Appendix B

Discussion of Issues related to the Jeopardy Analysis Framework In the Draft 2004 Biological Opinion on the Operations of the FCRPS

CRITFC, October 11, 2004

The new jeopardy standard articulated in NOAA's draft 2004 biological opinion on the operations of the FCRPS is counterintuitive to the ESA. Unlike prior biological opinions, NOAA Fisheries includes no type of trend analysis that would indicate if a given stock is in decline and, if so, how severe. While the draft 2004 BiOp acknowledges that for many stocks, the hydro system is the predominant cause of decline, there is no assessment of the likelihood of achieving survival or recovery goals, particularly such population goals that have been developed in over a decade of concerted biological collaborations such as the efforts of the Biological Requirements Work Group or the Plan for Analyzing and Testing Hypotheses. Even the concept of a stable population, whether the ad hoc goal of Lambda = 1 found in the 2000 BiOp or the 1986-1990 base period populations found in the 1993 BiOp, has been eliminated from the 2004 draft BiOp.

The following analysis recounts the history of biological opinions and how they have addressed the ESA's requirements of survival and recovery in the context of the FCRPS.

With the listings of Snake River salmon stocks in 1991 and 1992, NOAA began crafting a framework for its analysis of whether a proposed federal action would pose jeopardy under the ESA. Since 1992, NOAA's jeopardy framework has undergone substantial evolution. The most significant modifications in NOAA's approach occurred in 1995 and 2004 after the federal district court of Oregon remanded defective biological opinions to the agency. The 2004 draft opinion represents a major departure from the prior frameworks, ostensibly in response to legal guidance from the court. The following section describes the jeopardy frameworks applied by NOAA since 1993, with some discussion of the scientific deliberation that occurred during this period.

NOAA Guidance Document Entitled "The Section 7 Consultation Process: Analyzing Actions that May Affect Endangered or Threatened Snake River Salmon," March 16, 1993.

This guidance document formed the basis for the jeopardy analysis that was performed in the 1993 Biological Opinions on the Operation of the Federal Columbia River Power System Including the Juvenile Fish Transportation Program. In 1992, NOAA had established an interim goal "to improve survival and make progress toward reversing the decline of listed and proposed species." This so-called "bending the curve" goal was used in the Section 7 consultations to evaluate various agency actions including hydropower operations and fishery activities.[1] In 1993, NOAA substantially refined the framework.

[1] NMFS compared anticipated reductions in mortality against a 1984-1990 baseline for juveniles and a 1975-1990 baseline for adults passage counts.

The 1993 framework consisted to two basic steps:

> First, NMFS would consider an action individually to determine whether the action includes measures or modifications to significantly reduce the level of human-induced mortality compared with a specified base period. In the second step, NMFS would evaluate the combined effects of all actions using the available Columbia/Snake River salmon life cycle models and other information.

Unnumbered page 3

In addressing the first step for each proposed federal action, NOAA focused on “whether there would be a significant reduction in mortality relative to a 1986-1990 base period.” NOAA anticipated “that each action would achieve some reduction,” but did not quantify the level of mortality reduction required. In the second step (the combined-effects analysis) NOAA considered “whether improvements made in 1993 are sufficient (assuming that those improvements are continued) to halt the declining trend and stabilize the population abundance at specified levels” within four life-cycles or by 2004-2008. The stability levels were defined as those population sizes that were observed during the 1986-1990 base period. *Id.*

In applying this jeopardy standard to 1993 hydropower operations, NMFS found that the proposed operations represented a significant reduction in mortality (3-11% overall). Based upon this anticipated reduction, NMFS then determined that the long range goal of "stabilizing" the species' population levels, to 1990 levels by the year 2008, was possible to a confidence level of approximately 60-70%.

The tribes and states had misgivings with NMFS analyses, particularly with the selection of the base period and the stability analysis that NMFS performed. Among other things, the spring Chinook returns to the Snake River during the base period were very low and not indicative of recovery to the non-federal fishery managers.

IDFG v. NMFS (1994)

The primary focus of this lawsuit was upon NMFS' selection of, and the action agencies' acceptance of, a framework or methodology for analyzing whether jeopardy would exist to listed Snake River species from the operations of the FCRPS.

Judge Marsh found that NMFS' selection of the '86-'90 baseline (discussed above) was arbitrary as was NMFS’ disregard for low range assumptions (STFA model results being the lowest) in analyzing the likelihood of reaching stability goals and NMFS’ failure to consider additional risks posed from in-breeding and the "extinction vortex." Judge Marsh remanded the biological opinion to NOAA with instructions for NOAA to work with state and tribal fishery managers during the remand period.

On remand following the Court's decision, NMFS engaged in discussions with states, tribes and other parties. The participants established a Biological Requirements Work Group (BRWG) comprised of scientists and fishery managers representing the federal agencies, states, and tribes. The BRWG issued a report on October 13, 1994, which examined the biological requirements and their use in ESA §7(a)(2) determinations. The BRWG defined the biological requirements for listed salmon populations drawing upon and ESA Handbook developed by NMFS and USFWS. The BRWG developed the following definitions for survival and recovery:

> **Survival:** Persistence of a listed salmon population into the future under conditions that will retain the potential for recovery. Survival is characterized by sufficiently large populations, represented by all age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, that exist in an environment providing all of the requirements for completing the species' entire life cycle, including reproduction, growth, migration, and cover.
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> **Recovery:** The process by which the quality and quantity of the Columbia River/Snake River ecosystem is restored so that it can support self-sustaining and self-regulating populations of listed salmon species as persistent members of the native biotic community. At the end of this process, when the population conditions described above are achieved, delisting of the population is warranted. (BRWG, 1994; Draft Handbook at pp. 4-33 and 4-34.)

The BRWG focused on population levels as the measure of the biological requirements of listed species for both survival and recovery. For example,

> For spring/summer Chinook salmon, NMFS will consider the biological requirements to be met if there is a high likelihood, relative to the historic likelihood, that a majority of the populations modeled as well as the aggregate based on dam counts will stay above the threshold levels over a 24- and 100-year period, and a moderate to high likelihood that a majority of the populations modeled as well as the aggregate based on dam counts will achieve its recovery level within 48 years.

The BWRG framework, developed in concert with state and tribal scientists was applied by NMFS in issuing its 1995-1998 biological opinion on the operations of the FCRPS.

Biological Opinion on Consultation on Operation of the Federal Columbia River Power System Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin, March 2, 1995

NMFS applied the framework analysis identified in the BRWG discussions in issuing a new biological opinion in 1995. In rendering the new opinion, NMFS articulated a "five step" jeopardy analysis framework. This five-step analysis was refined in the 2000 biological opinion on the FCRPS, primarily with regard to the metrics used to define the biological requirements of the listed species and the analysis performed pursuant to step four. The following narrative is excerpted from the 1995 biological opinion.

1. Define the biological requirements of the listed species.

> To determine whether a proposed or continuing action is likely to jeopardize the continued existence of listed species or adversely modify its habitat, it is first necessary to know what is required for the species' continued existence, which is more specifically expressed by the regulations in terms of the species' survival and recovery.

1995 BiOp page 11

2. Evaluated the relevance of the environmental baseline to the species' current status.

> The environmental baseline, to which the effects of the proposed or continuing action would be added, "includes the past and present impacts of all Federal, State, or private activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation and the impact of State or private actions which are contemporaneous with the consultation in process." See 50 C.F.R. § 402.02, definition for "effects of the action".
>
> Consistent with this definition, the environmental baseline does not include future discretionary activities within the action area that have not undergone ESA consultation.

1995 Biop page 12

3. Determine the effects of the proposed or continuing action on listed species.

> In this step of the analysis, NMFS examines the likely effects of the proposed agency action on the species. The analysis may consider the impact in terms of mortalities inflicted upon the species' population size and variability, or the

analysis may consider the impact on species needs, such as water temperature, sediment load, total dissolved gas levels, etc. These are the effects that are, or with further authorizations and appropriations could be, within the action agencies' discretion to impose or not, a decision that is influenced by NMFS advice in this biological opinion.

1995 BiOp page 13

4. **Determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the environmental baseline and any cumulative effects, and considering measures for survival and recovery specific to other life stages.**

In this step of the analysis, NMFS determines whether the specific action under the consultation is likely to jeopardize the continued existence of the listed species. This step has two parts for Pacific salmon species. The NMFS must first focus on the action area and add up the effects of the proposed or continuing action, together with those of the environmental baseline and all cumulative effects. The NMFS must determine the significance of that aggregate effect upon the particular biological requirements of the listed species in that action area.

The second part of the analysis calls for NMFS to place the effects of the proposed or continuing action in the context of the full salmon life cycle. This comprehensive analysis is necessary to fully evaluate the significance of each action under consultation to the biological requirements of the listed species in all life stages.

At the species level, NMFS considers that the biological requirements for survival, with an adequate potential for recovery, are met when there is a high likelihood that the species' population will remain above critical escapement thresholds over a sufficiently long period of time. Additionally, the species must have a moderate to high likelihood that its population will achieve its recovery level within an adequate period of time.

In circumstances faced by these listed Snake River salmon, where their current status, as affected by environmental baseline, is such that there is a low expectation of survival with an adequate potential for recovery, the proposed or continuing actions must reduce risks to the listed species' in the action area to insure that the likelihood of the species' survival and recovery is not appreciably reduced. The amount of risk reduction necessary to determine that the action will not likely jeopardize the listed species will depend upon the current status of the species. Again, the Recovery Plan will be the best evidence of the amount of improvement required in each life stage and the measures likely to accomplish that reduction sufficient to satisfy the requirements of Section 7 (a) (2). NMFS will therefore first consider whether the proposed action is consistent with the

Recovery Plan. If not, NMFS will consider whether the proposed action reduces the risks to the listed species as much as or more than the Recovery Plan.

