Independent Multidisciplinary Science Team (IMST)

State of Oregon

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October 6, 2009

Ms. Suzanne Knapp
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Dear Sue,

In response to your April 27, 2009 letter, the Independent Multidisciplinary Science Team (IMST) reviewed the Oregon Department of Fish and Wildlife's (ODFW) April 2009 draft document titled *Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead* (hereafter the Plan). As you know, the IMST undertook its review of the plan in two stages because of budget constraints during the 2007-2009 biennium. The initial review (letter to Sue Knapp dated June 30, 2009) provided the State with IMST's preliminary assessment of the recovery plan. This final review incorporates the IMST's preliminary assessment of the Plan as well as detailed comments that support the overarching issues raised in the preliminary review.

This review includes modifications to the initial review and supersedes comments provided in the June 30th letter. Specifically, comments regarding the importance of sensitivity analysis of analytical models have been added to the section titled 'Presentation of Uncertainty' and a new section titled 'Timeline for Achieving Recovery Measures' was also added. The following comments address whether the Plan's approach and analyses are credible and consistent with accepted scientific standards, whether Plan assumptions are supported by best available science, and whether uncertainties are characterized adequately. IMST approached these issues from the perspectives of both the federal Endangered Species Act and ODFW's Native Fish Conservation Policy.

In general, the IMST feels that the Plan reflects the significant professional effort expended by the authors. IMST compliments ODFW for the frank, honest discussion regarding many elements of the Plan. ODFW placed emphasis on pointing out areas of uncertainty, where assumptions needed to be made, the lack of critical data, and shortcomings with the models used in the recovery planning process. The scientific rigor of a recovery plan is as much contingent on pointing out its weaknesses as well as its strengths, and IMST appreciates ODFW's approach in this regard. IMST also appreciates ODFW's consideration of comments and

recommendations made by the Team during reviews of other recovery and conservation plans. IMST has not made any formal recommendations in this review, but would encourage the State to consider IMST recommendations made during its reviews of the draft Rogue spring Chinook conservation plan (May 30, 2007) and the draft middle Columbia River steelhead recovery plan (May 8, 2008) as forthcoming recovery plans are drafted. These recommendations are included in Appendix A of the attached review.

IMST recognizes that this draft of the Plan represents a 'work in progress' that will undergo revision on a regular basis as new information and tools become available. IMST offers these constructive comments with the intent of aiding ODFW efforts to strengthen the scientific basis of the Plan during future revisions.

Sincerely,

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IMST Review of ODFW's draft *Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead* (April 24, 2009 draft)

Released on October 6, 2009

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Citation: Independent Multidisciplinary Science Team. 2009. IMST Review of ODFW's draft Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead (April 24, 2009 draft). Oregon Watershed Enhancement Board, Salem, Oregon.

Review Preparation: This review was prepared by the IMST based on an initial draft by an IMST subcommittee (Carl Schreck and Bob Hughes with Susie Dunham and Kathy Maas-Hebner providing technical support). Dave Jepsen of the Oregon Department of Fish and Wildlife discussed the preparation, goals, and intended use of the reviewed document at the IMST's February 19/20, 2009 public meeting. IMST discussed review comments at its June 25, 2009 public meeting and unanimously adopted the final review at its October 1, 2009 public meeting (Molina abstained; Shock and Yeakley were absent).

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ACRONYMS AND ABBREVIATIONS

CATAS	Conservation Assessment Tool for Anadromous Salmonids
DPS	Distinct Population Segment
EDT	Ecosystem Diagnosis and Treatment model
ESA	Endangered Species Act (federal)
ESU	Evolutionary Significant Unit
GNRO	Governor's Natural Resource Office
IMST	Independent Multidisciplinary Science Team
NFCP	Native Fish Conservation Policy
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O.	*Oncorhynchus*
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
Plan	Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead
SLAM	Salmon Life-cycle Analysis Modules
SMU	Species Management Unit
WLC-TRT	Willamette/Lower Columbia-Technical Review Team

INTRODUCTION

The Independent Multidisciplinary Science Team (IMST) reviewed the Oregon Department of Fish and Wildlife's (ODFW) April 2009 draft document titled *Lower Columbia River Conservation and Recovery Plan for Oregon Populations of Salmon and Steelhead* (hereafter the Plan) in response to a request from the Governor's Natural Resource Office (GNRO; letter from Suzanne Knapp dated April 27, 2009). This review incorporates IMST's preliminary review of the Plan released on June 30, 2009 as well as detailed comments that support the overarching issues raised in the preliminary review. This final review, which includes modifications to the overarching issues section, supersedes comments provided in the June 30th letter. Sections of the Plan covered by this review include Chapters 1–9 and appendices: 4-B, 6-D, 7-E, 7-F, and 7-G. Many of the appendices included in the Plan were not complete and therefore, not reviewed.

This review addresses whether the Plan's approach and analyses are credible and consistent with accepted scientific standards, whether Plan assumptions are supported by best available science, and whether uncertainties are characterized adequately. IMST approached these issues from the perspectives of both the federal Endangered Species Act (ESA) and ODFW's Native Fish Conservation Policy (NFCP) goals. This review focuses strictly on the science supporting the Plan. IMST does not offer opinions or judgment on whether or not proposed actions, should they be implemented, would lead to recovery of salmon and steelhead populations in the Lower Columbia Recovery Domain. IMST also does not intend to imply that alternative scientific analyses or explanations would necessarily lead to actions different to those proposed in the Plan.

This review consists of four sections, *Overarching Issues*, *Major Comments*, *Specific Comments*, and *Editorial Comments*. In the *Overarching Issues* section IMST provides extended discussion of several topics that arose repeatedly during review of the Plan. The majority of concerns raised in this section are relevant not only to the Lower Columbia Recovery Plan but also to forthcoming recovery and conservation plans. Subsequent sections contain detailed comments that are directly relevant to the Plan. Many topics discussed in the *Overarching Issues* section are revisited in subsequent sections of this review. The purpose of this repetition is to highlight where these overarching issues arose in the Plan and to provide additional details and examples relevant to overarching concerns

Many scientific details included in the Plan come from numerous supporting documents developed for the purposes of recovery planning. The IMST did not have the time or resources available to review these supporting documents in addition to its review of the Plan. It was, therefore, necessary to assume that ODFW correctly portrayed information taken from those reports.

IMST recognizes that the Plan represents a tremendous and very professional effort by ODFW employees to address the difficult and complex issues posed by declining salmonid populations. It is obvious that the Plan is based on a strong science foundation and careful thought. However, IMST also recognizes that in many instances the science and monitoring resources currently available for recovery planning are often incomplete and lead to uncertainty. Lastly, IMST realizes that this draft of the Plan represents a

‘work in progress’ intended to function as a living document that ODFW will revise on a regular basis as new information and tools become available.

IMST offers the following constructive comments, recognizing that ODFW may have already considered these issues but chose not to explicitly present them in the Plan. Many of our comments are presented as questions but the IMST does not expect ODFW to answer each question explicitly within the Plan. By considering these questions and by adding or clarifying content where needed during the refinement of this Plan, ODFW could strengthen the scientific basis of the Plan.

OVERARCHING ISSUES

Presentation of Uncertainty

IMST recognizes that the Plan represents an enormous and highly professional effort by ODFW employees to address the difficult and complex issues posed by declining salmonid populations in the Lower Columbia Recovery Domain. The Plan contains several improvements over conservation and recovery plans that IMST has reviewed in the past. However, it is also clear that the science and monitoring resources available to determine current status, desired status, and conservation gaps are, at best, incomplete and for many populations included in the Plan, almost entirely deficient.

In early chapters of the Plan (e.g., Chapters 1–4), ODFW provides several explicit descriptions of how professional judgment was used, data limitations, uncertainty associated with model results, and the limitations of analyses based on insufficient data. However, recovery actions presented in later sections of the Plan appear to be overly reliant on analyses that are compromised by these well-documented data limitations. For example it is not clear whether modeled values presented in Chapter 6 are being used directly to inform the strategies and actions in Chapter 7. As currently written, it appears as though model results are used to base decisions about where to focus recovery efforts. In early chapters of the Plan it appears that ODFW’s intent is for these models to provide a structure for future analyses when more data become available. This intent and caveats related to limitations of current model analyses and proposed actions should be consistently reiterated throughout the entire document, particularly sections that present extinction likelihoods for no-data populations or proposed recovery actions. Until data become available to sufficiently parameterize and validate models, the Plan would be strengthened if more low-tech assessments of current status, desired status, and conservation gaps were added for all populations. These need not be consistent across species or populations.

Areas where explicit descriptions of uncertainty would greatly strengthen the Plan include, but are not limited to:

- The likelihood that all critical factors limiting recovery have been identified and correctly ranked as key or secondary concerns.
- Current understanding about the interactive or cumulative nature of threats and limiting factors as they relate to population viability including the risk magnitude imposed by different threats or limiting factors.

- How proposed recovery actions are expected to perform given the uncertainty associated with current model scenarios and expert opinion.
- Compounding uncertainty resulting from multiple assumptions made at different stages during the determination of current status and during the development of desired status, conservation gaps, and recovery scenarios.
- Discussion of how the level of uncertainty in ranking the six threat categories (tributary habitat, estuary habitat, hydropower, harvest, predation, and hatcheries) compares to or is influenced by uncertainty in ranking threats imposed by ocean conditions, climate change, human population growth, and economic growth (increased per capita resource use).
- The minimum amount and quality of quantitative data required to have confidence in inferences made from model results.

The effort ODFW made to cross check results of the CATAS model with the more heavily parameterized SLAM model are a quantitative strength of the Plan. However it is not clear how well either of these models perform in predicting status of real populations. Have results from CATAS or SLAM models ever been validated using historical to current conditions with a reasonable start year and similar assumptions? Has anyone ever successfully used these models to recover an Evolutionary Significant Unit (ESU), Distinct Population Segment (DPS), or population? Reliance on these models as recovery planning tools would be better justified if the Plan included some description how these models were validated against data from actual populations.

