation to a fish's experience through the hydrosystem. Based on recent tagging data, there is direct evidence of delayed mortality by route of passage through the hydrosystem, including transportation and in-river routes (specifically collection/bypass). Spawner and recruit data demonstrate that there is a portion of delayed mortality specific to Snake River spring/summer chinook stocks that is coincident with the completion of the hydrosystem and greater for upriver stocks relative to downstream stocks (Fig. 1, 2, 3 in April 20, 2001). In addition, life-cycle survival for Snake River stocks is associated with annual smolt passage conditions, mainstem flows, and spill (Fig. 1 and 2 in State of Idaho 2000). The April 20, 2001 analysis (referenced in the first paragraph), regarding spill ignored this critical assumption of SIMPAS, and completely discounted these delayed impacts of eliminating spill on population viability and recovery.

In addition to our comments, we urge the NWPPC to heed the advice of their ISAB who commented on the use of SIMPAS on April 19, 2001. They urged caution in the emphasis placed on the model results and noted specific limitations:

> "While the assumptions behind the input values used in the modeling are consistent with the available data, and are also consistent with professional judgment of many scientists (they represent committee consensus), these are

only "point estimates" and are subject to a considerable degree of uncertainty. For this reason, it is not appropriate to develop a long-range management plan just on the basis of results from assuming that these uncertain estimates are true. "Best science" under these circumstances would explore the results from a range of assumptions corresponding to the range of the uncertainty. "Best professional judgment" under these circumstances would recommend a course of action that was predicted to perform acceptably throughout the range of predicted possible outcomes. "Precautionary" best professional judgment would be sensitive to plausible worst cases within the range of predicted possible outcomes. Although not possible before decisions must be made this year, the importance of uncertainty in assessments of this type needs to be evaluated carefully."

We hope that our comments provide some guidance for the NWPPC regarding the appropriate use of the SIMPAS model in this phase of NWPPC decisions. If you need any further input please feel free to contact me.

Sincerely,

Rod Sando

Rodney W. Sando
Director
Columbia Basin Fish and Wildlife Authority

CITATIONS

Budy, P. 2001. Analytical approaches to assessing recovery options for Snake River chinook salmon. Utah Cooperative Fish and Wildlife Research Unit UTCFWRU 1:1 -86. Logan Utah.

ODFW (Oregon Department of Fish and Wildlife). 2000. Comments of the Oregon Department of Fish and Wildlife on the Draft 2000 Biological Opinion of the Federal Columbia River Power System Including the Juvenile Fish Transportation Program and the Bureau of Reclamation's 31 Projects, Including the Entire Columbia Basin Project. September 13, 2000.

State of Idaho. 2000. State of Idaho's Comments on Draft Biological Opinion of the Federal Columbia River Power System Including the Juvenile Fish Transportation Program and the Bureau of Reclamation's 31 Projects, Including the Entire Columbia Basin Project (Dated July 31, 2000). September 29, 2000.

Independent Scientific Advisory Board. ISAB consultation recommendations on Council Staff's Draft Issue Paper: "Analysis of 2001 Federal Columbia River Power System Operations on Fish Survival." Northwest Power Planning Council Document 200 1-4.

Joint Technical Staff Letter to Mr. Mark Walker, Northwest Power Planning Council, April 20, 2001.

National Marine Fisheries Service, 2000 FCRPS Biological Opinion December 21, 2000.

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ECO LOGICAL RESEARCH

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To: Rodney Sando

From: Nick Bouwes, Eco Logical Research

Re: Review of the Bonneville Power Administration's analysis of the biological impacts of alternative summer spill operations

Date: January 29, 2004

Dear Rodney,

As requested, I have reviewed the Bonneville Power Administration's analysis of the biological impacts of alternative summer spill operations. I believe the approach used to evaluate these impacts suffers from several deficiencies as to limit the utility of their results. The BPA analysis takes a dangerous approach by using a simple juvenile passage model to estimate the difference in the number of adults under different management scenarios. Adult numbers are compared against potential revenue gains to justify a management strategy. No context is given for the value of an adult fall chinook relative to fall chinook populations or to management. This approach suggests that the rarer a species becomes the less mitigation strategies should be applied to ensure its survival. The uncertainties inherent in this analysis (e.g. survival estimates, smolt-to-adult return rates, benefits of offset mitigation, etc.) are not considered, thus the risks to the populations in question are not assessed placing the burden of proof once again on species in need of protection.

Specifically, the analysis ignores the caveats providing by NOAAF who developed this tool. The BPA approach is inappropriate because; the model cannot predict the likelihood of adult returns; does not include sources of uncertainty thus no evaluation of risk is possible; the model is based on seasonal averages and thus does not include a time or seasonal component and cannot evaluate seasonal changes in spill patterns; and the model is not mechanistic and cannot evaluate direct and indirect mortality by different routes of passage. In addition, the results are highly dependent on stating juvenile numbers and smolt-to-adult return rates, which are likely too low. Some mistakes in the formulas or model inputs are noted. Also the benefits to offset mitigation are highly uncertain, optimistic, and untested.

The model can be used to evaluate an alternative scenario not considered by BPA, but one that is more consistent with the BiOp and a spread the risk strategy. If used in a BPA type analysis, the SIMPAS model suggests that ceasing transportation and providing a spring-like spill program in the summer provides large increases in adult numbers over current BiOp and no spill scenarios. If the BPA analysis is emphasized in developing alternative spill programs, then I suggest that this alternative scenario also be considered.

Sincerely,

Nick Bouwes

Review of the Bonneville Power Administration's analysis of the biological impacts of alternative summer spill operations

by Nick Bouwes,
Eco Logical Research

Prepared for
Columbia Basin Fish and Wildlife Authority

January 29, 2004

Executive Summary

The Bonneville Power Administration is considering reducing or eliminating the summer spill program at the lower Columbia River dams, currently used to aid the migration of subyearling chinook. This consideration is based on an evaluation that uses a juvenile migration model, SIMPAS, as a means to assess the number of juvenile fish that are lost as spill levels decrease below levels prescribed in the Reasonable and Prudent Alternative (RPA) of the 2000 Biological Opinion on the Operation of the Federal Columbia River Power System (FCRPS). Upon review of the BPA spill analysis, I find that the proposal to reduce or eliminate the summer spill program is based upon inappropriate methods resulting in highly suspect results. The BPA analysis takes a dangerous approach by using a simple juvenile passage model to estimate the difference in the number of adults under different management scenarios. Adult numbers are compared against potential revenue gain to justify a management strategy. No context is given for the value of an adult fall chinook relative to the fall chinook populations or to management. This approach suggests that the rarer a species becomes the less mitigation strategies should be applied to ensure its survival. The uncertainties inherent in this analysis (e.g. survival estimates, smolt-to-adult return rates, benefits of offset mitigation, etc.) are not considered, thus the risks to the populations in question are not assessed placing the burden of proof once again on species in need of protection. The following observations of the BPA analysis are worth noting:

- **The use of SIMPAS model in the BPA analysis ignores the caveats providing by NOAAF who developed this tool.** The BPA approach is inappropriate because; the model cannot predict the likelihood of adult returns much less the absolute difference in the number of adult returns under subtle differences in management options; does not include sources of uncertainty, which are extremely large for subyealing chinook and thus no evaluation of risk is possible; the model is based on seasonal averages and thus does not include a time or seasonal component and cannot evaluate seasonal change in spill patterns as attempted in the analysis; the model is not mechanistic and cannot evaluate direct and indirect mortality by different routes of passage such as delay in the forebay, increased forebay predation and stress, and increased delayed mortality.

- **Results are highly dependent on stating juvenile numbers and smolt-to-adult return rates, which are likely too low**. This dependence is in large part due to the metric of choice to measure the benefits of an action (i.e. difference in absolute adult numbers). If juvenile numbers and SARs are based on recent or historic information (i.e. since the mid-1980s), then the benefits of spill are based on empirical information from a population before such a strategy was implemented. In essences this assumes no benefits exist to the prescribed mitigation efforts. This analysis assumes an estuary to Lower Granite SAR, but appears to use a Lower Granite to Lower Granite SAR. Review of past information suggests that a 4% estuary to Lower Granite SAR is at best moderate for a severely depressed stock (brood years 1985-1994). The 2%-6% Lower Granite to Lower Granite SAR goal described in the Mainstem amendments equates to a nearly 7%-20% estuary to Lower Granite SAR. An estuary to Lower Granite SAR of at least 10% appears more appropriate for this analysis.