5. Identify reasonable and prudent alternatives to a proposed or continuing action that is likely to jeopardize the continued existence of the listed species.

1995 BiOp pages 13-14

Between 1995 and 2000, a great deal of effort was expended in a scientific collaboration called "PATH", which stands for "Plan for Analyzing and Testing Hypotheses". In the course of the PATH proceedings, technical staff from NMFS, the action agencies, USFWS, state fish and wildlife agencies, Indian tribes, and others engaged in a formal and rigorous program of formulating and testing hypotheses. This effort was structured, in a decision analysis framework, to identify, address and (to the maximum extent possible) resolve uncertainties in the fundamental biological issues surrounding recovery of endangered spring/summer chinook, fall chinook, and steelhead stocks in the Columbia River Basin. Reports of the PATH proceedings are available at http://www.efw.bpa.gov/PATH/index.html. Among other things, the PATH participants considered alternative metrics for measuring survival and recovery of listed Columbia River salmon stocks. The work of the PATH group underlay life cycle analyses used in NNFS' 2000 FCRPS BiOp.

The PATH effort was a multi-million dollar, multi-year collaboration of scientists. The results of PATH are reflected in the PATH FY 1998 Conclusions document, authored by Marmorek, et al. (1999) and included as 10 to CRITFC's comments. Among other things, the PATH effort evaluated the likelihood that it would be possible to achieve survival and recovery of ESA listed stocks through various measures, particularly hydro and habitat measures.

A further analysis of feasibility of alternative measures for survival and recovery of listed salmon stocks was performed at the direction of CRITFC in 2000, using methods developed during the PATH proceedings. This feasibility analysis (Marmorek et al. 2000) is included as Attachment 12. Like the PATH work before it, the 2000 work identifies the limitations of achieving salmon rebuilding through habitat, harvest, or hatchery initiatives. This is particularly true for salmon stocks that spawn in large federally designated wilderness areas located in the Snake River Basin.

2000 FCRPS BiOp

Biological Opinion on Reinitiation of Consultation on Operation of the Federal Columbia River Power System Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin, December 21, 2000

The 2000 Biological Opinion on the FCRPS used the five step analysis developed in the 1995-98 biological opinion.. NMFS used the five-step approach for applying the ESA

Section 7(a)(2) standards. NMFS adopted metrics for survival and recovery in the 2000 BiOp that were different from those developed during the PATH proceedings or those that were applied in the 1995 FCRPS BiOp. In other major respects, the 2000 BiOp's jeopardy analysis framework was very similar to that used in 1995. Again, the steps are as follows (with the sections of the BiOp implementing each step in parentheses):

1. Define the biological requirements and current status of each listed species (Section 4).

For specific ESU's, NMFS identified population growth rates (lambda) over the base period beginning in 1980 and including 1996 adult returns. The population trends were projected under the assumption that all conditions will stay the same into the future. For example, when considering Snake River fall Chinook NMFS identified that the median population growth rate over the base period ranged from 0.94 to 0.86, depending on the assumed spawning effectiveness of hatchery fish.[2] On this basis, NMFS estimated the likelihood of absolute extinction over 100 years as being between 40% and 100%.

2000 BiOp page 4-4

2. Evaluate the relevance of the environmental baseline to the species' current status (Section 5).

Among other things, NMFS considered past actions to improve the configuration, operation, and maintenance of the FCRPS for the benefit of salmon. NMFS compared mainstem survival rates that were observed in the 1970's with those observed in the late 1990's.

2000 BiOp page 5-3

3. Determine the effects of the proposed or continuing action on listed species (methods described in Section 6.1 and applied in Sections 6.2 and 6.3).

NMFS generally considered the effects of the FCRPS on juvenile and adult salmon and developed quantitative estimates of salmon loss attributable to the FCRPS. 2000 BiOp pages 6-13 to 6-78. For adult salmon survival, NMFS estimated the effects of the FCRPS by two methods. NMFS estimated the cumulative loss for adults migrating up the Columbia and Snake rivers through the FCRPS as the difference in adult counts between dams after adjustments for legal harvest and tributary turnoff. NMFS also estimated adult losses using the results of radio telemetry studies, which NMFS considered to eliminate certain errors associated with dam counting procedures. 2000 BiOp page 6-1

The primary method for evaluating the effects of the proposed action on migrating juvenile salmonids in the mainstem Columbia and Snake rivers was through simulation

[2] A lambda value of 1.0 reflects a population that is neither growing nor declining. Lambda values greater than 1.0 indicate that the population is growing, less than 1.0 indicate population decline. A lambda value of 0.9 would indicate a rate of population decline of 10% per generation.

modeling. NMFS' used the SIMPAS model to evaluate the biological effects of current FCRPS facilities and operations and the likely benefits of potential measures to improve juvenile salmonid passage survival. This spreadsheet model is a fish passage accounting model that apportions the run to various passage routes (i.e., turbines, fish bypass system, sluiceway/surface bypass, spillway, and/or fish transportation) accounting for "successful fish passage" (survival) and "losses" (mortalities) through each of the alternative passage routes to estimate total survival. p. 6-2. In commenting on the 2000 BiOp, CRITFC and others were critical of NMFS application of SIMPAS. Many of these criticisms continue to apply to NMFS' current SIMPAS application. NOAA's 2004 draft BiOp does not address CRITFC or other's major criticisms of SIMPAS.

Next NMFS considered the likely effects of the proposed action on the risk of extinction and the likelihood of recovery (#5% risk of extinction in 24 and 100 years; $50% likelihood of meeting interim recovery abundance levels in 48 and 100 years; $50% likelihood that population growth rate will be stable or increasing). 2000 BiOp section 6.3. NMFS then compared the survival change necessary to meet the survival and recovery criteria with the survival changes expected to result from the proposed action. Based on this comparison NMFS estimated additional survival changes to achieve the survival and recovery criteria.

4. Determine whether the species can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the effects of the environmental baseline, and any cumulative effects, and considering measures for survival and recovery specific to other life stages (Section 8).

NMFS analysis of cumulative effects considered the effects of state, local, and tribal actions. In reviewing the 2000 BiOp, the federal district court ultimately determined that NMFS relied future state, tribal, and local actions that were not reasonable certain to occur. The court remanded the BiOp to NMFS, in part, because of its reliance on such actions.

NMFS determinations with respect to survival and recovery that are reported in section 8 of the BiOp refer to its previous analysis of the estimated necessary, expected, and additional survival changes in concluding whether the proposed action caused jeopardy.

5. Identify reasonable and prudent alternatives (RPAs) to a proposed or continuing action when that action is likely to jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat (Section 9). Thus, this step is relevant only when the conclusion of the previously described analysis is that the proposed action would jeopardize listed species.

Because NFMS found that the proposed action caused jeopardy to various listed salmon stocks, NMFS engaged in a lengthy identification and analysis of RPAs. The analysis of the RPAs essentially followed the foregoing procedures.

DRAFT Biological Opinion Reinitiation of Consultation on Operation of the Federal Columbia River Power System Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin September 8, 2004

Step 1: Evaluate Current Status with Respect to Range-wide Biological Requirements and Essential Features of Critical Habitat

> For this Opinion, NOAA Fisheries reviewed the current status of the populations affected by the proposed action in the context of viable salmonid population (VSP) criteria and then reviewed the status of each major population group before reaching a conclusion for an ESU. NOAA Fisheries based this analysis on information published in its June 14, 2004 Status Review (69 FR 33102), which states the reason for listing each ESU and any other relevant information about its status….
>
> 2004 draft BiOp pages 1-6 & 1-7

NOAA did not quantify species' population trends in this BiOp, such as the likelihoods of achieving threshold population sizes or population growth rates that were set forth in the 1995 and 2000 BiOps, respectively. The 2004 draft BiOp generally indicates whether recent (5-year) population trends are above or below replacement. For example, the 2004 draft BiOp notes that:

> All populations in the UCR spring chinook ESU exhibited strong returns of adults during the past four years suggests [sic] that the next few brood cycles will also be strong. These increases are encouraging, following the last decade of steep declines to record, critically low escapements. However, despite the strong returns in 2001, both recent 5-year and long-term productivity trends remain below replacement.
>
> 2004 draft BiOp pages 4-6 & 4-7

For Snake River Spring/summer Chinook the picture according to NOAA is slightly better:

> Due to the severe declines in the populations since the 1960s, the long-term productivity trends remain below replacement for all natural production areas, despite the recent increases. However, the short-term productivity trends for the majority of the natural production areas in the ESU are at or above replacement, which are positive signs for this ESU.
>
> 2004 draft BiOp pages 4-4

For Snake River steelhead the picture according to NOAA is somewhat worse:

> Numbers of spawners surveyed in sections of the Grande Ronde, Imnaha, and Tucannon rivers were generally improved in 2001. However, recent 5-year abundance and productivity trends are mixed. Five of the nine available data series exhibit positive long- and short-term trends in abundance. Most of the remaining long-term population growth rate estimates were below replacement, and most of the short-term population growth rates were either marginally above replacement or well below replacement, depending upon the assumed effectiveness of hatchery fish in contributing to natural productivity.
>
> 2004 draft BiOp pages 4-10

Unlike the 2000 biological opinion NOAA does not quantitatively assess the likelihood of extinction for these stocks. Neither here nor in following steps does NOAA assess the degree of survival improvement that is needed to assure meeting biological survival and recovery indicators. The reader is left to wonder, among other thigs, how the "strong" Chinook returns can be below replacement or how far below replacement the recent "well below replacement" rates are for Snake River steelhead. This is one of the most serious "gaps" in NOAA's jeopardy framework.