In addition to the need for model validation, a recent joint effort by the US Bureau of Reclamation, Washington Department of Fish and Wildlife, and NOAA Fisheries (Steel *et al*. 2009) highlights the importance of conducting sensitivity analyses of models used in recovery planning. In its past reviews of recovery and conservation plans for Oregon salmonids, IMST has raised concerns that model results reported as point estimates give a false sense of confidence in model results. The Plan contains some very good treatment of uncertainty with implicit sensitivity analysis (e.g., Figure 4-2 and similar figures). However, greater use of sensitivity analyses may be prudent. This would highlight model parameters that have disproportionate influence over model results and allow the construction of confidence intervals around model results. Steel *et al*. (2009) drew the following conclusions about use of models in recovery planning from three separate sensitivity analyses of Ecosystem Diagnosis and Treatment (EDT), a complex model frequently used in recovery plans for Pacific Northwest salmonids, including the Plan for lower Columbia salmon and steelhead populations.

- Sensitivity analyses can allow a more informed use of model results and increase the benefits gained by using model results in management decisions.
- As least some level of sensitivity analysis should be conducted prior to using model results in management decisions.
- The use of sensitivity analysis to construct confidence intervals is particularly important when results from one model are used to parameterize a second model.

- Very little computer programming expertise or specialized software is required to conduct simplistic sensitivity analyses.
- Sensitivity analysis yields an estimate of model precision but not model accuracy (i.e., validation against empirical data) and models should be evaluated for both whenever possible.
- In addition to sensitivity analysis, the use of multiple independent models can strengthen the basis for the use of model results in decision making.

While the results presented by Steel *et al.* (2009) were derived from sensitivity analyses of EDT, their general conclusions likely apply to the use of any model that might be used to direct fisheries management decisions. ODFW's use of results from multiple models as part of a 'weight of evidence approach' is a quantitative strength of the Plan. However, the transparency of management decisions based on model results would be increased if a sensitivity analysis of the CATAS model were included. In addition, model comparisons that involve EDT would be strengthened if sensitivity analyses were used to construct confidence intervals around model results. Steel *et al*. (2009) indicate that this practice is now frequently used in Puget Sound watersheds where EDT analyses have been completed and that such efforts have aided recovery planning for salmonids in Washington.

ODFW builds several analytical conservation buffers (pg. 3-7 of the Plan) into analyses presented in the Plan as a mechanism to compensate for varied sources of uncertainty that might lead to incorrect conclusions about when recovery goals have been met. Given the high level of uncertainty described in the Plan, IMST agrees with approaches that will result in conservative decisions about salmon and steelhead recovery in the Lower Columbia Recovery Domain. However, it is unclear how or how much the analytical conservation buffers outlined in the Plan change estimates of desired status and conservation gaps. It would be advisable to run the models without the analytical conservation buffers to provide estimates of recovery that are based on what is currently known. These results will likely provide different estimates of extinction risk and conservation gaps and provide an informative baseline for comparison. It might also help to review recent approaches to incorporating uncertainty into forecasts of environmental change, such as those used in the United Nations' Millennium Ecosystem Assessment (http://www.millenniumassessment.org).

Scientific Unknowns

ODFW's assessment of research needed to facilitate development of future recovery actions (Chapter 8 of the Plan) is clearly articulated and thorough. IMST appreciates the effort ODFW plans to put into addressing science unknowns and the time required to develop the necessary research plans. However, IMST's ability to assess not only the scientific adequacy, but also the biological feasibility of the Plan is hampered by the fact that the success of the Plan hinges heavily on future research that must be correctly targeted to address critical information needs. This aspect of the Plan could be strengthened if more detailed discussion of specific research activities and timelines for proposal development and research implementation were included for each research

element identified in the Plan. As currently written, this aspect of the Plan reads more like a research 'strategy' than a research 'plan'.

Fundamental Assumptions

One of the strengths of the Plan is the explicit documentation of fundamental assumptions that will affect delisting decisions at the population, strata, and ESU/DPS levels. Notable in this regard is ODFW's discussion of uncertainty related to the boundaries of strata and independent populations in Appendix 6-D. The numbers of populations and strata identified in the Plan obviously have strong influence over both the listing and delisting decisions. IMST agrees with ODFW's identified need to reconsider the structure of independent populations, particularly within the Gorge stratum. However, as with the modeling uncertainty outlined above, there is also general uncertainty in the designations of all populations and ESUs/DPSs/Species Management Units (SMUs). It would be useful to explicitly indicate in the Plan the existing life history and genetic data that support each of those boundaries.

The Plan's scientific rigor would be strengthened if ODFW also included some discussion of the consequences of applying listing criteria, current status assessments, and recovery scenarios to populations comprised of both resident and anadromous forms of *Oncorhynchus mykiss*. IMST raised this issue in its review of ODFW's recovery plan for steelhead in the middle Columbia and those comments also apply to the recovery plan for the Lower Columbia Recovery Domain. This is particularly relevant in the Lower Columbia Recovery Domain where spring and fall run life history variants of Chinook salmon are pooled into a single ESU (pg. 2-6 of the Plan) but resident and migratory life-history variants of steelhead are managed as if they were demographically independent. Such inconsistency in how life history variants within taxa are considered creates a scientific shortcoming in the Plan.

Future Threats

Chapter 7 (Strategies and Actions) is well written and comprehensive. It remains however firmly in the four H (hydropower, harvest, hatchery, and habitat) approach to freshwater salmonid management without questioning whether or not this paradigm remains valid in the light of emerging information about the risks associated with future threats such as ocean conditions, climate change, economic growth, and human population growth. In order to strengthen scientific credibility, it is important for ODFW to demonstrate a solid grasp of emerging threats that will likely influence the outcomes of its recovery plans. The current Plan contains overview information on the likely effects of a changing climate and human population growth on Pacific Northwest salmonids and watershed health. This is a significant improvement over recovery and conservation plans IMST has reviewed in the past. However, it is unclear how the 20% adjustment to the conservation gap mean abundances will compensate for the future effects of both population growth and climate change. Why is this adjustment applied equally across all populations when it is clear that some may be disproportionately affected by either or both of these threats? Why can threats imposed by the six threat categories be ranked in

the face of limited or no data when threats imposed by climate change and human population growth cannot be ranked? The level of guidance provided by the Plan would be enhanced by an examination of the limiting factors in Chapter 5 and how each might change (and in general become more limiting) under the most commonly agreed scenarios of climate change and of human population and consumption increases. For example, ODFW might extend the discussion of threats posed by climate change and growth of the human population or resource consumption to individual salmon and steelhead populations in the Lower Columbia Recovery Domain by identifying populations that may be particularly vulnerable to these threats, hypothesizing how key or secondary threats identified for these populations might change in the future, and discussing how recovery actions might be prioritized or implemented differently (e.g., type, amount, location, timing, intensity) under a changing climate and growing human population and resource consumption. Some of the discussion points would be speculative, but IMST believes that there is sufficient information from which to construct narrative analyses for each population. This process and discussion would greatly aid collection and interpretation of appropriate monitoring data and also lead to the development of criteria for reconsidering key and secondary threats within the context of climate/ocean changes and population/consumption growth. It is also very important to explicitly recognize that increased human population size and per capita resource consumption are the pressures driving global warming, hatchery production, harvest and hydropower demands, and physical and chemical habitat deterioration.

Also, how might a predicted increase in warming and acidification of the Pacific Ocean and an increase in, or northward movement of, additional piscivores affect anadromous salmonids? There is some ODFW evidence that different salmonid populations and species respond differently to ocean conditions because of differing life histories and ocean rearing locations. This suggests some inherent dangers in treating the ocean in the same way for all salmonid populations and species. Given the importance of the ocean to salmon survival and production, a marked increase in inter-agency research is needed to document how ocean conditions affect differing salmon populations and how human activities might be influencing those conditions.

Spatial Structure and Diversity Criteria

Combining abundance and productivity measures into an integrated variable (rather than two independent variables) is in line with comments made in the IMST's 2006 review of the coastal coho conservation plan (IMST 2006). However, spatial structure and diversity measures play equally important roles in recovery, particularly in areas where habitat fragmentation is likely to increase as a result of land use, climate change, or both. IMST is concerned that spatial structure and diversity measures may not receive adequate weighting in delisting criteria currently characterized in the Plan. Downplaying spatial structure and diversity criteria during the development of recovery scenarios underestimates the importance of location in protecting populations that may be more vulnerable to threats imposed by climate change, resource extraction, and/or human population growth.

Extinction Risk Categories

The use of vulnerability thresholds to define extinction risk categories and to make viability determinations is not a trivial matter, especially when used to prioritize management efforts. The definitions of extinction categories presented in the Plan are non-linear (e.g., Table 4-1) i.e.,

- the low risk category ranges from a 1 in 100 to a 1 in 20 risk of extinction,
- the moderate risk category ranges from a 1 in 20 to a 1 in 4 risk of extinction, while
- the high risk category ranges from a 1 in 4 to a better than even risk of extinction.

The sense of urgency that underlies recovery efforts is very different for a population with a 1:20 chance of extinction compared to a population with a 1:4 chance, yet both are considered to be at moderate risk under ODFW's current system of aggregating risk. IMST suggests that aggregating risk extinction as a first step in the analysis of current status, desired status and conservation gap analyses greatly decreases transparency in these analyses. For example, the figures depicting current and desired status for populations give the appearance that the steps between risk categories are linear when they are not. These figures would more clearly portray the range of variability in extinction risk within and among populations if the y-axis represented the continuous probability of extinction rather than extinction risk categories. Similarly, presenting the change in extinction risk required to meet desired status as a continuous range of probabilities (perhaps in summary table) would better reflect the magnitude of effort required to recover individual populations, as well as the uncertainty involved in doing so.