- **The SIMPAS model does not include a D-value for mid-Columbia stocks transported from McNary Dam.** This assumes D is equal to 1.0. Based 1995 and 1996 coded wire tag studies, D is more likely around 0.5. This value needs to be included into SIMPAS when evaluating trade-offs between spill and transportation for mid-Columbia stocks.
- **The SIMPAS model suggests that ceasing transportation and providing a spring-like spill program in the summer provides large increases in adult numbers over current BiOp and no spill scenarios.** Using SIMPAS in the same manner as in the BPA analysis (but including a mid-Columbia River D value of 0.5) in this no transport/spring-like spill scenario suggests an increase of over 3,000 (or 6 times the 1985-1994 average) in Snake River fall chinook over the current BiOp RPA. For all stocks, the model predicts an increase of 44,000 and 139,000 adults over the BiOp and no spill scenarios, respectively. This increase benefit under a no transport scenario occurs because T/I ratios are less than 1.0 for subyearling chinook. Consistent with a spread-the-risk approach and RPA action 51, this argues for a spring-like spill program during the summer migration.
- **Benefits to offset mitigation are highly uncertain, optimistic, and untested.** The benefits to the predator removal programs applied when evaluating the RPA of the BiOp (NMFS 2000b) were likely much too high. These benefits are likely inflated because the maximum impact of the predator removal program occurred in 1996-1997 with a reduction and leveling off of 15% in later years, is implicitly included in the 1995-1999 PIT-tag survival estimates used in SIMPAS. The RPA then assumes an additional 10% predator mortality reduction on top of this maximum reduction. The assumed benefits to the predator removal program in the BiOp is likely greater than the combined gains estimated from the offset measures. BPA proposes to add additional gains to this inflated benefit. Also, (all) predator removal benefits fail to consider compensation from growth rates, and numeric and functional response by the predator community. Trading spill mitigation measures for even more uncertain and untested mitigation measures, places the burden of proof on populations already in need of further protection.

Introduction

The Bonneville Power Administration is considering reducing or eliminating the summer spill program at the lower Columbia River dams, currently used to aid the migration of subyearling chinook. This consideration is based on an evaluation that uses a juvenile migration model, SIMPAS, as a means to assess the number of juvenile fish that are lost as spill levels decrease below levels prescribed in the Reasonable and Prudent Alternative (RPA) management action of the 2000 Biological Opinion on the Operation of the Federal Columbia River Power System (FCRPS). The spreadsheet model used in this analysis is posted on the Technical Management Team website **(www.nwd-wc.usace.army.mil/tmt/agendas/2004/0204.html).** The number of juvenile fish that are lost under reduced or no spill scenarios are converted to the number of adults lost under a fixed smolt-to-adult survival rate and compared to the amount of revenue that could potentially be generated if the summer spill program were ceased. Alternative mitigation efforts are described as potential offsets to the losses expected based on the model exercise.

Benefits of spill

Spill has long been considered the safest and least stressful route of passage past a dam (NMFS 2000a, NMFS 2000b, Giorgi et al., 2002). Studies estimating survival through different routes of passage at a hydroproject indicate that the direct mortality is lowest through the spillways (NMFS 2000a, Giorgi et al., 2002). In addition, review of smolt-to-adult return rates (SARs) by different routes of passage suggests that a smolt's experience at a dam can affect the probability of surviving below the hydrosystem (Budy et al. 2003). For example, after correcting for direct mortality by the different routes of passages, estimates of SARs have been demonstrated to be higher for smolts that did not pass the dams through bypass/collection facilities, suggesting that the lower survival of the bypassed fish must have occurred after but as a result of their experience at the dam (Bouwes et al. 1999, Budy et al. 2003). The National Oceanic and Atmospheric Administration Fisheries (NOAAF) presents recent evidence to suggest that this pattern no longer exists (Williams et al. 2004), however this analysis fails to consider direct mortality differences by route of passage that can obscure the delayed mortality impacts. When these direct mortality impacts are accounted for, delayed mortality of fish not detected in the bypass systems appears greater than for smolts not detected (Petrosky personal communication). Non-detected smolts are comprised of smolts passing a dam through a combination of spillways and turbines. Because passage through the turbines has been demonstrated to be the passage route with the highest mortality, it stands to reason that spill survival is not only the route of passage with the least direct mortality but also the least delayed mortality.

Several mechanisms can explain these empirical survival benefits of passing a dam through the spillways over other passage routes. Hydroacoustic studies have demonstrated that in the absence of spill, juvenile salmonids are found milling in the forebays of dams (Giorgi et al. 1985, Sheer et al. 1997), particularly for subyearling chinook (Vendetti and Kraut 1999). When spill was provided, forebay delays were reduced. Predators have exploited this holding area for migrating juveniles, making the forebay one of highest areas of smolt losses to predation (Poe et al. 1991, Beamesderfer and Rieman 1991). During the summer months forebay temperatures can exceed lethal levels introducing greater stress and mortality in these areas for subyearling smolts (Coutant 1983). In addition, forebay delays can affect estuary arrival timing, resulting in delayed saltwater entry after physiological changes to deal with the saline environment have occurred. This introduces a whole host of problems for migrating smolts such as increases in susceptibility to predation and pathogens in the estuary (for review see Budy et al. 2002).

Adults, in addition to smolts may also realize the survival benefits through a spill program at the hydroprojects. Survival of adults has been shown to be higher for returning fall chinook during times of spill. These increases in survival are presumably a result of fallback occurring at the spillways rather than through the turbines where mechanical injury and mortality are much higher (NMFS 2000a). Based on this information and reasoning, the RPA of the 2000 FCRPS Biological Opinion (BiOp) calls for spring and summer spill programs to help provide the benefits to listed stocks needed to avoid jeopardy.

SIMPAS

SIMPAS is a spreadsheet model developed by the NOAAF used to describe the impact of the FCRPS on juvenile salmon and steelhead. The model is an effective tool for summarizing empirical information regarding the general impacts of the different routes of passage through the FCRPS on juvenile survival. The different routes of passage at a hydroproject include bypass/collections systems, spillways, and turbines. Smolts are divided into those migrating through the reservoirs and dams (in-river), and those placed in barges and trucks at collector project, transported and released below Bonneville Dam (transport). Passage survival rates are based on passage route specific studies where possible, and in-river survival estimates through the reservoirs and dams are based on PIT tag studies. The model is deterministic and does not include measures of uncertainty for parameter estimates. The model is also not mechanistic such that impacts of changes is environmental conditions are not possible.

All models have limitations, due to an attempt in balancing the qualities of a simple understandable approach with the adequate detail to evaluate goals. In the BiOp (Appendix D), NOAAF acknowledges the limitations of SIMPAS and offers the following 'important' caveats:

1. The juvenile survival rates … are based on juvenile passage studies only and cannot be used to infer the likelihood of adult returns.

2. The juvenile survival rates shown, as well as the input passage parameters, are point estimates, i.e., confidence intervals are not calculated or implied.

3. The model does not contain a time-step function, so both inputs and outputs are scaled to seasonal averages.

4. The model does not account for the potential effects of various fish passage options on forebay passage in terms of reducing delay, residence time, or predation.
5. Best professional judgment was used to develop some of the passage parameters, e.g., in some cases, fish passage data gathered at one dam during a single passage season were applied to several other similar hydrosystem projects.

BPA spill evaluation

BPA attempts to use the SIMPAS model to predict the changes, in some cases subtle changes, in the summer spill program on adult return numbers of fall Chinook in the Snake and Columbia River. The BPA analysis is an extension of the spill analysis conducted by the Northwest Power Planning Council (NPPC). I reviewed the BPA spill analysis spreadsheet provided on the TMT website. Because this spreadsheet only included values rather than formulas for the SIMPAS results, I also reviewed the SIMPAS spreadsheet analysis, which included model formulas, conducted by the NPPC. The BPA analysis used more recent estimates of survival rates over different routes of passage. A simple copy of the these modified inputs from BPA spreadsheet pasted into the NPPC spreadsheet, allowed for an exact replication of the SIMPAS survival rates produced in the BPA analysis. Other worksheets in the BPA spreadsheet evaluated changes in adult numbers over a greater complement of stocks then the NPPC analysis. The results of the NPPC spreadsheet could be pasted into the SIMPAS results worksheet of the BPA spreadsheet to estimate the changes to this larger complement of stocks to evaluate modifications to BPA analysis if needed.

After thorough review of the analysis provided BPA, I find the conclusions, which will presumably be used in the decision in the implementation of the spill program, to be highly questionable for several reasons.