Step 2: Evaluate Relevance of the Environmental Baseline in the Action Area to Biological Requirements and the Current Status of the Species and Any Designated Critical Habitat

> In this step, NOAA Fisheries analyzes the effects of past, present, and certain future human factors within the action area to which the effects of the proposed action would be added. The environmental baseline, together with cumulative effects (Step 4), provides the starting point for evaluating whether the action would cause, directly or indirectly, a reduction in the productivity, abundance, or distribution of the listed species or diminish any essential physical or biological feature of critical habitat.
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> 1.2.2.1 Define the Action Area
>
> The action area defines the geographic scope of the environmental baseline and cumulative effects that are relevant to a particular consultation. It includes all areas affected directly or indirectly by the Federal action, not merely the immediate area involved in the action (50 CFR § 402.02).
>
> 2004 draft BiOp pages 1-8

NOAA defines the action area in this draft BiOp to include the mainstem Columbia and Snake rivers, high priority subbasins (Methow, Wenatchee, Entiat, Upper Salmon, Little Salmon, Lemhi, and John Day), areas affected by 19 BuRec water projects, and the estuary and near shore environment. Figure 5.1 on page 5-3 of the draft depicts these areas.

Once again, the identification of the action area in NOAA's BiOp is problematic. For instance, the action area defined in the draft BiOp does not appear to include any significant portion of the Yakima River Basin, yet this basin is pervasively influenced by the Bureau of Reclamation's water resources projects located therein, including five major water storage projects that largely dictate the flow of the Yakima and Naches rivers during certain months of the year.[3] Similarly, the operations of the Upper Snake projects should be considered in this BiOp because of their effects on Snake River water supplies. The action area inappropriately does not include subbasins where the Bonneville Power Administration is currently funding salmon restoration projects in fulfillment of its statutory duties under the Northwest Power Act. Attachment 6, the Columbia Basin Fish and Wildlife Program Rolling Provincial Review Implementation, prepared by the Columbia Basin Fish and Wildlife Authority, June 2004 (hereinafter "CBFWA Program Review"), describes BPA funded projects in numerous other basins such as the Walla Walla, Clearwater, Grande Ronde, Imanaha, Tucannon. These projects are directly and indirectly carried out by the action agencies in exercising responsibilities that are part and parcel of their operations of the FCRPS. These projects also directly affect salmonid species listed under the ESA. Also the draft does not incorporate the impacts of land disturbing activities that are the subject of programmatic consultations, due evidently to time limitations. The action area must be defined to include a much broader geographic range incorporating the full extent of areas affected by the action agencies' salmon mitigation projects and the full extent of Reclamation's project effects associated with the 19 projects under consultation in this BiOp.

1.2.2.2 Determine Biological Requirements and Essential Habitat Features within the Action Area

1.2.2.3 Evaluate the Environmental Baseline Relative to the Biological Requirements and Species Status

Unlike prior BiOps, NOAA's treatment of the environmental baseline in this BiOp has warped the jeopardy framework so severely that more than 90% of the salmon mortality associated with the operation and configuration of the FCRPS is excluded from treatment under section 7(a)(2) of the ESA. Moreover, the NOAA framework also effectively jettisons any notion of achieving salmon recovery from the agency's analytical

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[3] The Yakima Project provides irrigation water for land that extends for 175 miles on both sides of the Yakima River in south-central Washington. The irrigable lands presently being served total approximately 464,000 acres. Storage dams and reservoirs on the project are Bumping Lake, Clear Creek, Tieton, Cle Elum, Kachess, and Keechelus. Other project features are 5 diversion dams, canals, laterals, pumping plants, drains, 2 powerplants, and transmission lines. More information can be found at: http://www.usbr.gov/dataweb/html/yakima.html#general

framework. NOAA sets the stage for this wholesale turnabout in regulatory approach with the following narrative:

> Where the proposed action is a continuation of a past action, as is the case for the operation of the FCRPS, the analysis for this step is complicated, because the environmental baseline will necessarily include the effects of past actions taken to construct and operate the ongoing project. NOAA Fisheries must therefore distinguish the effects of the proposed future operation of the project from its past construction and operation. As described in more detail in Section 5.0, NOAA Fisheries made this distinction by following the fundamental principle of an ESA ' 7(a)(2) consultation. Section 402.03 provides: "Section 7 and the requirements of this part apply to all actions in which there is discretionary involvement or control." Accordingly, the ESA requires a Federal agency to consult on actions that it proposes to authorize, fund, or carry out that are within its discretionary authority. See also 50 CFR ' 402.02 *"action"* and ESA ' 7(a)(2). Thus, conversely, the effects of the existing project that are beyond the current discretion of the action agency are properly part of the effects of the environmental baseline. Those effects are part of the "no action" environment to which will be added the effects of the proposed action.
>
> 2004 draft BiOp pages 1-8 & 1-9

This new approach narrows the view of the effects of the operation of the FCRPS to the difference between a proposed operation of the FCRPS and a hypothetical reference case that purports to embrace the full "discretion" of the action agencies to operate the FCRPS for the benefit of salmon. As noted elsewhere in CRITFC's comments, the physical difference between the reference case and proposed operation is slight to non-existent. The measurement of survival differences between these two cases, using SIMPAS, compounds the omission of FCRPS induced mortalities from this BiOp, mortalities which were previously accounted for in the jeopardy frameworks of each FCRPS BiOp since 1993.

The 1995 and 2000 FCRPS BiOps recognized that the action agencies exercised control over both the operation and configuration of the FCRPS dams. Even the 2004 draft Biop recognizes that the action agencies will make configuration changes at the dams. Unlike the 2004 draft BiOp, however, these BiOps did not forgive FCRPS mortalities associated with past configuration decisions.

Step 3: Describe the Effects of the Proposed Action

As mentioned, the "net effects" approach taken by NOAA, which is essentially a comparison of two SIMPAS model runs and a qualitative assessment of the potential to fill any net survival "gap" identified stands in marked contrast to the analyses previously undertaken by NOAA.

> Effects of the action, to be evaluated in Step 3, are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the action, that will be added to the environmental baseline" (50 CFR § 402.02).

2004 draft BiOp page 1-10

While NOAA purports to assess the full effect of the FCRPS on species survival and recovery, what NOAA does instead is to focus on "net effects". E.g. table 6.7 and 6.9. The relatively small "net effect" starkly contrasts with the approach taken in section 6 of the 2000 BiOp, where NMFS concluded that for all ESUs, stocks will need additional survival improvements up to several orders of magnitude to achieve a stable population growth rate. E.g. Table 6.3-12. This "net effects" analysis, which occupies most of chapter 6 of the 2004 BiOp, has virtually nothing to say about the likelihood of species survival and recovery. Rather the focus has shifted from survival and recovery, which NOAA admits is profoundly impacted by the operation and configuration of the FCRPS, to net effects which have little or anything to say about survival or recovery, except to say that the proposed operation, including changes to system configuration, "would likely result in no **net** reduction in the numbers, reproduction, or distribution of this ESU." The "net" effects analysis performed in chapter 6 of the BiOp does not reveal whether the reproductive capacities of the target stock are such that it is in decline. Nor does the "net" effect analysis reveal whether the stock will achieve the indicators of survival and recovery identified by the BRWG or NMFS' 1995 BiOp or PATH or NMFS' 2000 BiOp.

Step 4: Describe Cumulative Effects

> The cumulative effects analysis in Step 4 requires NOAA Fisheries to evaluate the future effect of those state or private activities (not including Federal activities) that are reasonably certain to occur in the action area.

2004 draft BiOp pages 1-10 & 1-11

NOAA appropriately recognizes that the overall cumulative effects on the listed species are likely to be negative.

Step 5: Conclusion (section 8)

The evidence of a shift in NOAA's thinking about survival and recovery as regards the mortalities imposed by the FCRPS is clearly expressed in the conclusions section of the draft BiOp. The following excerpt concerning Upper Columbia River spring Chinook is illustrative:

> The main consideration in determining if the reduced numbers, productivity, and distribution of this ESU constitute an appreciable reduction in the likelihood of survival and recovery is the degree to which the proposed action poses an additional risk to the ESU.

2004 draft BiOp page 8-12

Even though NOAA recognizes that UCR spring Chinook are at “high risk,” and that the mortality of the FCRPS in the baseline is the primary cause of this risk, the “main focus” is not this risk. It is instead the “additional risk” imposed by the hypothetical difference between a reference operation and the proposed operation. Because this “net effect” only rises to a “medium” indicator level, NOAA isn’t too concerned about the “net effect”. Gone from the analysis is any suggestion that the FCRPS must account for the overwhelming levels of mortality now included in the baseline.

Appendix C

Comments on Ocean Conditions and Flows
frn the draft 2004 NMFS FCRPS Biological Opinion

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September 27, 2004

Overview

The draft hydro measures are generally the same as in the 1995, 1998, and 2000 NMFS Biological Opinions. NMFS continues to insist on flat flow targets instead of moving toward a natural peaking-normative river operation. Advanced weather/climate and hydro forecasting tools for decision-making are still lacking in the draft.

Specific Comments

Appendix "D": Ocean Conditions

No attempt is made to factor in the effects of the Pacific Decadal Oscillation (PDO), which gages the abundance of salmon populations as a function of multivariate ocean conditions and long-term climate regimes (Mantua, 2000). NMFS should collaborate with researchers at the Climate Impacts Group to conduct more research into understanding the driving mechanics of the PDO. Better understanding of the PDO may lead to predictive models, which could give policy makers a better idea on the duration of current "good" ocean conditions, when to expect the next down-turn, and how terrestrial mitigation efforts can be adjusted and improved upon.