Mortality Rate Estimates

ODFW estimates current rates of mortality as a result of human actions in six threat categories: tributary habitat, estuary habitat, hydropower, harvest, hatchery, and estuary predation. Among these categories, estimations of mortality and the capacity for threat reductions appear disproportionately attributed to tributary habitat. Improving freshwater capacity will have a positive effect only to the degree that the ocean is not limiting and the hatchery/harvest mortality does not preclude full seeding of tributaries. It is difficult to determine whether, how, or where ocean mortality was factored into these analyses. If variable ocean mortalities were not adequately integrated into cumulative mortality estimates tributary mortality was most likely significantly overestimated. If the scientific basis of this approach were better explained in the Plan, it would be easier to understand why management action effectiveness models and other aspects of the Plan are heavily focused on tributary habitat actions.

Assessment of Limiting Factors and Interactions among Limiting Factors

The description of limiting factors (e.g., Table 5-2) appears abbreviated or incomplete particularly with respect to water quality factors that occur along urbanized streams in the lower Columbia River and its tributaries. Also, effects of land use change, particularly urbanization and intensive agriculture, on habitat are not fully reviewed with respect to

limiting factors. Further, it is not readily apparent whether or how the potential for synergistic, antagonistic, or cumulative effects among limiting factors is considered in the Plan. Such interdependent effects could produce steep population declines when poor conditions that affect several limiting factors occur simultaneously. Some secondary factors are interrelated and may cumulatively equal a key factor. (e.g., cumulative effects of sediment trapped behind dams and not moving through the Columbia River system in addition to in-channel aggregate mining and dredging occurring in the main channel). What explicit criteria define key and secondary factors and are they applied consistently across populations where experts with varying backgrounds are sources of expert opinion? Given that all of Oregon's lower Columbia tributaries are listed on Oregon Department of Environmental Quality's (ODEQ) 303(d) list for exceeding temperature criteria for spawning, rearing, passage or all three, why is water quality typically a secondary concern – especially when linked with poor riparian and sediment conditions? It would be wise to incorporate information from ODFW's sister agencies in the Plan; for example, see Mulvey et al. (*Willamette Basin Rivers & Streams Assessment*. ODEQ. Hillsboro, OR[1]). Why is the role of toxins not given more weight, particularly when combined with lower base flow conditions that might be made more extreme by the "urban stream syndrome" in cities? The interactions between excessive harvest, excessive hatchery production, and the intergenerational carry-over effects of both in terms of decreased tributary productivity and decreased reproductive fitness, respectively appears underestimated. Continuing declines in these species within the realm of traditional fisheries management practices suggest that such practices are unsuccessful. When do cumulative effects of secondary concerns equal primary concerns and what is ODFW's plan for addressing cumulative effects of secondary concerns? IMST urges that recovery planners consider estimating the risk reduction potential and costs of classes of actions for individual populations/species.

Broad Sense Recovery Criteria

As currently written the NFCP's broad sense recovery criteria are vague and it is difficult to determine if meeting them is feasible. What criteria will be used to determine when populations have reached a point where they are capable of contributing ecological, social, cultural, and economic benefits beyond what already exist? What does it mean for salmonid species to "eventually achieve their historical role in their natural-cultural system in the Columbia Basin"? How will the contributions of salmonids to social, cultural, economic, and aesthetic benefits be quantified? Are these objectives constrained by the need to meet minimum levels of harvest and hydropower production? In addition, it is difficult to differentiate NFCP broad sense recovery goals and recovery objectives from ESA recovery goals. An explicit description of how and when ODFW will know when NFCP broad sense recovery goals, versus ESA recovery goals, have been met would increase the transparency of the Plan.

[1] http://www.deq.state.or.us/lab/wqm/orplan.htm

Document Organization

A few changes to the Plan's overall organization would increase the readers' ability to track information and analyses throughout the Plan. Additional cross referencing between chapters and appendices, an increased use of footnote summaries, and more detailed descriptions of tables and figures in their associated titles would allow individual chapters to be read as 'stand-alone' units. For example, cross referencing Appendix 6-D at first mention of differences between NOAA and Oregon's designation of populations and strata would be very helpful. While the recovery approach for chum salmon appears well reasoned its current presentation in Chapters 1–9 of the Plan gives the impression that nothing will be done with chum because there are no data to use in model scenarios. But there are few or no data available for a majority of the other salmonid populations. It would be beneficial to state early in the Plan that the approach for chum is completely different and explain what that approach is and why it differs from other data-poor species, rather than repeatedly stating that chum are excluded from analysis and discussion due to lack of data. Cross referencing Appendix 7-G at first mention of the approach for chum would also be very helpful.

Timeline for Achieving Recovery Measures

Success of any recovery plan depends greatly on the timeliness of undertaking and completing recovery actions. Since consequences of many recovery actions are not independent of other actions, the plan would be greatly strengthened from a scientific perspective if it included a schedule for anticipated initiation and completion of major recovery measures. The adaptive management plan associated with this conservation plan could then include alternative scenarios taking into account what would be proposed if one or more recovery actions failed to be completed as proposed. We recognize that the plan is a work in progress and that many actions have yet to be determined, depending on findings of future research. In those cases, it would be useful to identify when critical knowledge gaps will be filled and this knowledge accumulation is sufficiently timely.

Other Issues

With regard to sections on research, monitoring, evaluation, and adaptive management, the comments and recommendations IMST made during its review of the Middle Columbia steelhead recovery plan still apply (see Appendix A of this review for previous recommendations). While the discussion of adaptive management elements is considerably improved over what was presented in past recovery and conservation plans reviewed by IMST, a more thorough description of the adaptive management process and a timeline for the development of an adaptive management plan would strengthen the current document. For example, including a graph for each ESU that plots status against time (e.g., expected numbers of spawners over the next 50–100 years) and summarizes an implementation timeline for recovery actions would allow readers to visualize the type, timing, and sequence of actions ODFW believes will lead to recovery. With regard to status, plotting the lower prediction interval for the mean abundance/productivity measures (as opposed to the mean) would be most informative because it would show

how often populations, strata, or ESU's drop below critical levels. The implementation timeline could be represented as the percentage of recovery actions implemented over time, possibly weighted by the importance of specific actions to recovery. The scientific adequacy of the Plan depends on the timeliness of recovery action implementation relative to changes in status of populations, strata, and ESU's. If various recovery actions are not implemented as desired or if the effectiveness of recovery actions is delayed, then priority recovery actions or information required to prioritize actions may change. Without information on how ODFW would address such situations (i.e., actual implementation and adaptive management), it is difficult for IMST to judge the biological and social feasibility of the Plan.

MAJOR COMMENTS BY SECTION

IMST offers the following constructive comments, recognizing that ODFW may have already considered these issues but chose not to explicitly present them in the Plan. Many of our comments are presented as questions but the IMST does not expect ODFW to answer each question explicitly within the Plan. By considering these questions and by adding or clarifying content where needed during the refinement of this Plan, ODFW could strengthen the scientific basis of the Plan.

Executive Summary

- Pg. ES-3: IMST believes the stated recovery goals and benchmarks are appropriate with the following exceptions:
    - What criteria will be used to determine when populations are '*capable of contributing ecological, social, cultural, and economic benefits*'?
    - What are the biological and ecological justifications for the numeric thresholds used in stratum-level viability criteria outlined by the Willamette/Lower Columbia Technical Recovery Team (WLC-TRT) and adopted in the Plan? These criteria could be strengthened by inclusion of trend analyses conducted at the stratum level.

Chapter 1:

- Section 1.5.1: It is not clear exactly how the 'roll up' process described in this section will integrate the four recovery plans written for the Washington Lower Columbia, White Salmon, Oregon Lower Columbia, and Upper Willamette management units. How confident is ODFW that these recovery plans (particularly those for the Oregon Lower Columbia and Upper Willamette management units) can be sufficiently integrated to lead to recovery throughout the entire Willamette/Lower Columbia domain?
- Pg. 1-11: How will on-the-ground actions be adjusted as new information becomes available? It would be useful if some sense of the process by which this will occur were included in the Plan.
- Pg. 1-14: With regard to the following sentence '*Once a species is deemed recovered and therefore removed from a "listed status," section 4(g) of the ESA requires monitoring the species for a period of not less than five years to ensure that it does not decline to a state that requires the need to again list it as either threatened or endangered under the ESA.*', What is the biological justification for adopting the 5-year ESA criterion for monitoring delisted species? This length of time may be insufficient for salmonid species given the length of generations and the time need to modify their habitats (possibly several decades).
- Pg. 1-15: Item 4 on this page states that '*FR* [Federal Register] 69 33102 *concluded that while many causes of decline in salmon and steelhead are being addressed (e.g., providing fish passage above artificial barriers), habitat degradation and destruction have been slowed but not prevented. Cumulative effect of these and other protective efforts, and any additional measure necessary*

to address the ESU's factors for decline and extinction risk, need to be evaluated through recovery planning.' It is not evident in the Plan what type of cumulative effects analysis has been done.

Chapter 2:

- Pg. 2-4: Why is there such an extensive description of the Hood River drainage basin in this Plan when the drainage was included as part of the Middle Columbia Recovery Domain? This comment also applies to Table 1-5 (pg. 2-19 of the Plan). While IMST agrees with the need to reassess the boundary between the Middle and Lower Columbia Recovery Domains, explicit statements (included earlier in the Plan) about why the Hood River is included in the Lower Columbia Recovery Plan would increase clarity of the Plan. Cross references to Appendix 6-D would also be useful in these locations.
- Pg. 2-6: With regard to the following text – *'However, elsewhere in the species distribution, for example along the Oregon coast, there is apparently some level of interbreeding between the life histories and they are not considered separate ESUs (Myers et al. 1998). This last pattern is the case for the Lower Columbia Chinook ESU, where both spring-run and fall-run populations are combined in a single ESU. Some reproductive isolation, even where life histories are combined in ESUs, occurs due to different distributions within shared basins, with spring Chinook penetrating higher into tributaries while fall Chinook use lower mainstem habitats.'* What is the biological justification for combining distinct Chinook salmon life history types that exhibit reproductive isolation into a single ESU? Why are resident and migratory life histories of *O. mykiss* consistently managed separately even though they may not be demographically independent within all populations? The scientific rigor of the Plan would be strengthened if it included presentation of explicit criteria used to determine when or when not to combine fish with different life histories into a single ESU/DPS.
- Pg. 2-8: The Plan would be strengthened if some discussion of potential multiplicative errors introduced intra-ESU 'taxonomy'? For example, how might sequential errors in defining population and strata boundaries effect the determination of current status, conservation gaps, and viability at the ESU-level? What are the implications of such errors for salmonid recovery across the entire recovery domain?
- Pg. 2-18: IMST agrees with Oregon's reliance on life history criteria to define species management units. However, what is the biological justification for excluding resident *O. mykiss* from management units?
- Pg. 2-20: How does the lack of critical habitat designations for coho populations in the Lower Columbia Recovery Domain affect the recovery planning process? When are critical habitat designations expected to be completed?