<u>The BPA analysis ignores NOAAF caveats of the SIMPAS model</u>

Many of the deficiencies of the BPA analysis can be organized into the caveats provided in the BiOp of the SIMPAS model. The first caveat is extremely important in that the static juvenile model "cannot be used to infer the likelihood of adult returns" much less precise point estimates in the difference of return numbers expected under multiple scenarios of changes in spill timing and volume, as it used in the BPA analysis. The BPA analysis adds even greater uncertainties to the model by inputting an estimated number of subyearlings produced in the Columbia River Basin above Bonneville Dam (BON) and converting this number into adults over an assumed range of SARs.

There are several problems with using the SIMPAS model to estimate differences in adult returns. First, because the model is specific to the smolt life-stage the impacts to following life-stages cannot be evaluated. For example, spill can provide safer passage to adults by allowing fallback to occur over the spillway rather than through the turbines (NMFS 2000a). This could substantially change the value of spill but is not considered in this analysis because the same SAR is applied to all scenarios. Second, the experience of the smolt life-stage on subsequent survival can also not be addressed in the life-stage specific approach (see above description on delayed mortality). If delayed mortality is reduced by going through the spillway, as appears to be the case, then exclusion of this mechanism will result in an underestimate of the benefits of spill.

Third, using the number of returning adults is a highly suspect metric to determine the success of a recovery program because it does not provide a relative sense of what this means to decision making or to population persistence. Because this analysis compares potential loss of profit to the number of expected adults, a dollars per adult metric is advocated in this analysis. What is the dollars per adult threshold needed to make a decision about the spill program? Based on the highly negative relationship between of mitigation costs to adult returns in the Columbia Basin (Figure 1), it is clear the value of a fish is not constant and thus a context relevant to decision making is warranted. A reproductive adult of an endangered stock is worth considerably more than an adult of an abundant one. Is the production of 30,000 adult salmon from a non-listed population such as the Hanford stock, worth more than 100 adult salmon produced for the listed Snake River stock?

If a loss of 100 adult salmon was observed after removal of the spill program to the Snake River population, this could be significant given that population has been averaging about 500 adult spawners since the mid-1980s (Peters et al. 1999). However, a loss of 1,000 from a population averaging over 40,000 over the same time frame may not have a much of impact on the population persistence of the Hanford stock. To provide a context, this analysis should evaluate the benefits relative to population specific recovery goals, population growth rates, and/or probability of extinction.

In addition, the adult return metric is highly dependent on the assumed starting numbers of juveniles and the SARs used to convert these numbers to adults. These assumptions may be the most sensitive component of this analysis. The SAR assumed in this analysis will produce a proportional difference in the returning adult costs of alternative management actions. This analysis assumed a range of SARs, but these were considered constant for all alternatives. The 0.5%-4% range of SARs considered appears much too low. Because survival to salt water is estimated in SIMPAS, this analysis must apply an estuary-to-LGR SAR to convert juveniles into adults. Estuary-to-LGR SARs for Snake River fall chinook even between 1985-1994, during a time of severely depressed stock status, averaged around 2.7% and were as high of 6.5% (Peters et al. 1999). The NPPC interim objective of 2%-6% LGR-LGR SAR for Chinook and steelhead has been established in the Mainstem amendments. Assuming stocks achieve these goals an expected estuary-LGR SAR from the mitigation strategies outlined in the BiOp can be estimated. By applying a very optimistic assumption that survival from LGR to estuary will be doubled under the current BiOp, an estuary-LGR SARs of approximately 6.5%-20% for Snake River stocks would be expected. I cannot determine from where the values used in the BPA analysis were derived. If they were based on historic SARs, then I believe there is serious flaw in the logic applied to this analysis. Estimating the benefits of the current mitigation strategy by applying historic empirical information from a population before such a strategy has been realized or implemented, assumes no benefits exists. A range of 4% to 20% estuary-LGR SARs seems like a more reasonable assumption on which to base this analysis.

The same logic needs to be applied to the estimated number of juveniles produced. It is not clear if the number of juveniles used in the BPA analysis is assumed to have come from a depressed, current, or recovered population. If, for example, Snake River chinook were recovered based on the intent of the action agencies, we might expect to have greater than 2,500 returning adults (Peters et al. 1999), which will produce a much higher number of juveniles and therefore adults than a population that has been averaging around 500. A higher number of juveniles will produce a greater loss of adults under the no spill option relative to the BiOp spill program.

The second caveat, stating that SIMPAS inputs are only point estimates with no measure of uncertainty, is also germane to this analysis. This is even more problematic with fall chinook that have received relatively little research attention. Several of the input variables have not been estimated but rather are based on studies done at other project or on other species. For example, PATH assumed 90% turbine survival at many of the projects. While BPA has incorporated the latest point estimates, which generally has demonstrated that these PATH turbines survival estimates were optimistic, not all project and passage specific survival rates have been evaluated. Reach survival estimates based on PIT-tags are highly variable suggesting that complex interactions between release groups and their environments may not be captured in a highly simplistic model.

The D value, a critical uncertainty, used for the Snake River stock in this analysis is based on PATH estimates, which were highly variable (note: no D value was applied to mid-Columbia stocks transported from MCN, which assumes D=1.0). The D values derived in PATH using information specific to Snake River stocks were D=0.24 based on PIT-tags (the valued used in this analysis) and D=0.02 to 0.05 based on spawner/recruit data (Peters et al. 1999). This lower D value could have profound implications on model results as the benefits of transportation will be much lower. Because the uncertainty in these and other variable values has not been considered, the risks involved with the various strategies are not evaluated in this analysis. Even more problematic are that uncertainties in the largely untested offsets actions. A sensible first step to this problem would be to conduct a sensitivity analysis based on the range of values observed in the empirical information. Weighting the different scenarios based on evidence and theory would help describe the inherent risks of alternative management actions. In addition, studies, such as estimating the benefits of alternative management strategies, should be conducted before altering a mitigation strategy with demonstrated gains, else this puts the burden of proof on the species in question.

The third caveat explains that SIMPAS is not a seasonally dynamic model. This analysis attempts to evaluate the impacts of turning off spill over different portions of the season using seasonal average values. This could be quite problematic as this analysis makes no attempt to describe the possible mechanisms producing intra-seasonal differences. For example, non-spill options may be more detrimental to smolts later in the season as temperature problems in the forebay become more pronounced. As stated above, spill reduces time in the forebay and therefore exposure to higher temperatures that increases the energetic demand for both smolts and their predators. This may also result in more stressful conditions for transported smolts reducing the effectiveness of the transportation program.

The forth caveat as with the third further warns that this model is not mechanistic and therefore cannot handle indirect effects associated with different routes of passage. The mechanisms of why spill has direct and indirect benefits are discussed above. These ecological considerations are often given as rationalization for providing spill (NMFS 2000a, 2000b), yet this reasoning is largely ignored in this analysis.

The fifth caveat indicates that definitive research has not been conducted for several aspects of the model. This is particularly problematic for fall chinook due the relatively little research conducted on these stocks. These potential problems were discussed under the second caveat.

<u>Specific comments on the BPA spreadsheet analysis</u>

I reviewed the model structure and equations used to evaluate survival rates under the different routes of passage. Below is a list of the potential errors and problems I have noted.

-- There appears to be a mistake in the estimate of the Total to Salt Survival that includes an estimate of D (SIMPAS results page, column O). The cumulative survival of the proportion transported is based on a 3 collector project scenario (LGR, LGS, LMN) whereas the in-river proportional survival is based on a 4 collector project scenario where McNary dam is included. This mistake was made in the NPPC SIMPAS spreadsheet as well. Correction of this problem has a small impact on the results of the BPA analysis.

-- No D value is applied to mid-Columbia smolts transported from MCN. By default this assumes D = 1.0. Based on presentations by Bill Muir and Steve Smith to the ISAB, and on information in the recent white papers (figures 20 and 21 in Williams et al. 2003), the most relevant (under the 1995 BiOp conditions) and best estimates of transport SARs to in-river SARs (T/I) on mid-Columbia fall chinook transported at MCN, are derived from coded wire tag studies conducted in 1995 and 1996. In 1995 and 1996, 133, 663 and 146,658 transport fish and 166,266 and 182,289, inriver fish, respectively, were tagged and released above MCN. Results from this study suggest that in 1995 T/I = 0.9 and in 1996 T/I = 1.21, producing a geometric mean of both years of 1.04. SIMPAS was used to estimate survival from MCN pool to BON tailrace where $V_C = 0.47$, $V_T = 0.98$ so that $D = T/I * V_C/V_T$ or $D = 1.04 * 0.47/0.98 = 0.50$.