The draft assumes "good ocean conditions" without offering the science to back up such a claim. Figure 1 shows monthly values of the PDO (1976 through August 2004). The last full positive phase, when Columbia River salmon fares poorly, occurred from 1977 to 1998. Recent oceanographic research (Peterson and Schwing, 2003; Chavez et. al., 2003) strongly suggests that a new oceanic regime, favorable to Columbia River salmon, occurred in the summer of 1998, which suggests a reversal of the PDO to a negative phase. However, in August 2002, PDO values became positive again. Based on the last 100 years of PDO values, such excursions may last 2-4 years. So, for now, ocean conditions have temporarily turned less favorable for Columbia River salmon. As there is no predictive mechanism for the PDO, it is impossible to tell what trend the PDO may take in the future. So, assuming "good ocean conditions" is a poor assumption at this point in time.

Appendix "D": Flows

Table 1 shows monthly and seasonal flow values for the Reference Operation and NMFS' Proposed Action (PA), as modeled in Hydro-Sim (BPA). Comparison flows are given for the 2000 Biological Opinion, as modeled in GENESYS by NPCC staff (J. Fazio, pers. comm., 2004) and CRITFC's preferred alternative, a natural peaking-normative river operation that utilizes altered flood control rule curves (Martin, 2004), as modeled in GENESYS (CRITFC).

FLOWS (kcfs)	Project	Apr1-15	Apr16-30	May	June	Spring (4/03-6/20)	July	August	Summer (6/21-8/31)
Ref. Op.	Lower	69	90	105	105	96	51	33	51
NMFS PA	Granite	75	89	105	101	96	49	32	50
2000 BiOp		78	90	107	100	97	54	37	52
CRITFC		82	94	113	103	102	50	39	53
						(4/10-6/30)			
Ref. Op.	Priest	124	155	155	197	168			
NMFS PA	Rapids	101	124	169	185	162			
2000 BiOp		112	139	185	180	169			
CRITFC		111	141	179	225	184			
						(4/10-6/30)			(7/01-8/31)
Ref. Op.	McNary	200	247	259	303	269	246	199	222
NMFS PA		186	216	272	287	261	211	159	185
2000 BiOp		200	231	290	282	286	203	174	189
CRITFC		199	237	291	330	289	212	168	190
			Oct.	Nov.	Dec.	Jan.	Feb.	March	Winter (11/01-3/31)
Ref. Op.	Bonneville		113	132	137	150	149	168	147
NMFS PA			115	134	160	198	174	165	166
2000 BiOp			122	122	153	185	171	172	161
CRITFC			116	117	143	161	166	173	152

Table 1. Modeled flow studies, using Hydro-Sim (BPA) and GENESYS (CRITFC), 1929-1978.

A comparison with the Proposed Action to the 2000 Biological Opinion is far more meaningful. Spring flows decrease by 1-2 kcfs in the lower Snake, drop by 11-16 kcfs in the Hanford Reach (although increase by 5 kcfs in June), and decline 15-18 kcfs in the lower Columbia (although increase by 5 kcfs in June). Summer flows decrease by 5 kcfs in the lower Snake (net seasonal drop of 2 kcfs), and increase by 8 kcfs then drop 15 kcfs in the lower Columbia (net seasonal drop of 4 kcfs). Winter flows increase by 3-13 kcfs, which would enhance lower Columbia chum and Chinook populations at the expense of spring/summer salmon stocks.

Appendix "D" Attachment #1: Flows

The use of a three-point flow average is inadequate. The technique to replicate the same runoff volume during any year within 1994-2003 using past water years is sound, but fails on an important consideration—ocean conditions.

There is no mention of how the study flows selected by NMFS relates to ENSO (inter-annual) and PDO (decadal) conditions. A better approach would be to run an ensemble hydro model that can produce dozens of time-series traces of differing flow volumes that would better capture the variability of in-season flows and then match that result with ENSO and PDO conditions. The University of Washington's Climate Impacts Group is capable of running such historical flow simulations.

Appendix "E": In-Stream Flows

There is no quantification of past or present in-stream tributary flows. Since flow is a strong determinant factor in habitat quality- how can one make a proper assessment?

Other Comments on the Hydro-System:

There is no mention of moving the FCRPS to a natural peaking-normative system. The river continues to be run in piece-meal instead of a holistic basin-wide ecosystem approach to recovery. Many technical staff advocate a holistic ecosystem approach to managing water and salmon resources in the Columbia (Transboundary Conference, 2002). NMFS continues to insist on flat flow targets instead of moving toward a natural peaking-normative river operation (Bunn and Arthington 2002) that would benefit salmon (Williams et.al., 1996).

No mention is given to modified flood control operations, which will make more water available for spring migrants. NMFS needs to push the Federal Action Agencies into acting upon better flood control operations to the betterment of the juvenile salmon.

Updated GENESYS hydro studies conducted by CRITFC staff (Martin, 2004) shows that a refill date of May 31st, instead of the June 30th target proposed by NMFS, would ensure better refill probability and as a mitigation tool to counter the effects of global warming. For example, if reservoir refill occurred in May 31st, 2000, instead of June 30th, 2000, Grand Coulee and Dworshak reservoirs would have refilled completely, instead of missing full pool by 10 feet and 2 feet, respectively. The spring freshet peaked in mid-April and the COE continued flood control drafts of Grand Coulee through mid-May. Earlier freshet peaks will become dominant as global warming warms winter and spring temperatures and reduces snow-packs.

Modified flood control rule curves, combined with earlier refill, could reclaim 1.3 MaF from the Snake River and 6.7 MaF from the Columbia River without significantly increasing flood risk to Vancouver and Portland (Figures 2, 3). Current flood control operations wastes 8 MaF annually that could be used for anadromous fish passage. NMFS should push the COE into ceasing the overly conservative flood control operations in low-to-medium runoff years.

Current operations manage the Columbia at The Dalles to 350 kcfs each spring, or 100 less than bank full conditions or 200 kcfs less than flood flow conditions at Vancouver. An independent academic and/or engineering review should be conducted on the feasibility and the consequences of altering flood control operations to achieve an intelligent productive use of spring water.

Federal water managers often fail to meet flow targets (Tables 2, 3), partly due to current flood control operations, but also due to relying on Water Supply Forecast (WSF) information so early in the season, then engaging in hydro operations (e.g., power flows) that deplete system storage that is needed for spring flows. If the WSF volumes decline, then Federal operators are very unlikely to replenish that water in the reservoirs for spring salmon flows. Research by CRITFC shows how trending analysis can add a corrective value to the WSFs and save water in medium-low and low water year classes (Martin, 2002). Knowledge of these trends could keep more winter/early-spring water in the reservoirs in low and/or drought-prone *El Nino* water years.

Spring Target Flows	LWG 4-10/6-20 Target	(kcfs) Observed	MCN 4-20/6-30 Target	(kcfs) Observed	PRD 4-10/6-30 Target	(kcfs) Observed
1995	96.3	100.9	249.2	253.0	135	
1996	100	138.3	258	357.1	135	
1997	100	162.5	260	454.8	135	
1998	90.3	115.6	220	287.8	135	153.9
1999	100	117.0	260	303.6	135	169.6
2000	97	85.1	246.4	243.4	135	158.1
	4-03/6-20 Target	Observed	4-10/6-30 Target	Observed	4-10/6-30 Target	Observed
2001	85	47.5	220	123.9	135	76.7
2002	97	83.4	246	269.3	135	180.6
2003	89.1	90.0	220	231.4	135	141.4
2004	85	70.1	220	203.2	135	126.7
Hits:		6 of 10 yrs.		7 of 10 yrs.		5 of 7 yrs.

Table 2. FCRPS Biological Opinion Spring Target Flows and Observed Flows, 1995-2004.

Summer Target Flows	LWG 6-21/8-31 Target	(kcfs) Observed	MCN 7-01/8-31 Target	(kcfs) Observed
1995	51.3	55.3	200	165.0
1996	52.5	52.7	200	214.5
1997	55	66.3	200	236.5
1998	50.6	53.2	200	169.7
1999	54.3	56.0	200	228.2
2000	51.3	33.7	200	153.6
2001	50	25.4	200	90.9
2002	51.3	41.0	200	189.1
2003	50.5	32.3	200	135.5
2004	50	33.2	200	133.7
Hits:		5 of 10 yrs.		3 of 10 yrs.

Table 3. FCRPS Biological Opinion Summer Target Flows and Observed Flows, 1995-2004.

The probability of meeting flow objectives appears to have declined, as outlined in the draft. Tables 4a, 4b shows the probability of meeting or exceeding target flows under the scenarios modeled in Hydro-Sim or GENESYS. It should be noted that the CRITFC alternative drafts less water out of Dworshak in July, on average, compared with the Biological Opinion and reserves more water into August and September, which is consistent with the NPT-ID Plan.

Probability	**Apr16-30**	**May**	**June**

of Meeting	Lr Grn	McNary	Lr Grn	McNary	Lr Grn	McNary
Target Flow	85	220	85	220	85	220
Ref. Oper.	42%	64%	48%	56%	70%	66%
NMFS PA	44%	46%	60%	60%	68%	60%
2000 BiOp	54%	50%	72%	84%	68%	74%
CRITFC	58%	56%	80%	82%	70%	84%

Table 4a. Achieving FCRPS Biological Opinion Spring Target Flows (average of 1929-1978).

Probability	July		Aug1-15		Aug16-31	
of Meeting	Lr Grn	McNary	Lr Grn	McNary	Lr Grn	McNary
Target Flow	50	200	50	200	50	200
Ref. Oper.	42%	100%	0%	70%	0%	70%
NMFS PA	40%	60%	0%	8%	0%	8%
2000 BiOp	70%	52%	0%	40%	0%	12%
CRITFC	38%	54%	10%	28%	2%	4%

Table 4b. Achieving FCRPS Biological Opinion Summer Target Flows (average of 1929-1978).