Chapter 3:

- Section 3.3: The upfront acknowledgements of where data are lacking, when professional judgment was used, and the amount of uncertainty associated with various analyses are well presented. The bulleted sections on Pgs. 3-7 and 3-8 provide a clear and explicit summary of how uncertainty is addressed in the Plan.
- Section 3.3: Use of the term 'inference' in the Plan implies a specific statistical meaning that may not be entirely accurate. Typically the term 'inference' implies that a conclusion about a population is based on a sample drawn from that population and is estimated from a predictor variable value that falls within the range of data collected for that population. Extending inferences drawn from populations with data to populations with limited data is probably more accurately described as extrapolation because one is moving well outside the range of sampled data when one applies any conclusions drawn to the data-poor populations. This comment applies to similar use of the term inference throughout the remainder of the Plan.
- Pg. 3-5: IMST recognizes that ODFW requires numeric recovery goals. However, the Plan would be strengthened if some information demonstrating the biological basis for the numeric thresholds used for stratum-level delisting criteria were included in section 3.2. For example, how was an average extinction risk of 2.25 selected? Why does 'Oregon' believe that a stratum with 2 viable populations and an average extinction risk of 2.25 can be characterized as meeting or exceeding the biological requirements for viability? On the other hand, why would one viable population with a much lower extinction risk, or three viable populations with extinction risks of 2 fail to meet viability requirements? In other words, can ODFW offer explanations that would make these criteria appear less arbitrary?
- Pg. 3-7: The bullet titled '*Climate Change and Population Growth*' would be strengthened if a biological justification for the 20% adjustment were included.
- Pg. 3-8: The bullet titled '*Comprehensive Threat Reduction Intent*' is sufficiently vague that it is difficult to determine how this addresses action uncertainty. What benchmark is intended by suggesting that '*efforts should be made to go beyond*' actions and threat reductions proposed in the Plan? Is there some baseline at which tributary habitat improvements continue regardless of what is proposed in the Plan? What actions outside those proposed in the Plan would contribute to reducing hatchery, habitat, predation or hydropower threats '*as much as possible*'?
- Pg. 3-9: With regard to the following text '*The second benefit is that the data timeframe for our analyses uses slightly dated threat rates. This actually adds to the analytical conservation buffers mentioned previously, in that an overestimation of threats leads to an overestimation of extinction risk and a resulting overcompensation in proposed actions..'*. How 'dated' were the threat rates used in Plan analyses and does ODFW have any idea how different the dated information is from current threat rates? How might this difference compare to the level of uncertainty (e.g., confidence intervals) surrounding threat rate estimates?

It would strengthen the Plan if the use of dated data were characterized as another source of uncertainty rather than a conservation benefit.

- Pg. 3-12: Figure 3-2 shows that both the *Strategy and Action Plan* and the *Most Probable Delisting Scenarios* are primarily shaped by professional judgment. How will the quality/accuracy of professional judgment be assessed and improved?

Chapter 4:

- Sections 4.1 and 4.2: A common reason given for a change in the estimation of extinction risk was the treatment of 'no-data' populations (e.g., '*In the case of the Scappoose this difference was likely due to our new approach for modeling populations for which there were no data'*, pg. 4-4). However, section 4.2 includes strong cautions against using the model results as a means to characterize the true conservation status of 'no-data' populations (e.g., pg. 4-11). Given this caveat, IMST suggests that modifying extinction risk estimates based on alternative model structures may be ill advised. No matter how well qualified, there is a good chance that the new extinction risk estimates will be treated as actual changes in conservation status between 2007 and 2009.

- Pg. 4-2: Presenting the distribution of extinction risk scores for each population is an excellent approach to characterizing uncertainty in the Plan. However, it is not clear how the break points in the range of extinction probability values were determined and assigned to risk categories (e.g., Table 4-1). The Plan would be strengthened if an explicit description of the empirical basis for assigning extinction probabilities to risk categories were included or if the y-axis in subsequent graphs showing current status were changed to show a continuous distribution of extinction risk probabilities rather than the nonlinear extinction risk categories currently used. This point seems very important because correctly assessing the extinction risk at which '*the waist of the diamonds fall*' depends on the accuracy of this classification system.

- Pg. 4-7: How would the extinction risk categories for steelhead populations in the Lower Columbia Recovery Domain change if resident *O.mykiss* were included in the status assessments?

- Pg. 4-9: Regarding the paragraph that begins '*First, abundance and productivity is weighed more heavily…*', the reasoning for weighting abundance and productivity more heavily appears sound for the current status assessments. However, this type of weighting may be less desirable for determining conservation gaps and, ultimately, setting recovery goals. If the loss or fragmentation of critical habitats contribute to the decline of some populations then the spatial structure and diversity criteria may be important part of conservation gap and desired status assessments regardless of our relative (compared to abundance/productivity) understanding of the relationship between these factors and extinction. Will spatial structure and diversity criteria be more heavily weighted in future analyses as more data become available? This becomes particularly relevant for the discussion of tributary habitat threats and tributary

habitat improvements (pgs. 6-14 and 6-15 of the Plan). Will spatial structure and diversity criteria be weighted more heavily as recovery actions aimed at improving tributary habitat are prioritized?

- *Pg. 4-11:* With regard to the following text – *'We wish to stress that there are undoubtedly other solutions to approximate extinction risk and conservation gaps for these 'no-data' populations. However, we have opted for this approach because once the recruitment curve is approximated the remaining steps in the conservation gap estimation procedure is identical for populations with abundance data sets, and those without. Thereby, we believe our methodological goal which was to provide a consistent and independently repeatable means to build and weigh the effectiveness recovery strategies for all LCR populations was achieved. However, we acknowledge that in the process of doing so we may have rejected other, less consistent methods that would have more accurately reflect the status of these 'no-data' populations.'* In the next revision of the plan, why not use both the consistent and the potentially more accurate methods. This might allow an improved estimation of extinction risk and conservation gaps for individual populations in the short term until data become available to support the computationally intensive and consistent method presented in the Plan.
- Pg. 4-11: The following caveat seems to fall by the wayside by the time the reader gets into Chapter 6 of the Plan. '*As such we would strongly caution against using the results from our methodology as a means to characterize the true conservation status of the 'no-data' populations. We believe that a confident assessment of these population will only be possible after an expanded monitored program has been in place long enough to generate at least 15 years of population specific spawner abundance data*.' This point seems important enough to reiterate throughout the entire Plan and it could also be extended to all populations because Appendix 4-B of the Plan indicates that data on wild fish are limited throughout the Lower Columbia Recovery Domain. In Chapter 4 of the Plan it appears that ODFW's intent is to use the presented analysis structure to inform management decisions in the future after more data become available. However, it is not clear if the modeled values presented in Chapter 6 are being used to directly inform the strategies and actions in Chapter 7. Figure 6-9 (pgs. 6-70 and 6-71) provides an example of where it might be important to reiterate this caveat. As presented, it appears that ODFW has some confidence in the models used to create this figure, but the caveat restated from Chapter 4 suggests otherwise.
- Pg. 4-13: If the Hood River populations are correctly assigned to the Middle-Columbia Recovery Domain, is its inclusion in the analysis to derive 'inferences' for no-data populations appropriate?
- Pg. 4-13: What is the minimum quantity/quality of data required to use the 'Data' method of estimation for recruitment model parameters? Is this standard the same or greater for generating inferences for no-data populations? Appendix 4-B provides detailed descriptions of how data sets for 'Data' populations were assembled. The quantitative underpinnings of the plan would be strengthened if

either Appendix 4-B or Section 4.2.1 also included some discussion of how minimum data standards were set.

- Pg. 4-14: ODFW justifies not running CATAS in the expanded mode for all abundance/productivity gaps because of computing time constraints. It would be useful to explicitly state how much computing time ODFW would require to complete such modeling efforts and identify high-powered computing facilities in Oregon where ODFW could run CATAS in the expanded mode when additional data become available.
- Pg. 4-20: What criteria are used to assign river basins to the small, medium, and large categories for historically accessible habitat (e.g., Table 4-6)? How might errors in both extinction risk assignment and basin size assignment compound and affect assessments of current status and conservation gaps?
- Pg. 4-20: With regard to the following sentence '*Our assumption is that the average of the past is a reasonable predictor of the future*.' – Current projections for climate change and human population growth indicate that this may not be a scientifically credible assumption for use in recovery planning.
- Pg. 4-23: Does the scoring of the life history and habitat diversity scores as categorical variables affect their weight in current status and conservation gap analyses? If not, explain why not.

Chapter 5:

- Pg. 5-7: The definitions for key and secondary concerns appear subjective – were there explicit criteria used to determine the difference between 'greatest impacts' and 'significant impacts'? How much difference in population viability impacts is indicated by a 'lesser degree'? How exactly was 'consensus opinion' used to differentiate between threat categories? Some explicit criteria are mentioned in the sections on specific limiting factors and threats – it might be useful to mention on pg. 5-7 that such information is forthcoming.
- Section 5.2.1: Using catch rate analyses on their own to determine harvest impacts may be misleading because even a small harvest rate can have a large effect on declining populations. Also, figures showing fishery related mortalities (e.g, Figure 5-4, pg. 5-15) would be easier to interpret if stock size were superimposed on the graphs and information on the proportion of wild fish were somehow included in either the figure or the figure title.
- Section 5.2.1: Information on how harvest levels are set for different fisheries would be a useful addition to this section as would some discussion of how successful past and current fisheries models have been at accurately estimating actual exploitation rates relative to run size. In other words, how much uncertainty is associated with the contemporary management of different fisheries that affect salmon and steelhead populations in the Lower Columbia Recovery Domain?
- Pg. 5-25: Does the lack of concern regarding the effects of hatchery strays on chum salmon affect the outcomes of modeling efforts? Is this lack of concern

valid given the rarity of chum in Oregon? How do such assumptions affect chum populations in Washington?