Given the low D estimates for the Snake River stocks, this result is not too surprising. The benefits from transportation at MCN are expected to be lower because the smolts are only circumventing 4 dams rather than 8 dams, as in the case of Snake River fish. One might expect a D value less than 0.24, however mid-Columbia stocks experience different environmental conditions making this comparison difficult. A D value of 0.50 was added to the SIMPAS model for mid-Columbia smolts arriving at MCN.

--As discussed above the 0.5% - 4% range in SARs (2% appears to be the value the main conclusions were drawn from) used in the BPA analysis appears low for a estuary-LGR SAR based on past data and current goals. I cannot determine from where the values used in the BPA analysis were derived. Even during a time of severely depressed stock status the average estuary-LGR SARs for Snake River fall chinook between 1985-1994 was around 2.7% and was as high 6.5% (Peters et al. 1999). However, this analysis should not assess the benefit of a mitigation strategy based on information before such a strategy was in place. The NPPC interim objective of 2%-6% LGR-LGR SAR for chinook and steelhead has been established in the Mainstem amendments. By applying a very optimistic assumption that survival from LGR to estuary will be doubled under the current BiOp, an estuary-LGR SAR of approximately 6.5%-20% for Snake River stocks would be expected. Therefore, in addition to the modest 0.5%-4% evaluated by BPA, I included a 10% estuary to the furthest upstream dam SAR as a modest upper bound.

Alternative scenario

Using the above modifications to the SIMPAS model (the addition of a mid-Columbia D value and a corrected estimate of Total to Salt Survival), I estimated the benefits from one more alternative scenario not evaluated in the BPA analysis. Using the SIMPAS model, I evaluated a scenario in which the BiOp spring spill program was applied to the summer. Nighttime spills were modified at LGR, LGS, LMN, MCN, JDA so that spill was 31, 31, 31, 135, 111 kcfs, respectively. Daytime spill was modified at LMN to 31 kcfs. All other spills volumes were left as described in the BiOp spill scenario in the BPA analysis spreadsheet located on the TMT website. In addition, I assumed all transportation was discontinued at all collector projects (i.e. total survival is equal to the cumulative in-river survival to saltwater). Difference in juvenile numbers between the BiOp and no spill (BPA analysis) and no transportation (alternative scenario) scenarios were converted to adult numbers using SARs of 2%, 4%, and 10%. The results are displayed in Table 2.

The basic result of the analysis suggests that there is a large benefit of ceasing all transportation and increasing spill in the summer time. Model results suggest an increase of more than 3,000 listed Snake River adults over the current BiOp (under a more reasonable assumption of 10% SAR) will occur under this management alternative (Table 2). Considering this increase alone is over 6 times the early 1990 adult return and meets or exceeds the lower recovery goal of this population, the benefits of this scenario are tremendous. The no spill option resulted in a systemwide loss of nearly 38,000 and 95,000 adults under 4% and 10% SARs, respectively, as compared to the BiOp spill program. The total return under the no transport option is nearly 44,000 and 139,000 adults **greater** than the BiOp and no spill scenarios, respectively, under a 10% SAR (Table 2).

This increased benefit under the no transport option occurs because the survival through transportation as described by SIMPAS equals survival to the collector project * survival to the barge * D, which is lower than survival if smolts migrated through all projects. In other words, the T/I for both Snake River and mid-Columbia fall chinook is less than 1.0. T/Is of approximately 1.0 are now observed without the benefits of increased spill so this result is not unexpected. In the recent white papers, Willams et al. (2003) state results are uncertain but so far suggest that "…transportation of fall chinook neither greatly harms nor helps the fish, and thus transportation is consistent with a 'spread the risk' strategy." Actually, current operations are not consistent with the 'spread the risk' type of strategy applied to yearling chinook in the spring, because spill at the Snake River collector projects does not occur during the summer migration, therefore maximizing transportation.

Action 51 of the RPA described in the BiOp states "If results of Snake River studies indicate that survival of juvenile salmon and steelhead collected and transported during any segment of the juvenile migration (i.e., before May 1) is no better than the survival of juvenile salmon that migrate inriver, the Corps and BPA, in coordination with NMFS through the annual planning process, shall identify and implement appropriate measures to optimize inriver passage at the collector dams during those periods." BPA is actually suggesting a strategy in an opposite direction of this action based on their SIMPAS analysis. Results from the alternative scenario, more consistent with this action, suggest much could be gained through implementation of a no transport approach.

I do not place much faith in these SIMPAS analyses for the reasons I described above. Results are based on highly uncertain inputs. The SIMPAS model does suggest, as do the limited studies, that transportation may provide no benefit to migrating in-river. This also appears to be the case for spring migrants (Sandford and Smith 2002, Berggern 2003), which has lead to a spread-the-risk approach. Because these results are even more uncertain for fall chinook, the spread-the-risk approach applied to spring migrants appears equally or more applicable to fall migrants.

Offset mitigation

BPA offers alternative mitigations strategies, although hardly novel, to offset the loss of expected adult returns by reducing summer spill. Most of these strategies have not been tested and are therefore highly uncertain. Trading spill mitigation measures for even more uncertain and untested mitigation measures, places the burden of proof on populations already in need of further protection. A true adaptive management approach should be applied, by implementing these offset actions in conjunction with the spill program, and if it can be demonstrated that the necessary benefits to lead to recovery has occurred as a result of these offsets then, relax spill and evaluate the impacts.

BPA suggests that added survival benefits can be expected by increasing the removal efforts of northern pikeminnows, the major predator of migrating smolts. BPA indicates that by increasing bounties a decrease in pikeminnow predation on subyearlings resulting in increased adult fall chinook returns is expected. Previous predator reductions were estimated by ODFW and were based on detailed tagging studies to provide exploitation rates by size class. These exploitation rates were used in the Plan for Analyzing and Testing Hypotheses (PATH) and are reported in Peters et al. (1999). The BPA analysis simply assumes these exploitation rates can be increased without thorough analyses like those conducted by ODFW. The exploitation rates of pikeminnows from the removal program peaked in 1996 and 1997, then decreased and were projected to level off at approximately 15% mortality associated with these predators (Figure 2; note: review of the Friesen and Ward analyses by Schaller and Ward during the PATH revealed a miscalculation producing the 25% reduction in mortality, this is why NMFS used the estimates reported in PATH for the BiOp rather than Friesen and Ward). The leveling off in exploitation rates may partially be explained by the fact that a majority of the pikeminnows were removed by a very small percentage of the individuals participating in the program as it became less novel. Therefore, more experts, not just participants, have to be recruited into this program.

The PIT-tag estimates used to describe survival in the SIMPAS model were estimated during this peak time of the predator exploitation rates. Thus, the maximum benefits expected by BPA of the predator removal program are already included in SIMPAS. The BiOp then assumes a 10% additional decrease in the predator mortality, even though the SIMPAS analysis already implicitly included the maximum benefits expected from the predator removal program. Thus, the BiOp has double counted for the benefits of the predator removal program. This is a flaw in the BiOp that overestimates the expected survival improvements from the RPA, which is likely inadequate to achieve recovery of Snake River fall chinook (Table 1). This double counting of the improvements to predator removal program in the BiOp is likely greater the combined impact of all strategies proposed as offset mitigation in the BPA analysis. Thus, not only is BPA proposing a mitigation effort already in place, the assumed benefits are greatly overestimated.

An alternative of 0% predator reduction was explored in PATH because compensation in growth rates, numeric, and functional responses of pikeminnows and other predators may occur, as is commonly witnessed in other systems. For example, Peterson et al. (1999) found that proportion of salmonids found in the stomach of smallmouth bass in the Hanford reach was greater than the proportion found in Snake River smallmouth bass stomachs, where smallmouth bass were more common. They attributed this to the greater availability of prey per predator in the Hanford reach. This suggests that compensation in predation rates as prey per predator increases may result in much smaller benefits to predator reductions. This uncertainty is not explored in the BPA analysis, but applies to all the predator reduction programs included in the offset mitigation strategies.

The greatest concern I have with the offsite mitigation measures is that they are largely untested and are simply assumed to occur. I defer to comments provided by the USFWS on changes in Hanford stranding strategies and changes in exploitation rates in the BPA analysis since they capture my main and further concerns. These offset measures are offered as mitigation due to loss of adults expected from reducing spill, which is already a mitigation effort imposed to help offset the losses due to operation of the hydrosystem. The current hydrosystem mitigation efforts are not enough to compensate for survival improvements needed to prevent the hydrosystem from jeopardizing the survival and recovery of certain fall chinook stocks. Thus, these offset mitigation strategies should be put forth as additional measures rather than exchange for current strategies to ensure the recovery of listed stocks and the conservation of remaining stocks.