For Dworshak, there is no mention of the Nez Perce Tribe-Idaho Plan for Dworshak (IDWR, 2000). The Plan, now adopted by the Idaho Legislature and a part of the Snake River Basin Adjudication court process, advocates draft limits of 1535 feet by August 31st and 1520 feet by September 30th, so that 200 KaF of storage can be used in September for late sub-yearling migrants from the Clearwater, over-wintering smolts, and returning adult Chinook and steelheads. Lower Snake pool elevations should be kept at Minimum Operating Pool during the time in September when Dworshak flow augmentation water is still being released, in order to provide maximum benefits to late migrating Clearwater sub-yearling salmon.

The BOR proposes to use 130 KaF of Banks Lake water for summer flow augmentation. The Tribes want to see 250 KaF (short term) and 500 KaF (long term) from Banks Lake.

The lower Columbia flow gauging point should be moved away from McNary and back to The Dalles, for (1) historical significance, (2) longer-term water record (126 years) versus McNary (50 years), and (3) any flood control studies need to use The Dalles as the only reference point, as The Dalles indexes flood potential at Vancouver. It is logical to use the same reference point during real-time in-season operations.

The draft fails to mention advanced weather and climate predictive tools to help decision makers: NOAA's long-range probabilistic climate forecasts, multivariate ENSO (El Nino Southern Oscillation) index, NOAA's ENSO Risk Model, Pacific Decadal Oscillation research, sea-surface temperature departure analysis, and new models from the European Centre for Medium-Range Weather Forecasts.

The Climate Impacts Group (CIG, 2004) offers an increasing suite of new products to help Pacific Northwest water and salmon managers. Such products are not being used by managers, despite repeated calls for such usage. Nichols (1999) suggests that policy-makers and resources managers are unable, or unwilling, to utilize weather and climate forecasts in the decision-making process.

The COE needs to look beyond using a SOI diagnostic tool as the only managing guide to Libby autumn operations (i.e., pre-season December 31 draft). A comprehensive package of climate diagnostic tools (see above) is needed to better manage Libby, and for all of the COE's reservoirs, instead of continued reliance on outdated science because it is "comfortable."

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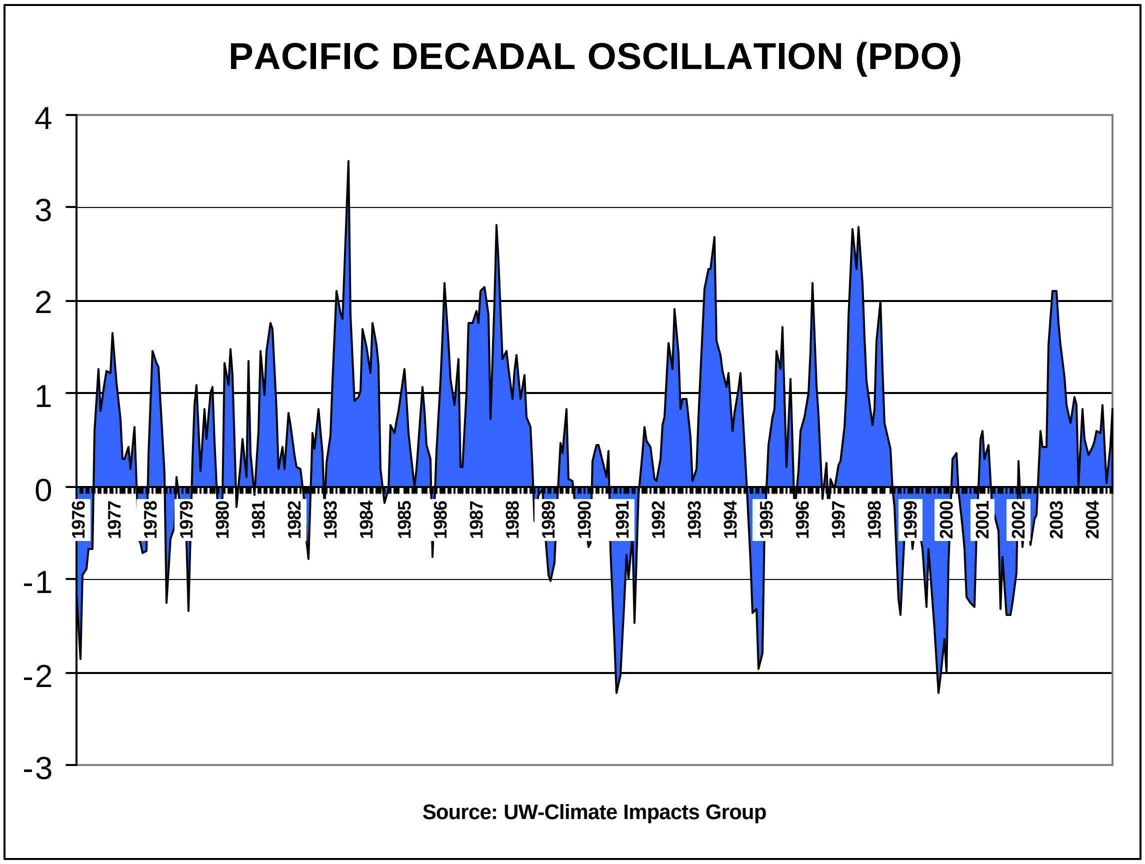

Figure 1. Monthly values of the Pacific Decadal Oscillation (Mantua, 2000).

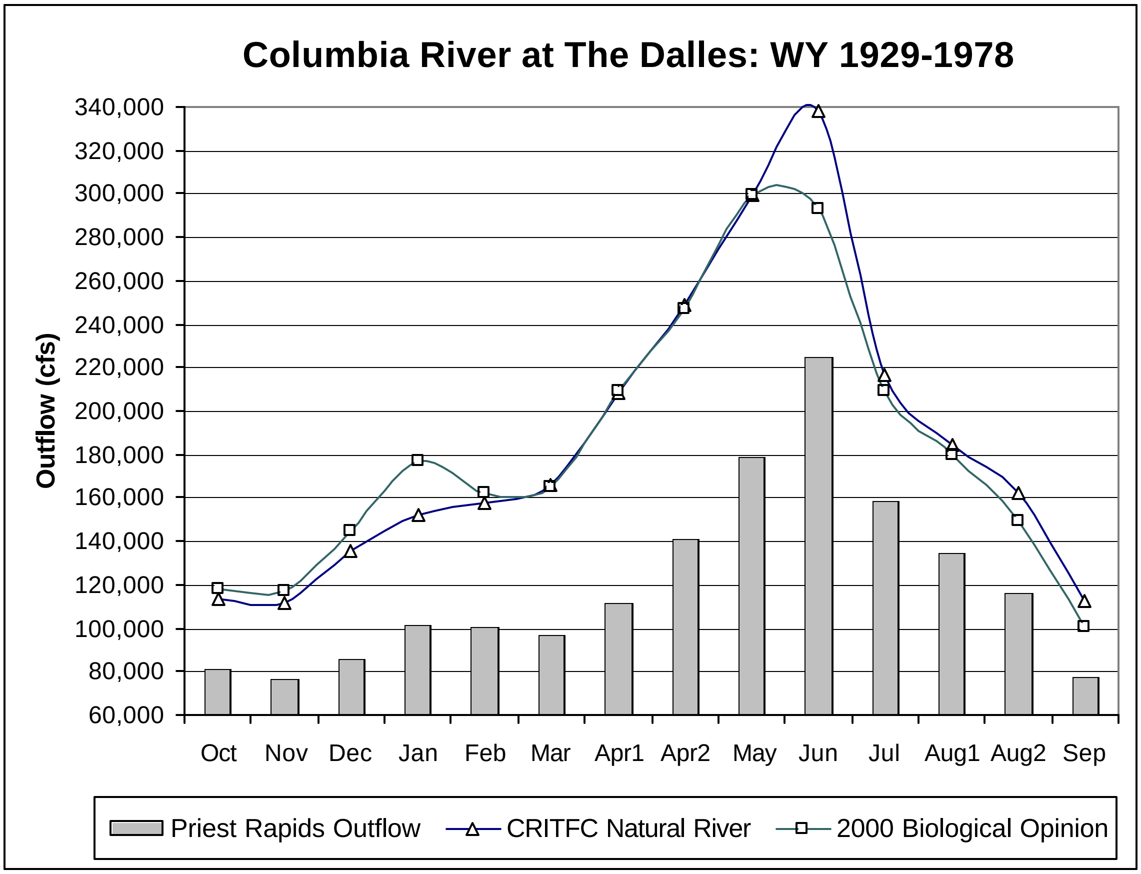

Figure 2. Monthly flow values at The Dalles, as modeled in GENESYS (Martin, 2004).