- Pg. 5-29: What is the justification for considering predation by northern pikeminnow as a secondary concern when the State is expending considerable resources on a sport reward program directed at these species?
- Pg. 5-29 to 5-30: What criteria were used to rank increasing water temperature in the estuary as a secondary concern? Is there sufficient information on how increased water temperature can affect the survival or salt-water-adaptation of juvenile salmon to know for sure that this should not be considered a key concern? Here and elsewhere in the Plan (e.g., pg. 5-61 and 5-66) increased water temperature is ranked as a secondary concern in locations where water quality guidelines set by ODEQ have been exceeded. It appears that ODEQ and the US Environmental Protection Agency view such water quality impairments as significant issues for salmonid recovery in Oregon. If this is true, why shouldn't these standards be given more weight (i.e., be ranked as key concerns) in recovery planning? Similar examples of this issue are found on pgs. 5-54 and 5-67 of the Plan. Toxic contaminants or high fecal coliform levels derived from urban and industrial activities have resulted in 303d listings but these problems were not even ranked as a secondary concern for affected salmon and steelhead populations. Such discrepancies send a message that Oregon agencies may not be in agreement as to the importance of water quality in salmonid recovery.
- Pg. 5-31: The statement '*Although many of the land management practices that led to impaired habitat conditions no longer occur, their legacy remains*' is potentially misleading. It is difficult to understand how this statement might apply to urban lands, which have been continuing to affect Oregon's aquatic ecosystems for decades. Human population growth is not an emerging threat to salmon and steelhead populations (in other words the threats associate with development are not new, e.g., Bilby & Mollot 2008). This statement and the entire paragraph that contains it might better reflect the current state of land use and its affects on salmonids if qualifications about improvements to specific land uses were included.
    - In addition, increased per capita resource consumption rates could be considered the driving pressure variables reflected in climate change and four H changes. In Brazil, streams still suffer from excessive high flows and fine sediments despite the requirement that 10-20% of a catchment's land area (usually the riparian zone) be protected from urban and intensively farmed uses. Few lower Columbia basins receive the Brazilian level of protection, so they presumably continue to load sediments into low gradient streams.
- Pg. 5-32 and 5-33: What is the biological justification for considering reduced habitat quality and habitat access in the Columbia River estuary as a secondary limiting factor? This is considered a key limiting factor in tributaries. How does the loss of '*seventy-seven percent of historical tidal swamps*' or twenty percent of estuary area (pg. 5-33 of the Plan) compare to the damage that has accumulated in

tributary habitats. How do the relative levels of accumulated damage within tributary and estuary habitats justify treating them differently when ranking limiting factors? Also, the first paragraph under 'Water Quality' describes the effects of increased water temperature on salmonids but does not rank water temperature as a key or secondary limiting factor. What is the biological justification for ranking increased temperature as a secondary concern in Table 5-6?

- Pg. 5-33 to 5-35: The summary on water quality, particularly on toxic contaminants, is well written and thorough. However, what is the justification for ranking toxic contaminants from urban and industrial practices as a secondary concern for all populations in the Lower Columbia Recovery Domain (pg. 5-34 of the Plan)? This ranking may not be sufficient for salmon and steelhead populations that must traverse heavily affected streams associated with the Portland-Metro and other urban areas. Given that the US Environmental Protection Agency recently banned the use of three common pesticides because of their effects on salmonid olfaction, that would strengthen the justification for considering toxic substances as of primary concern.
- Pg. 5-37: The following peer-reviewed references provide examples that might be useful in determining how to integrate uncertainty associated with climate change into recovery plans for salmon and steelhead populations in the Lower Columbia Recovery Domain.
    - Fuller T, Morton DP, Sarkar S (2008) Incorporating uncertainty about species' potential distributions under climate change into the selection of conservation areas with a case study from the Arctic Coastal Plain of Alaska. *Biological Conservation* 141: 1547–1559.
    - Heller NE, Zavaleta ES (2009) Biodiversity management in the face of climate change: A review of 22 years of recommendations. *Biological Conservation* 142: 14–32.
    - Vos CC, Berry P, Opdam P, Baveco H, Nijhof B, O'Hanley J, Bell C, Kuipers H (2008) Adapting landscapes to climate change: examples of climate-proof ecosystem networks and priority adaptation zones. *Journal of Applied Ecology* 45: 1722–1731.
- Tables 5-6 to 5-9: While these tables provide a useful summary of limiting factors and threats for each species considered in the Lower Columbia Recovery Domain, the following changes could increase the quantity of information they impart.
    - These tables highlight the numerous limiting factors and threats ranked as secondary concerns. It might be useful to use this structure to support a discussion of cumulative effects and possibly highlight groups of factors ranked as secondary concerns that might in combination equal a key concern. For example, multiple water quality impairments are ranked as secondary concerns for all or most coho populations in the Lower Columbia Recovery Domain. Might the combination of elevated water temperature and contaminants from agricultural, urban, and industrial

sources equal a key concern for some populations, particularly given the uncertainties associated with the increasing human population and a warming climate? The combined effects of dams restricting sediment movement through the lower Columbia River system and aggregate mining in the main channel might also represent a threat greater than the sum of these two individual factors. Are any strategies or actions being implemented or developed that will address the cumulative effects of interconnected limiting factors and threats. On the other hand, habitat (presumably physical habitat structure) includes multiple potential stressors (channel morphology, substrate composition, habitat unit size and complexity, fish cover, large woody debris, bank and riparian condition). Why can one category be cumulative but not others?

  - The structure of these tables provides ODFW with an opportunity to highlight limiting factors and threats that may be likely to increase in severity as the climate warms or as human populations and resource consumption rates grow. Considering how specific limiting factors and threats might change under future climate and population growth scenarios could help the State develop a more explicit strategy for managing threatened salmon and steelhead under the uncertainty imposed by these threats.
  - The limiting factors and threats listed in each table are generally similar. It might be useful to highlight the differences among species, perhaps by adding some additional text to support these tables.
  - Adding citations or cross-referencing (to other sections of the Plan) would help readers understand how ODFW arrived at these limiting factor and threat determinations. This could increase the capacity for these tables to be used as a stand alone reference within the structure of the Plan.

- Pg. 5-49: Here and for several other populations, the planning team determined that there was enough uncertainty associated with gill net mortality estimates to warrant listing it as a secondary concern. However, for many populations (including some in urban areas) water quality impairments are not considered key or secondary concerns despite environmental uncertainties associated with human population and consumption growth and climate change. What is the reasoning behind such unequal treatments of uncertainty in ranking limiting factors and threats?
- Section 5.3: For many populations high summer water temperatures are ranked as secondary concerns. How were the potential effects of future climate change factored into these rankings? The last paragraph under '*Actions to Address Future Threats*' (pg. 7-7 of the Plan) indicates the need for urgency in implementing actions to mitigate future impacts. How was this need for urgency considered when ranking limiting factors and threats (e.g., water quality) likely to be aggravated by human population and consumption growth and climate change?
- Pgs. 5-61 and 5-62: If municipal water withdrawals from Bear Creek average 100 percent during summer low flows – does this mean the river is essentially

dewatered from June through October? If so, what is the justification for ranking reduced flows due to water withdrawals as a secondary concern rather than a key concern? How were the future threats of a larger human population, increased resource consumption rates, and climate change considered during this determination?

- Pg. 5-72: In the water quality section (9c) toxins from urban and industrial sources are an issue in the Scappoose watershed that was not ranked as a key or secondary concern. What is the evidence that this situation is likely to improve as the human population in the area increases in size? A more conservative approach may be to rank such threats as secondary concerns to help initiate actions that will mitigate the effects of future threats.
- Pg. 5-86: What is the rationale for not ranking toxic contaminants as a key or secondary concern in a watershed where a superfund site is present?
- Pg. 5-91: Regarding the statement '*There is little or no data [water quality] are available based on Oregon DEQ's Water Quality Assessment database*.' This in itself is surprising, but it is a good example where a centralized natural resource database could be useful so other available data can be made accessible. This and other areas could be cross referenced in the discussion of additional research, monitoring, and evaluation needs (section 8.6 of the Plan).

Chapter 6:

- Entire Section: There are errors associated with being able to ascribe current status, determine conservation gaps, and understanding how populations will respond to recovery actions. Such errors likely interact in a multiplicative fashion, similar to the mortality estimates used in the scenario analyses presented in this section. The scientific rigor of the Plan would be strengthened if Chapter 6 included some discussion of how such multiplicative errors affect the certainty of predicted recovery outcomes.
- Pg. 6-1: One strength of the Plan is that desired status scenarios include a mechanism for addressing the likelihood of achieving recovery given the limiting factors and threats identified for each population.
- Pg. 6-8: What level of error/certainty is associated with the values presented in Table 6-3? The quantitative rigor of the Plan would be strengthened if the caveats about biological and model uncertainties discussed in Chapter 4 were reiterated here. As presented it appears that ODFW has a high level of confidence in these values.
- Pgs. 6-8 and 6-9: Rates of mortality due to human actions are estimated for six threat categories that were used in combination with modeled current and historical population abundances to estimate the mortality rates attributed to human alterations of tributary habitat. It is not clear how ocean mortality was factored into this analysis. The transparency of the analyses underpinning the Plan would be increased if a more detailed explanation of how variable ocean mortalities were included in these analyses.

