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

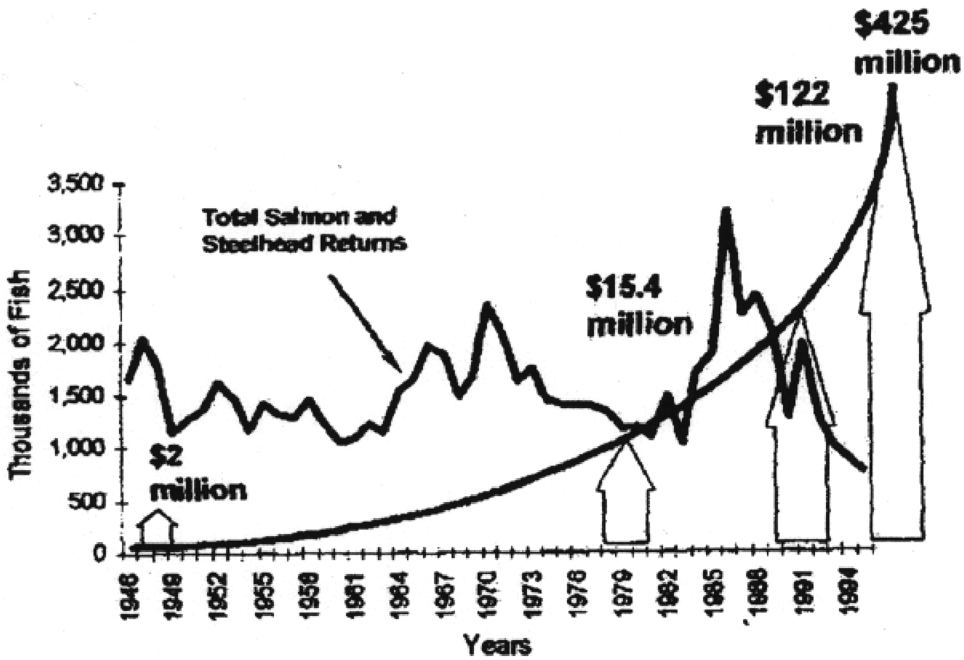

Figure 1: The estimated amount of money spent on mitigation and the estimated number of returning hatchery and wild salmon and steelhead in the Columbia River Basin (from Licatowich 1999).

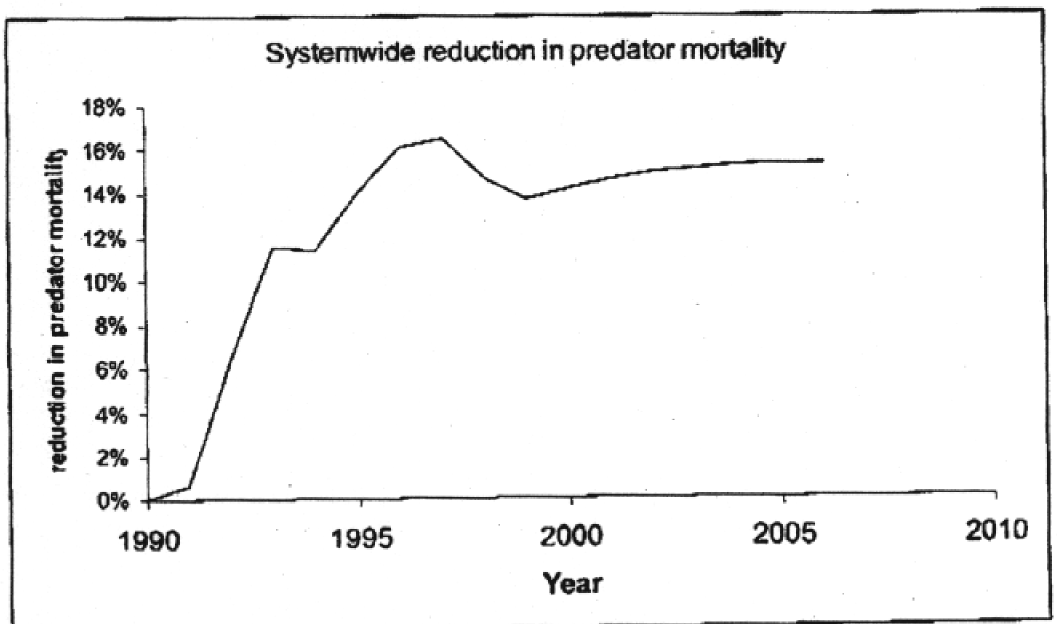

Figure 2: Estimated reduction (reduction relative to pre-1991 levels) in predator mortality due to the Northern Pikeminnow harvest management program. Predation is estimated for age 5-16 year old pikeminnow. The mortality reduction estimates are for the mean total pikeminnow exploitation rate estimates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