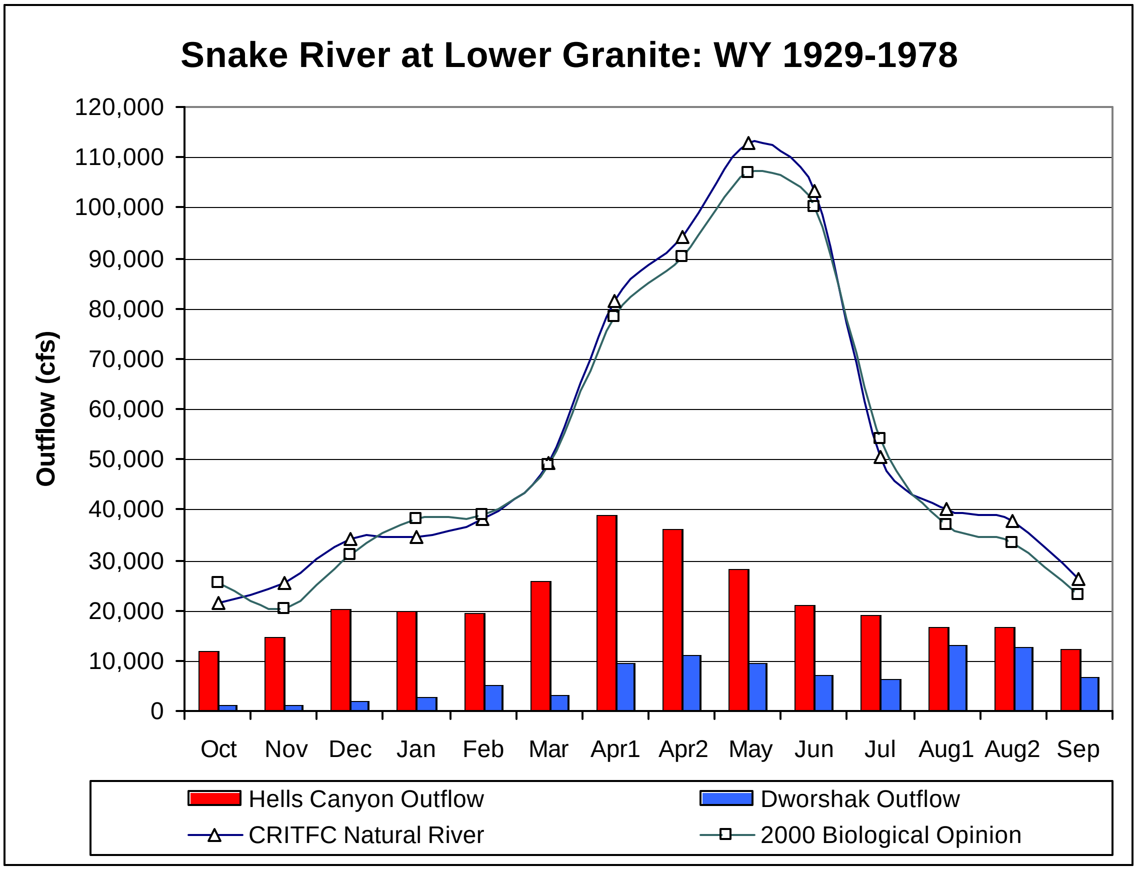

Figure 3. Monthly flow values at Lower Granite, as modeled in GENESYS (Martin, 2004).

Appendix D

A Review of the White Paper Entitled:

"Evaluating the Potential for Improvements to Habitat Condition to Improve Population Status for Eight Salmon and Steelhead ESUs in the Columbia Basin"

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October 8, 2004

The draft paper entitled "Evaluating the Potential for Improvements to Habitat Condition to Improve Population Status for Eight Salmon and Steelhead ESUs in the Columbia Basin" (Draft, Aug 18, 2004) presented the methodology and conclusions to the central question "Is there potential to improve anadromous salmonid population status through improvements to habitat conditions in tributary or estuarine environments?" The assessments made were intended to identify potential to make positive change in salmon and steelhead population status.

The assessment provides results for 8 ESUs affected by the Federal Columbia River Power System (FCRPS). The evaluation was based on GIS analysis of historical and current tributary habitat condition to predict areas *"likely to be impaired."* But it is also admitted that *"historical characteristics are almost universally unknown."* Consequently, the intrinsic potential of the landscape to support Chinook and steelhead was estimated from theoretical principles. If the historic condition were actually known with certainty in addition to current condition, there would be no doubt about the amount of change from historic condition.

There is significant uncertainty, however, regarding the extent to which existing levels of tributary habitat degradation could be reversed. This is a question because some impairments are likely permanent alterations in system capacity and also because the social and legal structure is not set up to address even the restoration opportunities that do exist. Unfortunately, many of these social/political uncertainties stem from internal NOAA processes that result in continuing to grant permission via habitat review Biological Opinions (BiOp) on actions that impair habitat or perpetually defer restoration. Other federal agencies (e.g., USFS, BLM) are also responsible for this situation in proposing actions that further degrade the available high quality habitat, not directing funds to restoration of degraded habitat due to budget constraints, and not maintaining infrastructure that protects habitat quality (e.g., not maintaining the extensive road system that is responsible for a significant proportion of the sedimentation of the stream systems).

The document indicates that *"we identified areas with minimal habitat or population status disruption"* as areas *"that may be important areas to maintain or protect."* The ambivalence about whether remaining high quality areas are important to maintain and protect is strange. When a very large percentage of the Columbia Basin is already totally inaccessible and much of the remainder is high compromised, it is all the more incongruous that NOAA might consider high quality habitat possibly not meriting maintenance and protection.

The foregoing statements indicate various areas of uncertainty:

1) Ability to accurately identify the historical condition from a theory of intrinsic potential.

2) Ability to accurately identify current condition for the entire Columbia Basin in order to assess the deviation from historic condition.

3) Allowing further degradation in the best remaining habitats that provide all the habitat elements (capacity, which is a function of habitat area and habitat quality; diversity; spatial structure) needed by populations that continue to decline due largely to hydrosystem effects.

4) Proposing minimal critical habitat areas. For example, the agency recently proposed limiting bull trout critical habitat (essentially the headwaters of salmon habitat) to less than 10% of the original proposal, which in itself was a minimalist effort.

5) The track record of federal agencies, such as the Forest Service and BLM, in continuing to propose actions that degrade habitat quality, defer restoration, and do not keep pace with maintenance needs, such as forest road quality.

SCOPE OF AND LIMITS TO THE EVALUATION

The scope of the analysis is described as "large-scale." Large-scale here is not used in the geographic sense of map scale where it would imply a relatively fine-grained analysis, but apparently means coarse resolution. This scale of analysis may be inescapable given the size of the Columbia Basin and the fact that resources have never been devoted to producing a reach-by-reach analysis of current condition except in the general way that habitat analysis has been treated in recent subbasin plans. However, the NOAA analysis does not even indicate that they have made use of the crude habitat analysis available in subbasin plans.

- Data are needed on land use activities to show its effect on instream habitat.

  "[T]ributary habitat analyses are based largely on land use, and are aimed at identifying likely impairments or disruptions to natural landscape processes that appear to affect in-stream habitat conditions."

  This assumed link between land use and instream habitat condition makes general sense.

Watersheds that are more intensively developed are also those that tend to have more extensive habitat degradation. However, the theory linking land use, instream habitat condition, and fish population health is not provided. There are no data mentioned that indicate how percentage of land in irrigated agriculture, non-irrigated agriculture, private forestry, federal forestry, road density, etc. translate to instream habitat condition. There is no correspondence given between acres of urban, range, forest, or farmland in terms of impact on fish survival. Consequently, the link between habitat condition, land use, and survival can only be the most crude, qualitative one. There is no assurance that 10% forest land means the same thing throughout the Columbia Basin, given the different ways that forests are managed and the inherent differences in the forests and their watersheds.

- Several potential impacts were not addressed.

  The range of potential impacts investigated *"was limited to sedimentation, riparian and floodplain corridor alterations, water quality (restricted to pesticide and herbicide applications), changes to in-stream flows, potential for entrainment in irrigation diversions, and barriers to passage."* Not addressed were *"exotic species, impacts of mining (either instream habitat alteration or water quality impacts), nutrient cycling, or nutrient cycling and availability."*

The analyses done were "intended to identify impairment to habitat-forming processes that influence in-stream habitat condition" based on current land use and condition. NOAA admits that "additional impacts may be associated with these factors." Also, impacts that occurred in the past may not be indicated.

Problems with this methodology then involve the fact that: (1) current land use is assumed to be linked to instream habitat condition, (2) some impacts associated with those factors analyzed are not represented at all, (3) some past impacts that influence instream conditions are not represented, (4) some key habitat conditions are not directly represented, such as water temperature, which is a key water quality parameter. Water temperature is related to extent of riparian vegetation loss, channel widening, loss of pool volume, loss of wetlands. Many of these important characteristics are not surveyed or considered at all. Change in riparian condition was considered, but the accuracy, representativeness, and extensiveness of the analysis done was not revealed.

A bootstrap statistical analysis was used on the samples of riparian cross-sections (see Appendix B: Anthropogenic Alterations to Habitat Forming Processes), but the various iterations of drawing samples did not involve resampling the original population (i.e., all potential cross sections) but merely continuing to draw samples from an initial sampling. If the initial sampling were biased, there would be no way to indicate this from repeatedly drawning samples from a biased sample.

- <u>Many key habitat forming conditions were overlooked</u>.

It is claimed that watershed or riparian condition would represent habitat forming processes, but as mentioned, many of the key habitat forming conditions were not captured at all. And the one (riparian condition) that was evaluated, was done by methods and to an extent not really revealed. Good intentions and not having time enough to complete a thorough analysis do not make for a reliable evaluation capable of deciding the fate of listed species. When it is known and admitted in this NOAA document that most watersheds aside from the Middle Fork Salmon River have been extensively altered, it is inconceivable that the conclusion would be that only some of them need to be restored. NOAA does not assign any responsibility at all for other federal agencies to take actions that would mitigate for hydro-losses, yet it appears to place some hope in their ability to do something that might provide a benefit to fish. In this sense, NOAA offers to assurance of how it would regulate federal actions proposed for implementing timber harvest, grazing, mining, or road development projects in salmon/steelhead watersheds—the very actions that are responsible for the majority of sediment and temperature problems that are extensively described in most subbasin plans.

OVERVIEW OF METHODS

The document is bereft of any methodology that would link riparian condition with water temperature. Given that riparian condition has an impact on water temperature, the effect of buffer width change, change in vegetation density, or rooting strength (change in species composition leading to differences in streambank stability and channel width) are not connected to water temperature in this document.

The document states that "*it is currently not clear how much water is removed from streams*." And also claims that "*impairments to normal temperature regimes may be associated with impairment or alteration to natural riparian functions*." Water temperature also is closely connected to the amount of water in the channel. If a significant percentage of water is diverted from the channel, this could lead to an exacerbation of water temperature.