- Pg. 6-10 (and elsewhere): The transparency of the Plan would be increased if unpublished analysis used to draw major conclusions to direct further analyses were included in appendices or made available elsewhere for review. For example, '*This relationship...has recently been confirmed in an unpublished analysis conducted by ODFW for a wider range of population.'*
- Pg. 6-12: What level of confidence does ODFW have in its estimates of mortality due to tributary habitat changes? This seems to be a critical point given that '*Estimates for tributary habitat impacts to salmonids were not available for most populations in the ESU/DPS*'. Were calculated estimates compared to estimates from populations for which field data actually exist? If so – how confident is ODFW that it can accurately estimate these mortality rates?
- Pg. 6-16: The assumptions leading to the use of 50% for the upper limit of survival increase associated with steelhead tributary habitat improvements is difficult to follow. Inclusion of a figure depicting how estimates for coho survival were used in this assessment along with a biological justification for generating steelhead estimates from coho information may increase the transparency of the Plan. For example, do coho and steelhead overlap in distribution enough to warrant some of the assumptions made in this analysis? How might differences in fine-scale habitat use or temporal differences in habitat use contribute to any uncertainty associated with this assessment?
- Tables 6-6 to 6-36: How will uncertainty and/or multiplicative errors associated with CATAS model scenarios, identification of limiting factors and threats, mortality rate estimates, and calculation of tributary habitat mortalities be considered during the determination and prioritization of recovery actions? The Plan would be greatly strengthened if some discussion of such considerations were included. Otherwise it appears that populations that were determined to have low feasibility for recovery may undergo fewer recovery actions based on the results of analyses associated with a high level of uncertainty (i.e., as stated in Chapter 4 of the Plan).
- Section 6.2.3: The candid discussion of model shortcomings in this section is an excellent example of the caveats that could be echoed throughout Chapter 6. However, it appears that the comparison between the SLAM and CATAS models is being used to validate the CATAS model. Validating the results of one model with the results of another seems rather dubious. Is there any evidence that either model has performed well in predicting real population trends (i.e., has either model been validated using field data)? Also, what is the justification for considering 50 percent between the two models as 'good'?
- Pg. 6-66: The inclusion of model scenarios that analyze the consequences of delayed recovery actions is a quantitative strength of the Plan.

Chapter 7:

- Entire Chapter: There is a significant disconnect between the quantitative approaches taken in Chapters 4, 5, and 6 and the qualitative nature of the analysis

in Chapter 7. Can recovery actions be ranked according to their potential to reduce the probability of extinction within a population, stratum, or ESU/DPS? Further, factoring action cost into an analysis would allow calculation of risk reduction/cost ratios and allow objective prioritization of high benefit/low cost actions. Such a strategy may be more desirable than the default 'stop the bleeding' approach which is inherently reactive and can result in costly action with sometimes limited risk reduction potential.

- Pg. 7-5: Given that only a few populations have data from watershed assessments and that professional judgment is used for the remainder, how confident is ODFW that the list of limiting factors and threats is complete? Is there a timeline for completing watershed assessments for the populations that still require such information?
- Pg. 7-6 (Under *Uncertainty – Research, Monitoring, and Evaluation*): How do the uncertainties in survival improvements for hatchery related actions or actions intended to improve water quality (e.g., reduce toxic pollution) compare to the uncertainties associated with tributary or estuary habitat improvements?
- Pg. 7-6: (Under *Linking Actions to Recovery Goals*): How will research monitoring and evaluation actions targeted at determining '*If insufficient progress is being made towards achieving recovery goals, or individual actions are deemed to not be working...*' achieve the goal of a quantitative assessment that will determine '*whether or not the actions in this Plan will, when considered in total, achieve the goals of the Plan*'?
- Section 7.2.1: The research activities proposed in the Plan (e.g., Table 7-2 and similar tables) are ambitious and may require decades to complete. Is there a proposed timeline for resolving uncertainties related to the effectiveness of recovery actions? If so, the Plan would be strengthened by an explicit description of such a timeline and the study design for conducting effectiveness monitoring.
- Pg. 7-9: The research approach proposed for chum salmon is ambitious and may require decades to complete. Is there a proposed timeline for actions to recover chum salmon? What is the likelihood that the recovery plan proposed for chum will succeed?
- Pg. 7-16 (Actions 89-92, Table 7-6): The actions proposed to address toxic contaminants from agricultural, urban, and industrial sources may be unrealistic. For example, is it realistic to '*Study and establish threshold treatment standards for pharmaceuticals and other unregulated substance discharges*' within the timeframe proposed for recovery of affected salmon and steelhead populations in the Lower Columbia Recovery Domain? Achieving such goals may require decades of research followed by the time required to determine policy recommendations (e.g., best management practices). This section would be significantly strengthened if it included some discussion of the potential timeline required for such actions or alternative measures that could be pursued if the actions proposed in this section are not achieved within a timeframe appropriate for recovery.

Chapter 8:

- Entire Chapter: It is possible that the time required to meet delisting goals may be effected by variability in the time and place in which limiting factors affect populations. For example, limiting factors located upstream may affect demographic characteristics of downstream fish (e.g., age at maturation, survival). A limiting factor in one place could have delayed effects on the status and trends of fish located elsewhere. However, there are no identified research needs or approaches for determining the nature and magnitude of such time lags. This seems to be a critical omission from the research, monitoring, and evaluation section of the Plan.

- Entire Chapter: Research on critical uncertainties appears to be a key component of the success of the Plan. While the approach outlined in Chapter 8 is logical, implementation of the proposed research appears to be a daunting task. The overall impression given by this chapter is that successful recovery will depend on information produced by many studies that are presently at the level of 'research goals' rather than detailed proposals. For example, in many sections the approaches to proposed research goals are described as 'to be determined' (e.g., Pgs. 8-7 and 8-8). This does not instill a tremendous amount of faith that the Plan will successfully lead to recovery. Chapter 8 of the Plan would be strengthened by either explicit descriptions of how research questions will be approached, or a timeline for determining research approaches, developing proposals, and implementing research programs.

- Pg. 8-35: Under both development of integrated monitoring plans and data management access, the Plan indicates that interagency groups will be formed to review research, monitoring, and evaluation programs and needs, and to review data management needs and implementation. Such review oversight is good, but what group will have the authority to make needed changes in the research, monitoring, and evaluation programs and data management after each review?

Chapter 9:

- Entire Chapter: IMST was pleased to see that the Plan contains a sufficient level of detail about the entities and policies involved in the recovery process and how Oregon will coordinate with Washington to achieve recovery.

- Entire Chapter: The first paragraph of Chapter 9 provides a clear statement of the need to integrate research, monitoring, and evaluation with adaptive management. However, it is difficult for IMST to assess the science underpinning the Plan when the actual recovery actions and a timeline for implementation have not been finalized. It is clear that the adaptive management and implementation plans remain under development and that the Plan is intended to function as a living document. The Plan would be strengthened by the inclusion of a timeline/trajectory for development of the first stage of the Plan (perhaps 3–5 years from present). For example, a simple figure plotting both predicted status of individual ESU's/DPS's (y-axis) and percent of the plan implemented (y-axis)

against time (x-axis) would give a useful indication of how ODFW expects implementation and recovery to proceed.

Appendix 4-B:

- Pg. 1: The transparency of the Plan would be increased if Appendix 4-B included further explanation of the shortcomings associated with using different 'ad hoc' approaches to determining conservation gaps for data-poor populations. What are the benefits of using the same model-intensive approach for all populations even though data do not exist to support this approach for all populations? Why does ODFW feel that consistency across all populations is critical? What are the costs or benefits of using different 'ad hoc approaches' to determine conservation gaps for data-poor populations?

Appendix 6-D:

- The discussion of how the population structure adopted for the Plan affects the potential for successful recovery of ESU's/DPS's within the recovery domain is a strong point of the Plan.

Appendix 7-G

- The rigor of the recovery plan for chum salmon would be greatly increased with the addition of an implementation timeline.

SPECIFIC COMMENTS BY SECTION:

Executive Summary

- Pg. ES6: Incorporating information on how Washington populations affect ESA delisting status into Table ES-1 would be very helpful.
- Pg. ES-8: Table ES-3 would be more easily interpreted if table title included definitions for terms and abbreviations used in the abundance/risk class and confidence columns, and an explanation of why data are missing from some sections.
- Pg. ES10: Does the phrase '*marking of all hatchery fish*' include fish not released by state or federal agencies (e.g., tribal hatcheries)?
- Pg. ES10: The last paragraph lists '*healthy watershed conditions and ecosystem functions*'. Should streamflow be included in this list?

Chapter 1:

- Pg. 1-4: Are there explicit definitions for the terms 'rural' or 'Native American' values that will be used in the recovery planning process?
- Pg. 1-10: In the paragraph beginning '*The intent of Oregon's recovery planning effort…*' – should meeting broad sense recovery goals also be included in the intent?

Chapter 2:

- Pg. 2-2: In the Plan, an independent population is defined as '*a group of fish of the same species that spawns in a particular lake or stream (or portion thereof) at a particular season and which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place at a different season….not interbreeding to a 'substantial degree' means that two groups are considered to be independent populations if they are isolated to such an extent that exchanges of individuals among the populations do not substantially affect the population dynamics or extinction risk of the independent populations over a 100-year time frame'*. It is difficult to determine how this definition differs from that given for the ESU/DPS concept described on pg. 2-1 of the Plan.
- Pg. 2-7: The following definition appears to give a large amount of latitude in identifying the boundaries of independent populations. '*The WLC-TRT defined an independent population as 'a group of fish of the same species that spawns in a particular lake or stream (or portion thereof) at a particular season and, which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place at a different season.*'
- Pg. 2-18: In the following sentence, what is meant by the phrase '*considered to be extinct*'? Is this also an interim status or a final designation for the population status of chum salmon? '*All SMUS were given interim status assignments of "At*

Risk" except for the Lower Columbia Chum SMU which was considered to be "Extinct"'.

- Pg. 2-20: Cross referencing Appendix 6-D in the first paragraph would increase the transparency of the Plan.