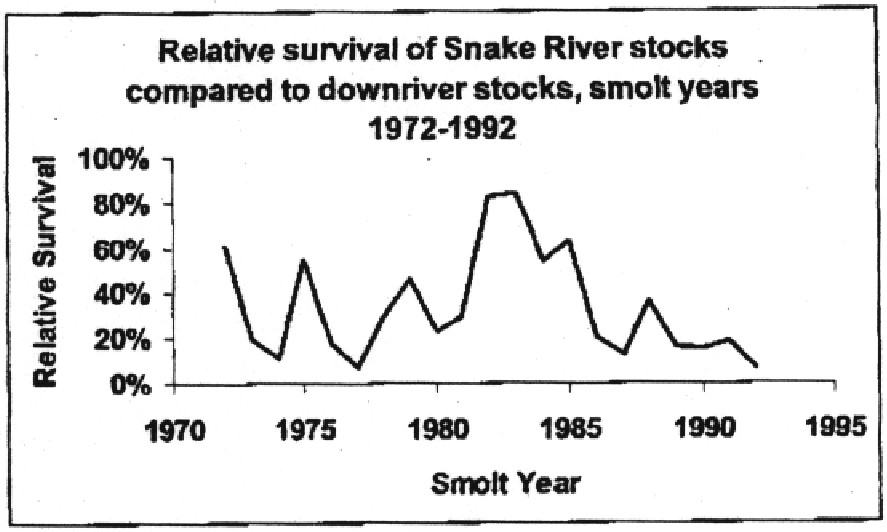

Figure 1. Relative survival of Snake River spring/summer chinook stocks compared to downriver stocks, smolt years 1977-1992 (Source: Deriso in press).

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.

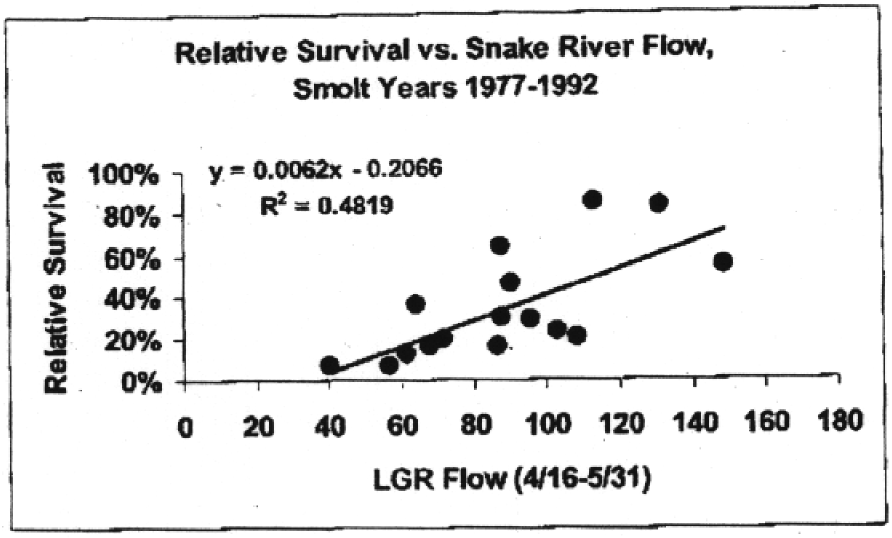

Figure 2. Relative survival of Snake River stocks compared to downriver stocks versus Snake River flow during spring migration season, smolt years 1977-1992.

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.

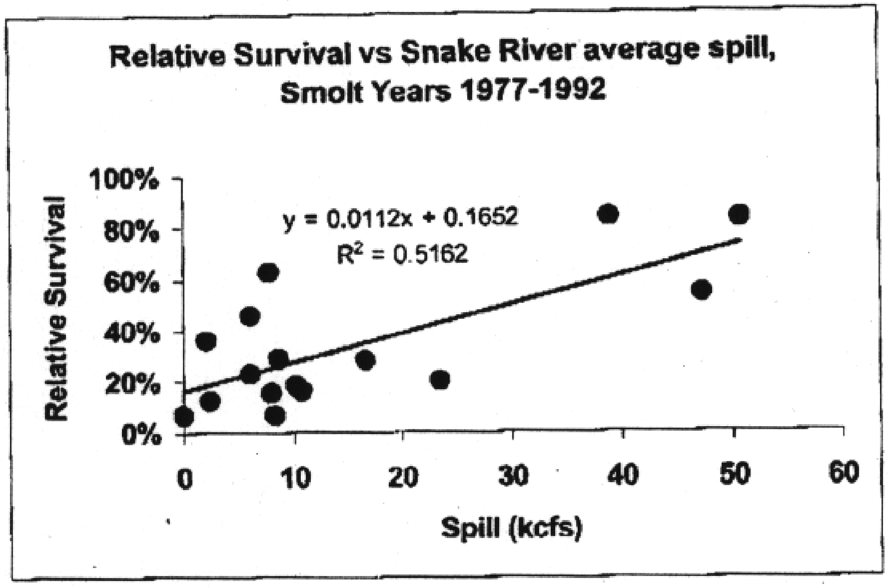

Figure 3. Relative survival of Snake River stocks compared to downriver stocks versus average spill at Snake River dams during spring migration season, smolt years 1977-1992.

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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Idaho Department of Fish and Game

Bob Heinith
Columbia River Intertribal Fish Commission

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