It is clear that riparian condition has an important linkage to potential and current water temperature. However, there are so many additional key determinants of water temperature that the actual effect of water temperature in limiting the abundance and productivity of salmonids is not apt to be adequately calculated. NOAA wisely does not make any significant claims about the accuracy of its analysis. However, an analysis with highly dubious results is not an adequate basis for determining the fate of listed species. It is especially not a suitable decision-making tool for deciding not to undertake actions on watersheds known to have suffered significant habitat impacts.

- Mass wasting and surface erosion on forested lands.

"We summarized an estimated difference between current and reference condition sediment supply for each population using road density, timber harvest rates and land-use and land cover information."

No specifics were given as to data sources for road density. ICBEMP data are typically incomplete, only providing a sampling of the road network in various basins. NOAA did not indicate using data on erosion rates from different classes of roads (paved, unpaved, etc.). Differences in erosion rates on different slope classes or geological or soil types were not mentioned. No data were available for amount of forest harvest on the John Day, Grande Ronde, Deschutes, or many other basins. (See also, Appendix B). It is not clear that timber harvest rates were specific to land types. From the description, it appears that timber harvest rates were simply forest-wide averages for extensive time periods. Data are not provided to allow independent evaluation of the adequacy of the analysis and nothing more than a cursory description of the methodology is given. Given the uncertainties in methods and incompleteness of analysis, there can be little confidence given to the result.

- Instream Flows.

"Data limitations include incomplete accounting of all diversions, withdrawals are not measured at each diversion, and return flows are difficult to account for."

We are sympathetic to the difficulties in obtaining meaningful data on instream flows and many other factors. However, the uncertainties in data quality make the analysis questionable. These uncertainties justify taking a precautionary approach to managing the habitats of listed species. Perhaps it can be argued that if very little work is applied on a very small portion of the habitat for an ESU, it makes little difference where one starts working. In that case, it makes little difference whether there is a draft process in place that, based on a very limited set of habitat variables, would indicate that the John Day is more damaged than the Klickitat. But, we believe that all watersheds are in desperate need of restoration and protection and that the value of a limiting factors analysis is to most effectively address the individual needs of each basin.

- Irrigation Diversion Entrainment.

  "Data limitations, as with in-stream flows, include incomplete accounting of all diversions, withdrawals not measured at each diversion, and a lack of information about the presence or status of screen on any diversions. We therefore treat the number of diversions each population encounters as a relative measure of the impact of entrainment on the population."

NOAA uses incomplete and ambiguous data to make estimates of only a potential for effect. This potential is based on a faulty assumption that if a diversion is present, the probability of an impact would be uniformly expressed. For example, if a basin has 100 diversions but 100% are screened and the diversions are well-maintained, the probability of impact is far different from another basin with 100 diversions that are all unscreened and unmaintained. The amount of water entering a diversion is also a key to the level of effect.

Given all the uncertainties, it is questionable whether this analysis provides any useful estimate of probability of impact. It is commendable that diversions would be considered; they are known to cause significant fish losses, but they are also subject to social conflict. If water rights as well as other habitat issues are subjects that NOAA claims no ability to regulate on private land, NOAA then should not be relying on in-basin management to be maintaining listed populations. Purchasing water rights is no guarantee that water will remain in the stream for fish if systems are not in place to regulate water usage. Projections of recovery should be based on those factors that NOAA can and will take responsibility to regulate, not on those factors that it cannot or could but will not.

- Habitat Restoration and Population Decline.

The time required for habitat restoration also needs to be accounted for relative to the projected rate of population decline. Habitat recovery that could be effective if implemented could also require so long to be implemented and work that the population would become extirpated.

- Pesticides and Herbicides.

"50 different pesticides were recently detected by the U.S. Geological Survey in the Willamette basin." and *"their effects on salmon are also poorly understood."*
"We calculated an index of likely exposure to pesticides based on land-use patterns and associated pesticide use."

We are greatly concerned about the effects of pesticides and herbicides on salmon as well as on people. The analysis contained in this document on this subject raises many questions considering the cursory treatment in discussing the methodology. What was the source of the data on pesticide use? Was it specific to watersheds at the HUC 5 or 6 level? What is the relationship between pesticide use and the amounts that are present in streams? Are all pesticides considered to be equal in toxicity to salmon? If this is the threat that is claimed, what will NOAA's response be to plans to use these pesticides on federal and private lands? At this stage, would the argument be that not enough is known about these pesticides to restrict their use? Is NOAA actually reviewing the use of pesticides or is it allowing EPA to make all determinations of the suitability of pesticides in listed watersheds?

In the Results section the document states:*"This water quality metric is very coarse, and provides only a relative measure of potential pesticide impacts."* This would only have a possibility of being a valid statement if all pesticides and herbicides are equal in toxicity, the total pounds per acre applied is known, application is done equally in all watersheds, and the material all has an equal ability to enter streams. Has it ever been determined that 1 acre of dryland wheat in Washington is equal to 1 acre in Oregon for pesticide risk? In other words, the analysis is lacking since it does not consider a series of critical variables.

- Barriers.

“our evaluation of areas rendered inaccessible by anthropogenic barriers was limited by data availability. Thus, our results should be viewed as an initial investigation of blocked areas rather than a definitive analysis.”

It is normal that certain types of analyses would take a long time to complete. But the uncertainty that is generated in the decision process by preliminary analyses makes the decisions themselves very uncertain. Even if an adaptive management process is contemplated, the net result is that any decision whatsoever is considered acceptable so long as the decision authorities permit the proposed action and allow agencies to monitor and adjust over an extended timeframe.

DISCUSSION AND SYNTHESIS

- No accounting for the varying levels of impact of the eight metrics.

The number of factors that were impaired in each population were counted, given a list of eight different metrics. However, there is no guarantee that the level of impact would be substantially worse with eight factors than with one, provided that the severity of the impact in a single factor is very great. For example, if the stream sedimentation is extreme and the water temperatures are very high, it might make little difference whether the stream also ranked high on pesticides, diversions, and flow diversion. (Of note, there was no accounting for water temperature here). Each factor considered is not necessarily of equal rank in conveying an impact, so it would then be inappropriate to simply add the number of impacts to get a total impact.

- Evaluating metal concentrations and pesticides.

“Trace metals and petroleum-based products also enter surface waters in high concentrations in urban areas (Wentz et al. 1998), and their effects on salmon are also poorly understood.”

No apparent attempt to index metals concentrations was given. Also, only pesticide use was mentioned being incorporated into the index, even though herbicides were mentioned elsewhere. This distinction (if there is one) is not illuminated or defined. (There is also – and perhaps it is unnecessary – no reference to whether the term “pesticide” includes herbicides and other related products such as insecticides, fungicides, and fertilizers). No distinction was made in type of application (e.g., aerial vs. ground-based) among the pesticides and watersheds. It is also not clear whether amount of chemical use was also considered. Heavy metals concentrations were not considered from mining operations. This is evident in tables of water quality effects, where Panther Creek was listed as a stream of greatest purity, despite having extremely high heavy metals concentrations.

- <u>Population status</u>.

  "First, for those populations for which a total population estimate was available, we calculated the geometric mean number of spawners for the last five years of the time series."

Population status was described in terms of abundance/capacity, productivity, spatial structure, and diversity according to definitions in McElhaney et al. (2001). The method for estimating current population size is fine, but the method for estimating historic population size was not mentioned.

- <u>Ecoregions</u>.

Diversity was indexed to the number of ecoregions and the distribution across those ecoregions. Although this might be construed to be a useful hypothesis, there is no real guarantee that an ecoregion at the scale used has any significant relationship to life history, genetic or morphological diversity, or stream potential. Ecoregion designations can use different characteristics among regions for classification. Also, it is not likely that within one level of ecoregional classification that every pair of ecoregions is equally different in potential to generate different life history types. Likewise, it has not been demonstrated that ecoregion hierarchy has any causal relationship to genetic hierarchies except for the coincidental fact that the greater the distance separating any two watersheds, the greater is the likelihood that fish population genetics and watershed characteristics would diverge. However, some ecoregions span subbasin boundaries where one population in one subbasin could be separated in stream miles by a great distance from a population in another subbasin, but in direct air miles the distance could be very small. This poses the logical problem of whether life history or genetic similarity is more attributable to ecoregion or to drainage boundaries.

- Riparian and floodplain functions.

Riparian and floodplain corridors in agricultural, urban, forest, and rangeland areas were evaluated for changes from historic buffers. The objective is to detect change in function of riparian and floodplain areas. A variety of functions are mentioned but no indication is given to how all desired functions in total are synthesized by buffer width. No discussion is given from whatever papers are reviewed how a buffer width of 1 m can maintain anywhere from 1% to 90% of ability to retain sediment. (See Fig. B-5). No mechanism is mentioned to relate percentage of buffers for either riparian or floodplain with level of maintenance of the entire set of physical functions or in provision of biological abundance, productivity, spatial structure, or diversity. No connection is made between riparian function and water temperature regulation, one of the most critical issues in land management.

IMPLICATIONS OF HABITAT AND POPULATION STATUS FOR OFF-SITE MITIGATION

> *"It is in these areas that there is the greatest likelihood that habitat process impairments have substantially affected population status. The greatest potential to improve population status through habitat actions thus also probably lies in these situations."*

Highly compromised habitats have many factors identified as impaired, according to the system of indexing degree of impact developed in this document. This system of accounting for habitat impacts assumes that total magnitude of impact is linearly related to the number of factors that are considered to merely have the potential for impact. This amounts to only counting presence of the factor, not calculating the magnitude of actual impact in terms of survival. For this reason, it is very likely that severe impacts can be present in certain watersheds where there may be extreme sedimentation, for example, but the presence of pesticide use and other factors may be missing. Such a watershed might be ranked as a low impact watershed, despite a severe impact in one particular factor.