Chapter 3:

- Pg. 3-3: The decision framework presented in Figure 3-1 presents a very clear picture of the delisting process and pathway to recovery.
- Pg. 3-4: Regarding the section titled '*Safety Factors*', in how many more populations should '*recovery be attempted*' and how will this number be determined?
- Pg. 3-4: What is meant by the phrase '*high probability of persistence'*? Does this indicate a probability, a period of time, or both?
- Pg. 3-5: ODFW's explicit assessment of how potential errors in determining independent population boundaries will affect stratum-level viability assessments (footnote 9), is scientifically credible and a strong point of the Plan.
- Pg. 3-5: It is difficult to determine the explicit meaning of the paragraph beginning '*NOAA has noted that decisions to delist…*'. As written it seems to indicate that the delisting criteria given in section 3.2 may be revised at any time or simply not used to make delisting decisions. Is this an accurate interpretation? If not, a clearer statement of intent may increase the transparency of this paragraph.
- Pg. 3-5: Footnote 9 indicates that the population structure for the Gorge stratum may never meet the stratum-level delisting criteria. The Plan would be strengthened if explicit options for resolving this issue were detailed.
- Pg.3-10: Are the CATAS and SLAM models a substantial improvement over modeling strategies used in other recovery plans? If so, will these models be used in future recovery plans or during future revisions of ODFW recovery plans produced prior to the development of CATAS and SLAM?

Chapter 4:

- Pg. 4-1: What is the biological justification for determining that a 5% chance of extinction is an acceptable threshold?
- Pg. 4-3: In the paragraph beginning '*In general…*' It is difficult to determine if the estimates of historical (600,000) and recent (400) coho salmon returns apply to the entire Columbia River, the Lower Columbia ESU, or a stratum, etc.
- Pg. 4-12: With regard to Figure 4-5 – the shape of the curve appears to imply that there is no effect of density dependence as the number of spawners increases. Is this the case? If so, the figure would be more clear if some explanation about this assumption were included in the figure title.

- Pg. 4-19: The paragraph beginning '*The last quantifiable element*…' describes the Plan's approach to quantifying anthropogenic mortality. In estimating conservation gaps only mortality caused by fish harvest is considered. How would limitations in spawning habitat affect these estimates?
- Pg. 4-19: In the paragraph beginning '*Finally, the last two*…' life history and habitat diversity are listed as elements important to the maintenance of genetic diversity and a population's ability to evolve in the face of a changing environment. On what source of information is this supposition based? Inclusion of additional literature citations in this paragraph would strengthen the Plan.

Chapter 5:

- Section 5.1.1: The process for determining and ranking limiting factors and threats would be more transparent if a list of suitable habitat areas and their definitions were included in addition to the information on life stages and geographic areas already provided in the Plan.
- Pg. 5-2: Use of the word 'considered' in the first sentence is vague. Was each salmonid life stage listed actually assessed by the expert panel to determine possible limiting factors and threats? Also, regarding the life history stage definitions:
    - How long does the fry stage typically last?
    - Is there some characteristic that solidly delineates the presmolt and smolt stages? If not, it would be useful to include this in the description.
- Figure 5-1: The amount of information imparted by this figure could be increased if major tributaries were somehow highlighted, a scale bar was added, the figure was converted to landscape format to increase its size and resolution, and the figure caption included additional descriptive information regarding species and population boundaries.
- Figures 5-4 to 5-8: Is it possible to report error rates or confidence intervals for the catch rates shown in these figures?
- Pg. 5-5: It would be useful if an explanation that harvest is considered under 'threats' were included in the first paragraph.
- Table 5-2: The following comments apply –
    - It would be helpful if limiting factors posed by native predators were distinguished from limiting factors posed by non-native predators.
    - The description of water quality as a limiting factor is very broad (i.e., comprising impairments from increase temperature to toxins). It would be useful if major classes of limiting factors housed under 'water quality' were treated separately and described with more specific details. For example, the population limitations posed by increased water temperature are very different than those posed by pesticides or pharmaceuticals.

- The definitions provided in the table do not follow a consistent structure and this leads to an uneven level of detail about each type of limiting factor.
- Under '*Habitat Access*' the last sentence is unclear – it might be simpler to state in the table title that multiple limiting factors might be assigned to the same reach of stream.

- Pg. 5-6: Adding a cross reference (i.e., page or section numbers) to the sections on population growth and climate change to the end of the second paragraph would increase the readers ability to track information throughout the document.
- Table 5-3: It would be useful if the threats listed in Table 5-3 were explicitly linked to specific categories of limiting factors listed in Table 5-2.
- Pg. 5-9: The first sentence indicates that Figure 5-3 shows the types of fisheries that affect salmon and steelhead populations in the lower Columbia River. However, Figure 5-3 depicts only fisheries that operate within the lower Columbia – other fisheries besides these (listed in the Plan) affect listed salmonid populations in the lower Columbia.
- Pg. 5-13: In footnote number 19, what exactly is meant by the phrase '*…but it is shades of gray, not black and white*'? A more explicit statement of the uncertainty involved increase clarity of the Plan.
- Pg. 5-14: In the section under '*Size, Age, Timing Selection*' the reference to the discussion of mixed-stock fisheries would be improved by use of a cross reference.
- Pg. 5-15: Interpretation of Figure 5-4 includes the following statement '*During the last few years, the combined ocean and in-river harvest rates for most of the LCR coho populations has dropped below 20 percent*'. While this is true, the interpretation is somewhat misleading because harvest rates have not remained below 20 percent and appear closer to 30 percent for recent years.
- Pg. 5-16: With regard to the description of harvest effects on Columbia River chum, how confident is ODFW that incidental take on chum will not increase as populations begin to recover?
- Pg. 5-23: Regarding Table 5-4 and other tables in the Plan that report data on numbers of individual fish – ODFW's confidence / uncertainty in data reported in the plan would be more transparent if the use of significant digits reflected the level of accuracy in numerical estimates. For example, Table 5-4 contains hatchery release estimates from Washington Department of Fish and Wildlife down to the individual fish. Estimates by ODFW and US Fish and Wildlife Service presented in the same table report to the level of thousands of fish. Does the difference in use of significant digits really reflect differences in how and how accurately hatchery fish are counted?
- Figure 5-13: The addition of major stream tributaries and possibly population boundaries would be useful in this figure.

- Pg. 5-24: The biological justification underpinning the selected benchmarks for hatchery fish spawning in 'wild' populations would be more transparent if additional explanation for the selection of these criteria were included in the section titled '*Loss of population traits*'.
- Figure 5-14: This figure specifically shows *mean* annual Columbia River flow. The amount of information provided by this figure could be increased by adding some measure of variance (e.g., standard deviation) around the monthly averages.
- Pg. 5-28: It is not clear from the text whether the food web effect of hydropower and flood control is considered a key or secondary concern.
- Pg. 5-31: The IMST's 2002 report titled Recovery of *Wild Salmonids in Western Oregon Lowlands* might be a useful reference to support the second bullet on this page. Also, urban and rural-residential development (the 5th bullet) also alters the hydrograph of affected streams, and impairs water quality due to stormwater runoff, combined sewer overflow events, and toxic contaminants derived from various industrial and wastewater effluent sources.
- Figures 5-15, 5-16, and 5-17: It would be helpful if the water quality parameters that limit the streams marked in these figures were better described (or simply listed) in the figure captions.
- Pg. 5-37: '*Impacts due to the spread of noxious weeds are discussed under land management*'. We were unable to find this discussion in Section 5.2.4.
- Table 5-5: While this summary table is an excellent addition to the Plan, there are additional recent references (beyond 2004) that could be included. For example, see Crozier *et al*. (2008) and references cited therein. Also, reporting temperature changes in both ^{o}C and ^{o}F would be useful for many readers.
- Pg. 5-39: The language in the first two bullets on this page is vague. A possible revision for the first bullet might read as – Changes in land use due primarily to increased human population size and per capita consumption rates will increase water use and affect land management and ultimately degrade fish and wildife habitat. In the second bullet – what is meant by the phrase '*increase pressure*'? Also, the effects of urban development on groundwater recharge (fifth bullet) are not well defined. Diversion of water into a basin for agricultural or residential use can increase base flows in the receiving basin.
- Pg. 5-58: What is the justification for not using unmarked fish as broodstock in the Big Creek Hatchery?
- Pg. 5-71: Regarding the statement '*..non-native, invasive vegetation is also considered a problem..*' – What are the plant species of concern and what is the extent of the problem? Although mentioned in more than one spot as an issue, the link between non-native, invasive vegetation and riparian condition is not well discussed in the Plan.

- Pg. 5-94: Has any research directly linked marine mammal predation to population-level effects on salmonid populations? If so, it would be useful to include relevant citations in the section on '*Predation*'.

Chapter 6:

- Pg. 6.2: In the paragraph on chum salmon, the criteria stating that '*Oregon set the desired status for populations based on having half of the Oregon populations in a stratum reaching low extinction risk and the others improving significantly.*' is somewhat vague. If a population is extinct, even a few fish returning might be a significant improvement. Are there more explicit criteria for determining desired status?
- Pg. 6-5: There seems to be some inconsistencies between how many populations need to be viable to allow delisting of steelhead in the Lower Columbia Recovery Plan and the recovery plan for steelhead in the Middle-Columbia Recovery Domain. If strata and major population groups are comparable (pg. 2-7 of the Plan), what is the source of these apparent inconsistencies and what are the biological implications for steelhead within each recovery domain?
- Pg. 6-9: What is the biological basis for assuming mortality rates of 40 (coho, steelhead, spring Chinook) or 50 (fall Chinook, chum) percent are associated with estuary habitat and predation?
- Pg. 6-9: With regard to calculating mortality due to human effects on estuary habitat, it seems that it would be difficult to compare the Columbia River estuary to other estuaries because the hydrograph and discharges are sufficiently different. The general approach to calculating this mortality rate makes sense, however the Plan would be strengthened if it included some discussion on the quality/quantity of data available to make such a calculation and discussion of ODFW's confidence in the results.
- Pg. 6-10: What is the biological basis for assuming that 50% of the impact of pinniped predation is caused by humans?
- Figure 6-2: It is not clear from this figure or the associated text whether steelhead, coho, and Chinook populations were combined for this analysis or analyzed separately. There is only one regression line shown in the figure but estimates of reduced productivity are reported for each species. If the analysis was combined, what is the biological justification for including data from multiple species in the same analysis? If species were analyzed separately, the clarity of the figure would be increased by color coding the data points by species and showing individual regression lines. Also, it would be useful to see the regression equations and r-squared results for each analysis.
- Pg. 6-11: What is the biological justification for assuming that the hatchery rate for Chinook was 50% of the rate for coho and steelhead? Is this assumption supported by the regression analysis presented in Figure 6-2? If so, additional discussion of the analysis presented in Figure 6-2 might clarify this point.