Table 7. Fraction of survival increase needed to achieve recovery target that is expected from the proposed action, the Hydro component of the RPA, and the offsite mitigation component of the RPA (from Peters et al. 2001).

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
ESU	% Survival Improvement Required to Achieve Recovery	% Survival improvement expected from			% Survival Improvement required from Non-Hydro RPA	Fraction of Required Survival Improvement		
		Proposed Action (PA)	Hydro RPA	PA+ Hydro		PA	Hydro RPA	Non-Hydro RPA
Lowest estimate of survival improvement required from Non-Hydro RPA								
Snake River fall chinook	72	63	23	86	0	0.88	0.32	0.00
Highest estimate of survival improvement required from Non-Hydro RPA								
Snake River fall chinook	114	31	18	49	65	0.27	0.16	0.57

Column Notes:

A. % increase in base period survival rate required to achieve 48-year recovery standard (for stocks with defined recovery escapement thresholds) or lambda=1.0 (for stocks without recovery thresholds). Values are from BiOp Table A.4 and A.6.

B. Values are from BiOp Tables 6.3-1 to 6.3-11.

C. expected survival improvements from the Hydro RPA were not provided separately in the BiOp, so we calculated these values as Column D – Column B.

D. Values are taken from BiOp Tables 9.7-6 to 9.7-16.

Table 2: Difference in numbers of adults produced under different scenarios relative to the BiOp spill program estimated from a BPA type analysis using the SIMPAS passage model. The scenarios include the BiOp spill and no summer spill scenarios of the BPA analysis, and an alternative no transport/spring-like spill during the summer scenario.

	BiOp spill	no spill (July- August)	no transport (spring-like spill)	Difference between no transport and no spill
Listed Snake River Stocks				
# of juveniles difference from BiOp spill	0	-1287	30,037	31,324
difference converted to adults with 2% SAR	0	-26	601	626
difference converted to adults with 4% SAR	0	-51	1201	1,253
difference converted to adults with 10% SAR	0	-129	3,004	3,132
All stocks				
# of juveniles difference from BiOp spill	0	-948623	437,589	1,386,211
difference converted to adults with 2% SAR	0	-18972	8,752	27,724
difference converted to adults with 4% SAR	0	-37945	17,504	55,448
difference converted to adults with 10% SAR	0	-94862	43,759	138,621

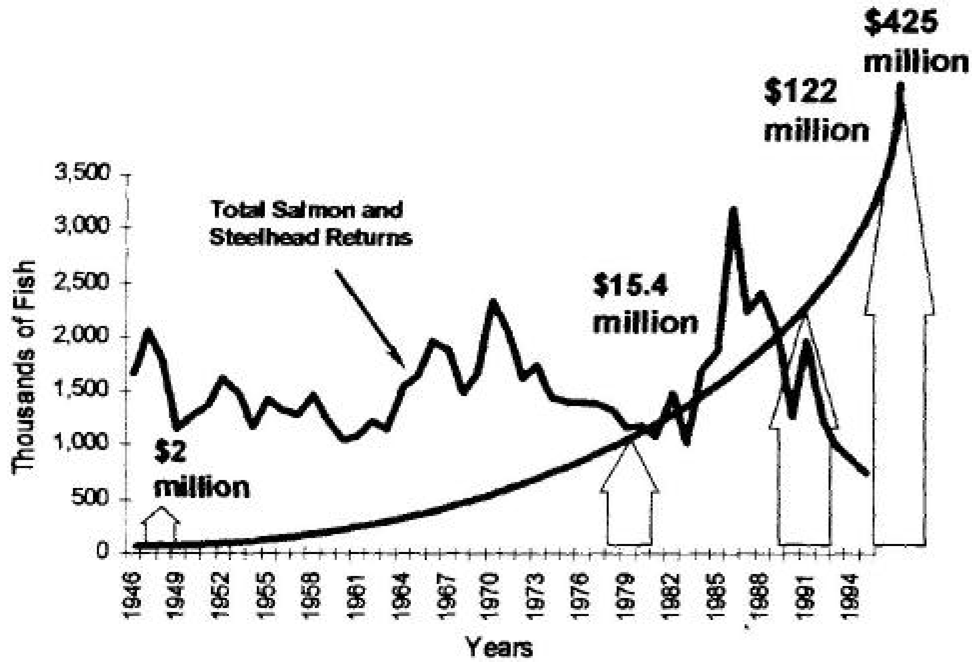

Figure 1: The estimated amount of money spent on mitigation and the estimated number of returning hatchery and wild salmon and steelhead in the Columbia River Basin (from Licatowich 1999).

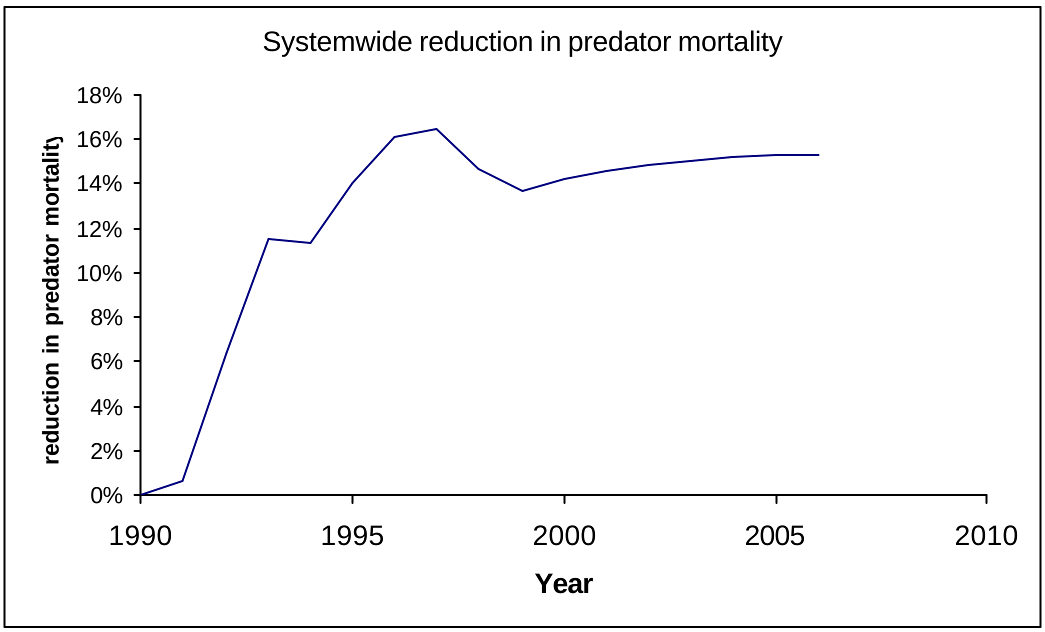

Figure 2: Estimated reduction (reduction relative to pre-1991 levels) in predator mortality due to the Northern Pikeminnow harvest management program. Predation is estimated for age 5-16 year old pikeminnow. The mortality reduction estimates are for the mean total pikeminnow exploitation rate estimates (reproduced from Peters et al. 1999).

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Joint Technical Staff Letter

CRITFC, USFWS, WDFW, IDFG, NEZ PERCE

April 20, 2001

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

Dear Mr. Walker,

We have reviewed the Northwest Power Planning Council's (NPPC) "Recommendations on 2001 Federal Columbia River Power System Operations and Fish Survival", dated April 5, 2001. We offer the following comments for your consideration. We are disappointed that Council staff did not consult with the salmon managers in the development of the analysis of spill and declined to share the model inputs with us when those were requested.