Cumulative impact assessment involves incorporation of all key sources of impact (a good start was made here, but the list is only partial), but it also requires examining the extent, frequency, and history of impacts for any individual source (e.g., sediment input).

A good example of this type of problem can be found with Joseph Creek steelhead (GRJOS-s) in the Grande Ronde system. The habitat ratings indicate a high rating for non-forest increase) in sediment (index value 8) and a relatively high potential for increase in forest sediment (index value 6). Floodplain conversion, riparian conversion, toxics, entrainment, and instream flow were all rated low. Joseph Creek scored only 1 value with a rating of =8. By creating two separate categories for potential increase in sediment (i.e., forested and non-forested), the indexing system allows streams that are only forested to be ranked lower than streams that have both forest and non-forest areas. Even if the forested stream has extreme sediment potential, its significance would be reduced dramatically in this scoring system if it has no non-forest sedimentation potential. The Grande Ronde subbasin plan completed in 2004 indicates that Joseph Creek is managed as a wild-only steelhead stream. Joseph Creek and its tributaries are listed as having these limiting factors: temperature, sediment, habitat modification.

In the subbasin plan, ODFW had estimated a 74% reduction in summer steelhead returns in Joseph Creek from historic levels, whereas only a 67% reduction was estimated for the upper Grande Ronde. The subbasin plan states: “The EDT model predicts relatively large (75%) changes in abundance through restoration of 1) Lower Chesnimius, 2) Lower Joseph Creek, 3) Upper Joseph, 4) Swamp Creek, 6) Crow Creek (Figure 25).” Almost all of the Joseph Creek drainage has roads in the riparian area. Removal of these roads was cited as an important part of sediment reduction. “Overall this is one of the most heavily roaded watersheds in the Grande Ronde Subbasin.”

Grazing was also cited as being heavy and extensive in the Joseph Creek drainage. The kinds of habitat improvement projects that have taken place in the Joseph Creek drainage included road obliteration, streambank stabilization, riparian planting and seeding, livestock fencing, upland seeding and erosion control, road improvements, improvement of stream crossings. The NOAA method of scoring habitat limiting factors places Joseph Creek in the same category as Chamberlain Creek in the Salmon River. Despite the significant habitat problems itemized in the subbasin plan, NOAA considers that Joseph Creek has no potential for improvement in productivity, spatial structure, and diversity. The tributaries to Joseph Creek were all implicated in the habitat limiting factors described, including Cottonwood, Tamarack, Swamp, Elk, and Chesnimnus creeks.

> *Those populations with minimally compromised habitat, for instance, provide little apparent opportunity for habitat restoration (across the range of factors that we examined); engaging solely in tributary habitat actions to improve population status in these cases would be a relatively high risk strategy, if local information does not indicate other problems. A lower-risk strategy for these populations would include actions with greater certainty of achieving a response. Those populations with highly and moderately compromised habitat are more likely to show a response to habitat improvements. Importantly, the likelihood of a response will be affected not only by the diversity of habitat factors impaired in an area, but also by the magnitude of change from historic conditions, the certainty with which changes (improvement) in a particular factor can be linked to population response.*

We agree that in watersheds with minimally compromised habitat, there are minimal opportunities to restore habitat. That is, if it is not greatly divergent from historical habitat conditions, there is little ability to improve population status via habitat restoration, unless a largely pristine watershed is only significantly altered in a strategic location. For example, if 90% of spawning habitats are nearly pristine, but the 10% that were significantly altered historically accounted for 50% of the production, then one could say that a single factor with strategically located impacts could be responsible for restoration in disproportion to the spatial extent of the impact.

More importantly, for the many watersheds, such as exist in the Middle Fork Salmon River, the Wenaha, the East Fork of the Umatilla, White Sand Creek on the Lochsa, etc., where tributary habitats are in high condition and there is little opportunity to make conditions better, NOAA admits that to undertake only habitat improvement on these habitats would place the populations at relatively high risk. Even though the populations in these watersheds have the benefit of having all the tributary conditions necessary to optimize abundance/capacity, productivity, spatial structure, and diversity, the tributary conditions do not provide the limiting factor. In these populations, the limiting factors exist in the mainstem hydrosystem.

This same system has similar impact on all other tributary populations arising from either pristine or moderately or heavily compromised habitats. If even the populations from the minimally compromised habitats have non-sustaining growth rates, it is not realistic to think that simply by improving habitat quality for populations in heavily compromised habitats that one can cause these populations to be restored and somehow rise above the downstream limiting factors.

> *The Snake River fall chinook ESU generally showed minimal impact in the habitat factors we evaluated. However, these fish, which use mainstem habitats as a spawning area are more likely to be affected by other habitat factors, such as mainstem temperatures and flows.*

This statement is a partial statement of the limiting factors for Snake River fall Chinook. Water temperature and flows are a significant impact on this population. However, sedimentation of the mainstem and accessible tributary habitats (e.g., lower Grande Ronde) is significant. In addition, habitat loss has reduced system capacity and population spatial structure and diversity. Even within the currently accessible mainstem habitat below Hells Canyon dam there has been substantial spawning habitat loss due to excessive water depth and sedimentation and the rearing habitat has been degraded due to prolonged high temperatures and shifts in the temperature peaks.

> *"The Snake River sockeye ESU, clearly challenged in many ways, shows minimal impact in the habitat screens completed. However, we have not yet conducted analyses relating to water diversions for this population. Nonetheless, opportunities for habitat improvement for this ESU are likely to be low."*

NOAA applied a minimal set of habitat screens leading to an underestimate of difficulties for sockeye. The opportunities to improve habitat may be limited in Redfish Lake. However, there has been much discussion about the nutrient limitations in the lake causing a limitation in productivity. In addition, the mainstem temperature regime is significantly shaped by the hydrosystem and significant past thermal impacts (i.e., significant adult mortality) to adult sockeye migration have been recorded in the Columbia River.

Appendix E

PAH Impacts to Salmon
Patti Howard
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Numerous scientific papers report that exposure to environmental contaminants compromises the health of anadromous and marine fish (Arkoosh et al. 1994, Moore and Waring 1996, Waring and Moore 1997, Ewing 1999, Scholz et al. 2000, Collier et al. 2002, Johnson et al. 2002, Arkoosh and Collier 2002 and Jacobson et al. 2003). These health impacts include many sublethal effects such as decreased immune function, DNA damage, liver dysfunction, reproductive impairment, growth impairment, decreased olfactory function and predator avoidance behavior dysfunction.

Polycyclic aromatic hydrocarbons (PAHs) are a group of chemicals that occur naturally in coal, crude oil gasoline, and products made from fossil fuels. PAHs are a sediment-associated contaminant frequently found in urban estuaries, urban or industrialized areas. Part of a broad class of chemicals referred to as polycyclic organic matter (POM); POMs have been listed by the U.S. EPA as pollutants of concern due to their persistence in the environment, potential to bioaccumulate and toxicity to humans and other organisms.

A known mutagenic, teratogenic, and carcinogenic set of compounds, PAHs are considered one of the most toxic compounds found in contaminated estuaries and watersheds (as reviewed by Arkoosh and Collier 2002). Anadromous fish are exposed to PAHs via direct sediment contact or food web dynamics. Laboratory and field studies have shown an increased risk of immunosuppression and disease resistance in juvenile chinook salmon migrating through polluted estuaries or through direct exposure to PAHs compounds (Arkoosh et al. 1994 and Arkoosh and Collier). Biological impacts to English sole taken from the Puget Sound have also been linked directly to sediment PAH concentrations (Johnson et al. 2002).

Arkoosh M.R., Clemons E., Myers M. and Casillas E. (1994). Suppression of B-Cell mediated immunity in juvenile chinook salmon (*Oncorhynchus tshawytscha*) after exposure to either a polycyclic aromatic hydrocarbon or to polycholinated biphenyls. *Immunopharmacology and Immunotoxicology*: Vol. 16, No. 2, 293-314.

Arkoosh M.R. and Collier T.K. (2002). Ecological risk assessment paradigm for salmon: Analyzing immune function to evaluate risk. *Human and Ecological Risk Assessment:* Vol. 8, No. 2, 265-276.

Collier T.K., Meador J.P. and Johnson L.L. (2002). Fish tissue and sediment effects thresholds for polychlorinated bihenyls, polycyclic aromatic hydrocarbons, and tributyltin. *Aquatic Conserv. Mar. Freshw. Ecosyst*. 12: 489-492.

Ewing R.D. (1999). Diminishing returns: Salmon decline and pesticides. Oregon Pesticide Education Network.

Jacobson K.C., Arkoosh M.R., Kagley A.N., Clemons E.R., Collier T.K., Casillas E. (2003). Cumulative effects of natural and anthropogenic stress on immune function and disease resistance in juvenile chinook salmon. *Journal of Aquatic Animal Health* 15: 1-12.

Johnson L.L., Collier T.K., and Stein J.E. (2002). An analysis in support of sediment quality thresholds for polycyclic aromatic hydrocarbons (PAHs) to protect estuarine fish. *Aquatic Conserv.: Mar. and Freshw. Ecosyst.*12: 517-538.

Moore A.. and Waring C.P. (1996). Sublethal effects of the pesticide Diazinon on olfactory function in mature male Artlantic salmon parr. *Journal of Fish Biology* 48: 758-775.

Scholz N.L., Truelove K., French B.L., Berejikian B.A., Quinn T.P., Casillas E. and Collier T.K. (2000). Diazinon disrupts antipredator and homing behaviors in chinook salmon (*Oncorhynchus tshawytscha*). *Can. J. Fish. Aquat. Sci*. 57: 1911-1918.

Waring C.P. and Moore A. (1997). Sublethal effects of a carbamate pesticide on pheromonal mediated endocrine function in mature male Atlantic salmon (*Salmo salar* L.) parr. *Fish Physiology and Biochemistry* 17: 203-211.