Testimony of

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before the

U.S. Senate

Subcommittee on Water and Power

in

Hood River, Oregon

April 6, 1999

My name is James J. Anderson, I am an Associate Professor in the School of Fisheries at the University of Washington. I have studied Columbia and Snake River salmon for fifteen years and my research group is engaged in quantitative analyses of the environmental and policy factors affecting the decline of salmon and the actions being taken to recover the runs. I am a member of the Plan for Analyzing and Testing Hypotheses (PATH). In my testimony I discuss my perspective on the process to determine the future of lower Snake dams.

To assist in making the 1999 decision on the fate of the lower Snake River dams a structure was setup to separate the science from advocacy and political pressures. An Independent Scientific Advisory Board (ISAB) was established by the Northwest Power Planning Council and the National Marine Fisheries Service to ensure the use of sound scientific methods in the fish and wildlife recovery programs. The PATH was established as a formal program to identify, address and reduce uncertainties in the fundamental biological issues of salmon recovery. PATH has built and analyzed models describing fish decline and the potential effects of recovery through two options: dam breaching and an improved transportation program. The products of PATH have been reviewed by four fisheries scientists comprising a Scientific Review Panel (SRP).

In my testimony I address the following question: is PATH a sound scientific process as was intended? My conclusion is there are problems. In particular PATH results do not comport with the recent survival observations of the National Marine Fisheries Service.

In the 1998 report, PATH concluded that, with up to 90% certainty, breaching the lower Snake River dams will recover endangered salmon. This conclusion is perplexing when compared to the observation-based assessments of the impacts of breaching. Currently about 0.25% of the smolts return as adults. The recovery target is 2 to 5% returns, which is the level observed prior to the completion of the lower Snake River dams. By breaching the four dams a smolt survival of 50 to 70% is expected; however currently measured smolt survival is between 35 and 55%, and barged fish return at twice the rate of the in-river migrating fish. So the direct measurable benefit of dam breaching is nil. Furthermore, contained in the dam breaching hypothesis is the requirement that smolt survival increase strongly with small improvements in fish travel time. The NMFS data shows this strong travel time-survival relationship doesn't exist.

My conclusion from the PATH analysis is that we cannot identify biologically-based mechanisms for the continued low returns of Snake River salmon. The direct evidence says dam breaching will yield little if any improvement in survival, and we have no mechanism to explain how passage through four breached dams in the smolts first week of migration will affect their returns three years later. In a very

basic sense the dam-breaching hypothesis says that if we remove the four dams, fish will return as they did in the 1960s. It is possible, but it is also possible that a climate change is required to restore the fish runs, and finally, it is possible that nothing can be done to restore the runs. There are a significant number of scientists working on these issues and I believe the best we can say at this time is that the work is not finished.

The question then is: with so many unresolved issues and uncertainties how can PATH conclude that dam breaching will recover the fish with a near 100% certainty? I don't have an answer to this question. Perhaps my perspective is wrong and fish will return simply by breaching the dams. Or perhaps PATH was destined to reach its present conclusions, given its mixture of the Bayesian techniques and the organization used to decide what goes into the analysis and what comes out. I cannot resolve these possibilities, but from my participation in PATH I have some observations to offer.

1. There is advocacy: Nearly all of the state and tribal scientists on the PATH regular working group and 20% of the ISAB signed a letter by Idaho Rivers United to President Clinton advocating dam breaching. State fisheries agencies have publicly advocated positions on the unfinished science. The PATH facilitator and the SRP have vigorously defended themselves against charges of bias and I have expressed my views publicly on several occasions. There is nothing wrong with scientists expressing their opinions as the public enquires, but there is the problem of misrepresentation, intended or otherwise.

2. Models are inaccessible: The critical passage models used in the analysis are largely inaccessible. The FLUSH smolt passage model is simply not available. The CRiSP model is available from the Web but both models are complex and have only been run by the groups that developed them. Furthermore, requests from NMFS for important model results sometimes have not been forthcoming.

3. The analysis is opaque: PATH in its attempt to explore the complexity of the issue, used a Bayesian analysis in which 5000 hypotheses were distilled into basically two numbers: the chance of recovery with transportation or with dam breaching. Intuition and clarity were left behind in the details of the analysis. An alternative approach, not taken in PATH, is to simplify the models into a handful of essential hypotheses and then explore and test these to see if they are biologically realistic and agree with data.

4. Uncertainty is under represented: Through the Bayesian distillation, PATH reports specific chances of recovery. These numbers are easily misinterpreted as absolutes. The public does not realize the numbers are only the numerical results of limited hypotheses as weighted by four people.

5. The SRP has great influence on the results: In a Bayesian analysis the outcome depends on the weights given to the hypotheses by a panel of "experts". Nearly any result can be obtained by a choice of weights. The four SRP scientist weighted the hypotheses and determined that the dams must go. My concern is that this system gives the four people inordinate influence on the results. The weighting depends on the panel receiving good information, their ability and fairness to critically review it and the biological validity of the models using the information. There is no process in PATH to obtain other opinions or question the SRP's conclusions.

6. The PATH reports reflect the facilitators' opinion: PATH sought consensus by having a facilitator agency write the documents. They did an amazing job at compiling a vast amount of information and in particular in explaining the process and results of the Bayesian decision analysis. Unfortunately the reports are difficult to read, even for PATH members, and some important assumptions and comparisons to data are not well documented. Finally, there is no place for a minority report in PATH and the reports strongly reflect vision of the facilitators.

Additional comments on PATH are available at http://www.cbr.washington.edu/papers/jim/handout.html