The NPPC recommends that no spill be provided in the lower Columbia River ostensibly based on a biological analysis that implies that little biological benefit will result. The analysis inappropriately evaluates one measure of the NMFS 2000 hydrosystem Biological Opinion (BIOP) in isolation. The BIOP relies on the cumulative survival improvement of all measures to avoid extinction and recover the listed upper basin populations. The impacts of an extremely low flow year were considered for recovering the upper basin ESUs, but not in combination with eliminating some of the hydrosystem measures of the BIOP. Given the extremely low size of the outmigrating Snake River spring and summer chinook population and the extreme drought conditions, the narrow scope of the analysis appears to be a highly risky approach for evaluating the survival needs of the listed populations. In addition, the NPPC analysis is limited to ESA listed stocks of Snake River origin; little consideration is given to Mid-Columbia listed stocks or the remaining unlisted stocks. We recommend that the NPPC re-evaluate on the basis of the following points:

- The biological evaluation conducted by the NPPC has fatal shortcomings that do not support the recommendation that spill will have little benefit to listed stocks. The NPPC approach is incapable of evaluating the effect of elimination of spill on the cumulative survival improvements needed for population growth to avoid unacceptably high probabilities of extinction and achieve recovery of listed upper basin populations.
- The NPPC recommendation should be reviewed in terms of the Power Act. One of our most significant concerns is that the analysis ignores the fate of millions of unlisted anadromous juveniles, which is not consistent with the Council's responsibilities under the Act. Also, consideration of cost of measures addressed in 6 U.S.C. § 839b(h)(6)(c) provides that the Council's Program shall "utilize, where equally effective alternative means of achieving the same sound biological objective exist, the alternative with the minimum economic cost..." Spill has been shown to be the most effective and safest means of downstream fish passage.
- The NPPC recommendation does not consider the impact on unlisted wild and hatchery stocks entering the lower Columbia River from Oregon and Washington tributaries below McNary Dam. For these stocks, lower Columbia River spill is the only protection possible. The NPPC has expended considerable investment in these tributary programs.
- The NPPC recommendation does not reflect the "equitable treatment" standard of the Power Act. Fish protection measures are bearing a disproportionate share of the burden of the power crisis and power system reliability. Fish protection measures are the only ones being eliminated. The NPPC recommendation does not address other potential modifications of water use, on power system stability such as the reduction of irrigation water withdrawals, and the production of hydropower with those volumes instead.
- The analysis ignores the concerns expressed by the Independent Scientific Group's in "Return to the River" over the selective effects of transportation and screen bypass systems on juvenile salmonids. In that document, the ISG stated that spill was the least selective means of juvenile passage available.

Within the context of the Biological Opinion, spill at the Snake River transport collection facilities will not occur because of the recommendation to maximize transportation of fish in this very low flow year. Discussions continue regarding the ability to provide some level of spill at the lower Columbia projects for the benefit of the juvenile migration. The NPPC has provided an issue paper that presents a case for further reducing spill at projects other than the Snake collector projects. An argument based on a narrowly focused assessment of incremental survival changes and adult returns is made for reducing the spill program. At question is whether the analysis presented by the NPPC provides an adequate or appropriate biological basis for these recommendations.

Summary

The draft issue paper focuses on three questions related to the 2001 juvenile salmon and steelhead migration:

1. Given full implementation of the 2000 BIOP for 2001 water conditions, how will additional spill reductions at FCRPS dams change the total system survival of migrating ESA-listed juveniles?
2. How will juvenile transportation at McNary Dam affect the survival of the Upper Columbia ESA-listed stocks?
3. How will adult returns be affected by changes in spill and fish transportation?

Unfortunately, we believe the most important question was not asked and the assessment tool (SIMPAS) was inappropriately applied. The important question is; how risky is the elimination of BIOP measures to the goal of having low extinction probabilities and achieving recovery of listed upper basin populations. Therefore, the critical point is given the extremely depressed state of the outmigrating upper basin population levels and the extreme drought conditions, the NPPC analysis inappropriately uses a tool to assess risk to the populations. The SIMPAS model was not designed to make inferences about the likelihood of adult returns (see Caveats to SIMPAS Modeling Results NMFS 2000 BIOP). This is due, in part, to the fact that SIMPAS simulations were not designed to include delayed hydrosystem mortality, i.e., "extra" mortality. The NPPC Staff implicitly assumed no delayed mortality due to the hydrosystem. This mortality component occurs in the estuary and ocean and is common to both transported and in-river migrants. In addition, the differential delayed transportation mortality ('D' values) assumed in SIMPAS may be optimistic, which exacerbates the basic problem of ignoring delayed or "extra" mortality. The issue paper's caveats overlook these crucial points. If a model is not designed to make inference about the likelihood of adult return rates, there seems to be little justification to using the model to simulate adult return rates for alternative options in a decision process. Also, the NMFS 2000 BIOP caveats SIMPAS results, because the model does not account for the potential effects of various fish passage options on forebay passage in terms of reducing delay, residence time, or predation. The NPPC analysis of spill ignores this critical assumption of SIMPAS, and completely discounts these delayed impacts of eliminating spill on population viability and recovery.

The NPPC Staff Recommendations to further reduce spill and increase juvenile fish transportation in 2001 to "optimize power production" may have economic or power supply bases, but in our opinion are not biologically supportable based on the narrowly focused and inappropriate incremental NPPC analysis. A more biologically realistic assessment of these options would likely indicate that the consequences of "optimized power operations" to Snake River spring and summer migrants are more serious than implied from the Staff analysis. The Recommendations erode a Reasonable and Prudent Action (RPA) in the BIOP, which was considered by NMFS inadequate to avoid jeopardy without off-site mitigation actions. Of particular concern is the recommendation to eliminate spill at Ice Harbor Dam (because of upriver transportation operations) and at McNary Dam (in favor of a questionable bypass system). Maximized transportation of spring migrants from McNary Dam also is not supported biologically by existing information.

Specific Comments

The SIMPAS Model Was Inappropriately Used as An Assessment Tool for Spill Options

The SIMPAS model was not designed to make inferences about the likelihood of adult returns (see Caveats to SIMPAS Modeling Results NMFS 2000 BIOP). This is due, in part, to the fact that SIMPAS simulations were not designed to include delayed hydrosystem mortality, i.e., "extra" mortality. This class of models has limited application for realistically predicting the overall effects of an action on salmon survival.

Many passage models have been employed over the years as a tool to compare alternate scenarios in a qualitative sense. Using the models beyond this application in a relative sense is inappropriate. The relations and point estimates used in these simple passage models are far too simple to adequately capture the complexity of salmonid survival relations and are therefore inappropriate as the rational basis for management decisions.

The NMFS recognizes the limitations in the use of the SIMPAS model and usually places caveats around the model results. The NPPC analysis employs the model results more liberally. For example, the NMFS 2000 BIOP caveats SIMPAS results because the model does not account for the potential effects of various fish passage options on forebay passage in terms of reducing delay, residence time, or predation. The NPPC analysis of spill ignores this critical assumption of SIMPAS, and completely discounts these delayed impacts of eliminating spill on population viability and recovery.

In Appendix D of the 2000 BIOP NMFS writes "Although there may be uncertainty about the accuracy of the resulting pool and dam survival estimates, the Biological Effects Team and NMFS found that the model output for the years 1994 through 1999 was reasonable and produced reach survival estimates similar to the empirical estimates. Once the model was calibrated to data for the current operation, the Biological Effects Team and NMFS considered it had a reasonable base case from which to make comparisons of additional model studies of potential future juvenile fish passage actions over a range of water conditions represented by water years 1994-99. (See Table 9.7.1 for SIMPAS model results of aggressive RPA hydro actions)."

SIMPAS is calibrated to reach survival estimates from primarily high flow years. Even the lowest flow year in the data set used extrapolations from 1994, which was a higher flow year than projected in 2001. It is thus possible that NMFS direct survival estimates are too optimistic for low flow conditions expected in 2001.

There are several possible reasons for the discrepancy between SIMPAS system survival estimates and historic survival patterns. A key concern is that although SIMPAS assumes NMFS' BIOP values of delayed mortality for transported fish ('D') it does not explicitly consider delayed hydrosystem mortality that is common to both transported and in-river migrants. SIMPAS could have been used in the assessments along with assumptions about hydro or non-hydro sources of "extra" mortality, as was done in the BIOP. The implicit assumption of NPPC Staff in the issue paper is that the hydrosystem causes no delayed

mortality to in-river migrants. This is the most optimistic assumption possible about operations, with little empirical support (see Evidence of Delayed Mortality) and has the effect of diminishing the benefits of spill for juvenile survival.

The ‘D’ values assumed for Snake River spring/summer chinook appear to be optimistic. IDFG commented on the draft BIOP (State of Idaho 2000) that more recent ‘D’ values are less than 0.5 from PIT-tag data for 1997-1998 (versus 0.63 – 0.73 assumed in the BIOP and issue paper). If ‘D’ values are too high, the problem of excluding delayed hydrosystem mortality is exacerbated in the NPPC spill analysis. In addition, there does not seem to be any justification to the high range assumption of ‘D’ = 1 for upper Columbia River spring migrants. We are not aware of any existing biological information that supports transportation of spring migrants from McNary Dam. NMFS estimated that in 1994, the last low flow year, that zero wild Snake River spring/summer chinook adults returned from over 3,000 smolts (LGR equivalents) transported from McNary Dam (Fig. 6 in State of Idaho 2000).

The FGEs for Lower Granite (0.75) and Little Goose dams (0.78) appear high compared with collection efficiency estimates at zero spill (~0.6, R. Kiefer, IDFG, personal communication). NMFS’ own staff at the Northwest Fisheries Science Center employed much lower estimates (0.6 at Lower Granite and 0.65 at Little Goose) in their memo estimating listed salmon numbers for ESA purposes. Combined with optimistic transportation and delayed mortality assumptions (critiqued above), this would minimize the influence of reduced spill in the NPPC analysis because too few Snake River spring migrants would be modeled as continuing in-river past these collector projects.

With maximum transportation at Snake River dams and the likelihood of 50-100% transportation at McNary Dam, the benefits from spill on smolt survival will be seen at John Day, The Dalles, and Bonneville dams. The issue paper acknowledges this fact, but does not attempt to show that a higher system survival would occur if both McNary Dam transportation and Alternative 2 (reduced spill at The Dalles and Bonneville dams) were in place rather than just McNary Dam transportation and no spill in lower Columbia River. In Table 5, the NPPC analysis shows listed stocks from Upper Columbia ESA Region (Mid-Columbia River basin) getting the following percent change from the Base Case BIOP with McNary Dam transportation and no spill: +10.4 to +67.0% for yearling chinook and –13.7 to 58.8% for steelhead. These changes increase when one utilizes the results in Table 2 for Alternative 2 vs Base Case and No Spill vs Base Case, and applies McNary transportation to both of these cases in a proportional manner. The percent change from the Base Case BIOP with McNary Dam transportation and Alternative 2 spill would be around +20 to +80% for yearling chinook and –7 to 70% for steelhead. These percentages reflect a trend toward shifting survival through the three dams upwards about 10 percentage points by provision of Alternative 2.

The NPPC analysis also ignores the impact spill has on the survival of non-listed stocks of fish. The conclusions drawn regarding the limited numbers of fish impacted by reducing spill are misleading when considering non-listed populations.

The issue paper notes that listed fish from the Middle and Lower Columbia ESA regions would have reduced survival due to no spill at John Day, The Dalles, and Bonneville dams. But the issue paper seems to downplay the importance of spill to these fish. Regardless of whether the listed fish are from the Upper or Middle Columbia ESA regions, the same general survival reduction occurs in passing John Day, The Dalles, and Bonneville dams under a No Spill case. Using Alternative 2 spill levels instead of No Spill would increase the system survival (upwards of about 10 percentage points) of the listed fish as well as any non-listed fish originating from the Umatilla, John Day, Deschutes, and tributaries of Bonneville pool. The issue paper seems to be shortsighted in its analysis of the benefits of spill to fish passing the three dams in the lower Columbia River. In addition, it is not clear what portion of the Lower Columbia chinook and steelhead ESUs were included in the analysis.

The NPPC analysis does not take into consideration the impact that reductions in spill will have on the survival of adult salmonids that “fall back” through the hydrosystem. Turbine passage mortality for adults has been estimated at 46% for turbine passage (Liscom and Stuehrenburg, 1985), and bypass mortality at 15%, while spill mortality has only been estimated to be 2% for adults. Given these estimates it is easy to see that significant additional mortality may be incurred by adult migrants due to the elimination of spill in the federal hydrosystem.

The issue paper’s caveats overlook these crucial points. If a model is not designed to simulate adult return rates, there seems to be little justification to using the model to simulate and compare adult return rates for alternative options in a decision process.

SIMPAS Survival Estimates Do Not Simulate Historic Stock Performance

The SIMPAS system survival estimates indicate that Snake River spring/summer chinook survival in 2001 will be greater than survival of other spring migrant populations passing through fewer federal dams. This is not biologically realistic given historic smolt-to-adult return rates in poor flow years. For example, Table 3 indicates Snake River spring/summer chinook survival through 8 dams with transportation will range from 56% to 64%, whereas spring chinook survival through four federal dams will be 47%. In other words, Snake River stocks should outperform stocks migrating through the lower Columbia River hydrosystem by at least 19% in 2001, largely due to transportation. Yet, recent smolt-to-adult return rates for spring chinook from the Yakima River (above four federal dams) have averaged nearly ten times higher than for Snake River populations (Fig. 8 in State of Idaho 2000).

Expected survival to returning adult of Snake River spring/summer chinook from smolt year 2001 is very poor based on recent past stock performance. Spawner and recruit information and PATH analyses (Plan for Analyzing and Testing Hypotheses) indicated that Snake River stocks (above 8 dams) have survived only about 1/3 as well as similar stocks which originate above fewer dams (Deriso et al. 1996; Schaller et al. 1999, 2000; Deriso in press). Prior to dam construction, Snake River stock survival equaled that of the downriver stocks. The relative survival of Snake River stocks compared to downriver stocks for smolt years 1972-1992 (Figure 1) has ranged from 6% in smolt year 1992 (a low flow year) to 84% in 1983 (a

high flow year). Although a number of hydrosystem modifications were implemented during this period, there was no empirical suggestion of an increasing trend in relative survival over time.

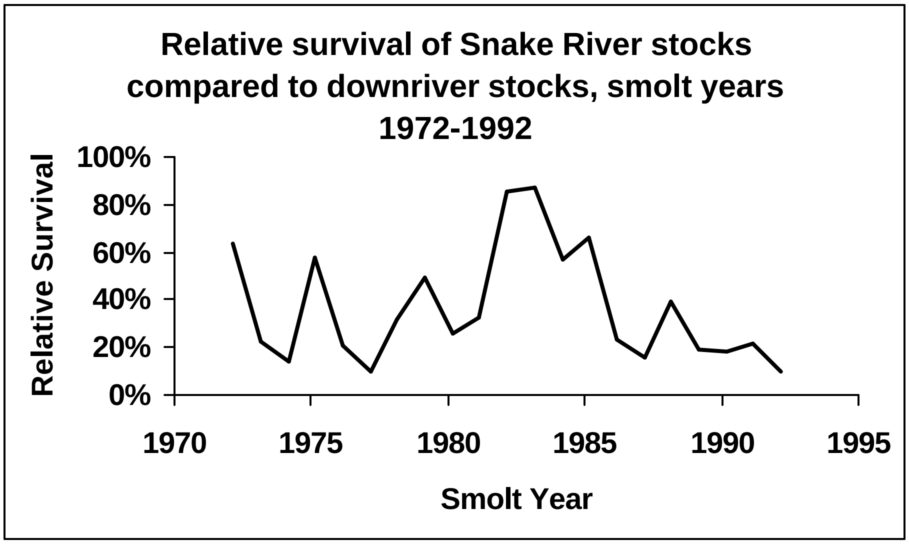

Figure 1. Relative survival of Snake River spring/summer chinook stocks compared to downriver stocks, smolt years 1977-1992 (Source: Deriso in press).

Runoff projections indicate 2001 may be the second worst runoff in the historical record, rivaling 1977 and worse than 1992. Based on historical stock performance, Snake River stocks are expected to survive poorly to returning adult. Relative survival of Snake River stocks correlated significantly with the average flow experienced by smolts during the spring migration period (Figure 2). This regression used data only since 1977, after mass smolt transportation was initiated in the Snake River to mitigate for hydrosystem losses, and since the turbine installation and spill deflectors reduced supersaturation problems. (Note: in the 2000 BIOP, NMFS considered 1980-1992 to be a period of relative stability in hydrosystem conditions).

Projected Snake River flows in the 2001 spring migration might be as low as 40 kcfs. The relationship indicates that at a projected Snake River flow of 40 kcfs Snake River stocks will survive at a much lower rate than downriver stocks (Figure 2). In addition, the relationship indicates that for a projected flow of 60 kcfs Snake River stocks will also survive at a considerably lower rate compared to the downriver stocks' rates.

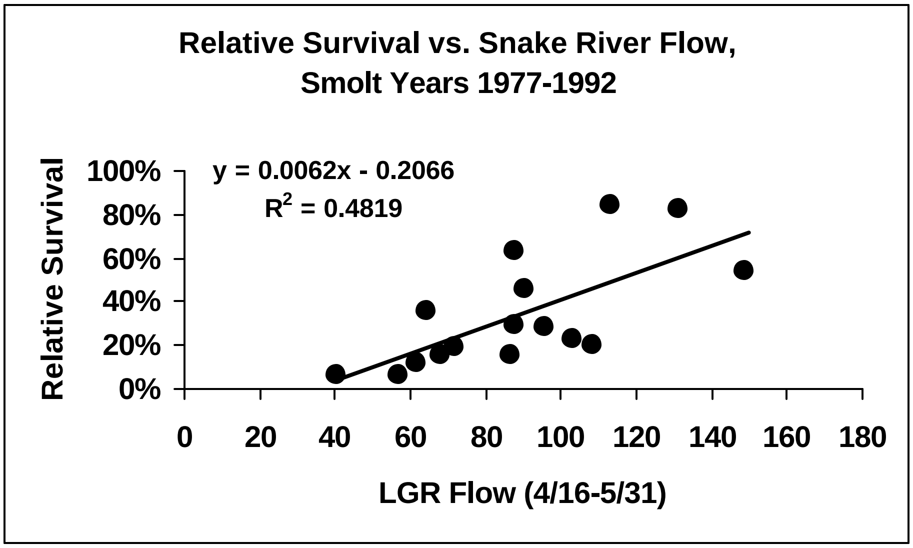

Figure 2. Relative survival of Snake River stocks compared to downriver stocks versus Snake River flow during spring migration season, smolt years 1977-1992.

Historic stock performance of Snake River stocks also correlated significantly with spill at Snake River dams (Figure 3). Because flow and spill are also positively correlated, and both are beneficial, this is expected. Spring 2001 spill would be zero at collector projects under the BIOP operations, and some proposals have been made for full curtailment of spill. The relationship would indicate that for zero Snake River spill the Snake River stocks' survival rates would be much lower than the downriver stocks'.

The historical record suggests poor survival of Snake River stocks for mainstem conditions projected in 2001. Based on historic information, Snake River spring/summer chinook return rates may be only 5% - 20% those of downriver stocks (which will also be negatively affected by poor mainstem conditions). Yet the NPPC issue paper (Table 3) implies Snake River stocks will survive to returning adult at least 19% better than stocks migrating through the lower Columbia River hydrosystem from the 2001 juvenile migration. This does not seem biologically realistic, based on historic patterns.

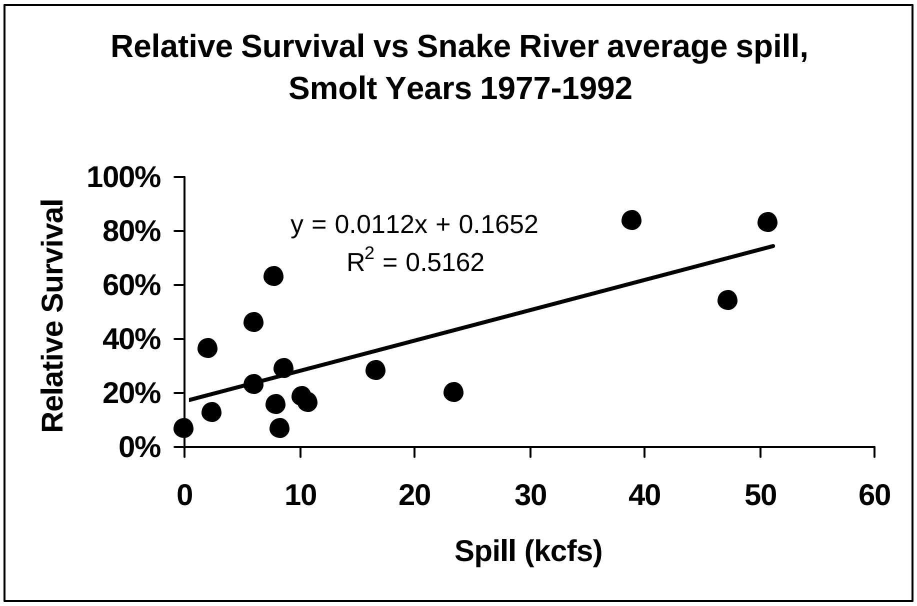

Figure 3. Relative survival of Snake River stocks compared to downriver stocks versus average spill at Snake River dams during spring migration season, smolt years 1977-1992.

Evidence of Delayed Hydrosystem Mortality

The implicit assumption of NPPC Staff in the issue paper is that the hydrosystem causes no delayed mortality to in-river migrants. It follows that if there is no delayed hydrosystem mortality, then the historic patterns of relative survival are merely coincidental with some unknown factor that selects against Snake River stocks in low flow/spill years, and is unrelated to the hydrosystem. IDFG has previously commented that the empirical basis for such a hypothesis is weak (State of Idaho 2000).

Considerable evidence suggests that the source of "extra" mortality, which occurs in the estuary and early ocean, is related to earlier hydrosystem experience, i.e., delayed hydrosystem mortality (Budy 2001; Sections 3.3.1.1. and 3.3.1.2. in ODFW 2000). Evidence from the literature suggests numerous mechanisms that would explain this delayed mortality in relation to a fish's experience through the hydrosystem. Based on recent tagging data, there is direct evidence of delayed mortality by route of passage through the hydrosystem, including transportation and in-river routes (specifically collection/bypass). Spawner and recruit data demonstrate that there is a portion of delayed mortality specific to Snake River spring/summer chinook stocks that is coincident with the completion of the hydrosystem and greater for upriver stocks relative to downstream stocks (Fig. 1, 2, 3). In addition, life-cycle survival for Snake River stocks is associated with annual smolt passage conditions, mainstem flows and spill (Fig. 1 and 2 in State of Idaho 2000). Analytical results indicate current hydropower configuration and transportation options would rival the natural river option only when little or no delayed mortality is due to the hydrosystem, as was assumed in the Staff

issue paper. The different types of evidence in combination suggest that it is implausible that little or none of the delayed mortality of Snake River fish is related to the hydrosystem. This is important in the context of the NPPC spill analysis and the NMFS caveat to the SIMPAS that the model does not account for the potential effects of various fish passage options on forebay passage in terms of reducing delay, residence time, or predation. The NPPC analysis of spill ignores this critical assumption of SIMPAS, and completely discounts these delayed impacts of eliminating spill on population viability and recovery.

NPPC Staff Recommendations

The NPPC Staff Recommendations to further reduce spill and increase juvenile fish transportation in 2001 to "optimize power production" may have economic or power supply bases, but are not biologically supportable. A more biologically realistic assessment of these options would likely indicate that the consequences of "optimized power operations" to Snake River spring and summer migrants are more serious than implied from the Staff analysis. The Recommendations erode a Reasonable and Prudent Action (RPA) in the BIOP, which was considered by NMFS inadequate to avoid jeopardy without off-site mitigation actions.

Of particular concern is the recommendation (#1) to eliminate spill at Ice Harbor Dam (because of upriver transportation operations) and at McNary Dam (in favor of a questionable bypass system). Tucannon River spring migrants and Lyons Ferry Hatchery on-station releases will be affected disproportionately by elimination of Ice Harbor spill, and it appears the Staff analysis underestimates the effects of reduced spill on the Snake River spring migrants in general. Elimination of McNary spill routes a greater proportion of migrants through the turbines causing additional mortality. In addition, the collection/bypass systems (including McNary) appear to be sites contributing to increased stress and delayed mortality.

Maximized transportation of spring migrants from McNary Dam (#2) is not supported biologically by existing information. The model results that transportation increases survival for Upper Columbia stocks under all or most conditions is entirely dependent on the assumptions (particularly those for delayed mortality) used in the NPPC analysis. As stated above the SIMPAS model appears to be inappropriately applied in the NPPC evaluation. Given this problem, the model results do not appear to mimic historic patterns for Snake River stocks, which are subjected to transportation.

Use of surface spill (#3) is biologically preferable to no spill, but it will result in lower juvenile survival than would have occurred with BIOP spills. Additionally, there is little ability to implement surface spill this year. Also, the Council should be aware that the Corps of Engineers and several of the mid-Columbia Public Utility Districts have spent significant time and money in the past few years attempting to develop surface collection/bypass systems at various projects in the Snake and Columbia. To date, none of these efforts, with the possible exception of the Bonneville Second Powerhouse Corner Collector have resulted in a workable system that can perform even as well as a conventional screen-bypass system.

Sincerely,

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U.S. Fish and Wildlife Service

Steve Pettit
Idaho Department of Fish and Game

Bob Heinith
Columbia River Intertribal Fish Commission

James R. Nielsen
Washington Department of Fish and Wildlife

Gregory Haller
Nez Perce Tribe

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