- Pg. 6-16: What level of confidence does ODFW have in the assumption in NOAA's Estuary Module that estuary habitat improvements could increase the number of outmigrants by as much as 20%?
- Pg. 6-18: What are the biological, economic, or social bases for the following assumption that Chinook salmon ocean fisheries would 'continue unaltered'?
- The last sentence in the section on hatchery threats is not well supported by the preceding text. What is the evidence that '*the proposed hatchery stray rates at different risk level goals…are feasible for most populations*'? Are there other sections of the Plan that could be cross referenced here to better support this conclusion?
- Pg. 6-19: Recent research findings indicate that the conscious decision to retain hatchery fish production in the Lower Columbia Recovery Domain could have negative consequences on the fitness of wild fish (see Araki *et al*. 2009; Small *et al*. 2009). The implications of this decision for salmon and steelhead recovery would be more transparent if some discussion of this research were included in the section on hatchery threats. This comment also applies to the discussion of '*Loss of population traits*' on pg. 5-24 of the Plan.
- Pg. 6-20: What is the purpose of running both the 'Max Feasible' and the 'Most Probable' threat reduction scenarios when they are '*generally the same*'?
- Pg. 6-21: What is the biological justification for the assumption that all threats affect populations in ways that are independent of population density? Page 6-58 of the Plan includes the following sentence in the second paragraph – '*Most populations are limited by some degree of density dependence*.' How are these two contrary assumptions reconciled within the models used to create the Plan?
- Pg. 6-38: In the footnotes of Table 6-21 it is stated that '*This discrepancy is another indicator of recovery issues with this population*'. Within this context it is difficult to interpret the meaning of this statement. Additional information summarizing the recovery issues would increase transparency of the Plan. This statement is included in similar footnotes for other populations and this comment applies to those populations as well.
- Pg. 6-57: If the CATAS model cannot incorporate trends or cycles then how does it model the effects of the Pacific decadal oscillation on salmonid population recovery, as well as long term trends resulting from other environmental factors?
- Pg. 6-61: In the caption for Figure 6-4 a smolt is defined '*as a fish that is leaving the estuary to enter the ocean*'. Based on this definition, what life stage of salmonids is counted at dams?
- Pg. 6-64: The text associated with Figures 6-5 and 6-6 indicates that projections were only run to year 2060 but these figures show data beyond that time. There may be a typographical error in the text on pg. 6-63 (bottom paragraph, second sentence) which states '*...14%-42% by 2009*'. If not, these figures would be easier to interpret if their titles included additional information on the simulation parameters used to create them.

Chapter 7:

- Pg. 7-8: Regarding the following statement '*Mark-selective fisheries for hatchery coho and Chinook are proposed for both sport and commercial fisheries where they are not currently in place, if practicable techniques and gear can be developed.*' What alternative actions will compensate if these actions cannot be achieved?
- Pg. 7-12 (Action 29d Table 7-14): Are there compensatory actions available if action agencies do not follow policy recommendations on flow?
- Pg. 7-15 (Action 87): Exactly what structures are considered over-water structures and why are they a concern?
- Pg. 7-17 Action 95, Table 7-7) What is the evidence that the northern pikeminnow bounty program has had any effect on salmon and steelhead recovery in the Lower Columbia Recovery Domain (or any other area in the Columbia River system) or that increasing this bounty program will contribute to recovery?
- Pg. 7-21 (Action 205, Table 7-9): Will any additional actions be taken to restore degraded upland processes after the sediment source analysis is complete?

Chapter 8:

- Pg. 8-4: What is the evidence that a 12 year period is sufficient for monitoring abundance and productivity metrics for all four salmonid species (that exhibit varied life histories) that are ESA listed in the Lower Columbia Recovery Domain?
- Pg. 8-8: '*At least one intensively monitored watershed*..'- How will ODFW determine if the selected watershed is representative or that information from one watershed can be extrapolated to other watersheds?
- Pg. 8-11 (and elsewhere): A 12-year period may not be sufficient for monitoring structural diversity (or other criteria) given that environmental factors that affect salmon and steelhead populations (e.g., the Pacific decadal oscillation) can span this timeframe.
- Pg. 8-16: How was ±30 percent selected as an acceptable level of precision for annual spawner abundance and juvenile density estimates?
- Pg. 8-28: Are there any non-native predators that need to be included under the predation related metrics?

EDITORIAL COMMENTS:

While reviewing the content of the Plan the IMST noticed several typographical errors and figures or tables legends that are not clear. The following are examples of errors but this list is not comprehensive.

Entire Document:

- Clarity of the entire document could be greatly improved if it were reviewed by a professional copyeditor.
- The extensive use of acronyms decreases the clarity of the Plan. Increased use of footnotes to define acronyms would address this issue.
- Tables and figures included in the Plan would better support the document if they were presented as stand alone pieces. This requires that all information necessary to interpret a figure or table be presented in the caption and/or footnotes. Particularly helpful information would include (but is not limited to) acronym definitions, and information about the type of fish (i.e., wild vs. hatchery) represented by values.
- It would be useful if early in the Plan there was some explanation of what is meant by the use of 'Oregon' as an identifier. Does this indicate the same agency/entity everywhere it is used in the Plan?
- The use of numeric units (US standard/metric) is not consistent throughout the Plan. Including both would increase clarity of the Plan.
- Table cell fills, cross hatching, and variations in font color do not show up in black and white copies. Black and white printings of the document could be made easier to read if different color schemes were selected.
- In several places the word historic is used where historical may be the correct term. By definition, historic refers to having considerable historical importance such as a place, event, or document.
- The word data is plural but is often treated as singular in many areas of the document. This leads to incorrect subject-verb relationships (e.g., *the data suggests* is often used when the proper phrase would be *the data suggest*).

Executive Summary

- Figure ES-2 is rather difficult to read with the grey background text included. The figure might be clearer if the background were deleted and more detail about the over all road map of the Plan were added to the bold part of the figure.

Chapter 1:

- Entire Chapter: There is an inconsistent use of agency names and use of "Lower Columbia" throughout Chapter 1. The "lower" in lower Columbia is also inconsistently capitalized and leads to confusion of what is being referred to – the geographical area or the domain. There is no geographic feature called Lower

Columbia, it would be correct to say the lower Columbia River. If the domain is being referred to, then a capitalized "L" makes sense since it is referring to the domain and not the river.

- Entire Chapter: Is the use of NOAA, NOAA Fisheries Service, and NMFS, particularly in Section 1.5, meant to differentiate the various responsibilities within the hierarchy of the agency or is it reflection of various authors of the section?
- Pg. 1-3: There is a problem with voice agreement in the first sentence of the second to last paragraph '*…reversing the decline of a listed species and its habitat so that them initially become viable…*'.
- Pg. 1-4: Item four under the sequential process for developing recovery plans (*Determine any gap between the two…*) – does the word two refer to items two and three?
- Pg. 1-9: Were there any other types of scientists (other than biologists) included on the *Oregon Lower Columbia Expert Panel*?
- Pg. 1-12: In the second paragraph, the apostrophe after FCRPS is not necessary. Also, the first two sentences of the third paragraph include grammatical errors that make it very difficult to understand their meanings.
- Pg. 1-13: What does LCFRB stand for?
- Pg. 1-15: The subheading '*Disease or Predation*' does not indicate that the following paragraph will address non-native species.

Chapter 2:

- Figure 2-1: Do the grey ovals represent populations? If so this should be indicated somewhere on the figure or in the figure title.
- Pg. 2-1: The last sentence of the first paragraph appears to imply that both anadromous and resident *O. mykiss* populations spend their entire life cycle in freshwater.
- Pg. 2-4: The word 'creeks' is misspelled in the first paragraph under '*Columbia Gorge*'.
- Pg. 2-7: In the following sentence, the use of the phrase 'biological structure' is vague. '*Thus, the overall biological structure of salmonids is hierarchical; spawners in the same area of the same stream will share more characteristics than those in the next stream over.*'
- Table 2-1: Depending on how populations in the Gorge stratum are counted this table lists 23 or 25 population names – not 24 populations as indicated near the top of the table.
- Table 2-3: The table indicates there are 23 historical populations in the DPS but 25 populations are listed.

- Pg. 2-18: The table cited in the first sentence of the second paragraph does not compare state and federal population designations. Also, in the second sentence of the last paragraph, SMUS should be SMUs.
- Pg. 2-19: The designation "Table 1-5" appears to be a typographical error.

Chapter 3:

- Pg. 3-2: In the first sentence under Viability Criteria the word strata should be singular – 'stratum'.
- Pg. 3-6: There is an extra bullet before broad sense recovery objective #1.
- Pg. 3-7: The explanation for '*Extinction Probability Adjustment*' is extremely difficult to follow and may warrant revision to increase clarity.
- Figure 3-12: What are the differences between boxes that indicate 'Data and/or Inference' vs 'Population Data and/or Inference'? Also, should the dashed arrows connecting the CATAS analyses to the SLAM box be 2-way? What is a 'Calculated Tributary Habitat Rate'?

Chapter 4:

- Pg. 4-3: Regarding Figure 4-1 and all similar graphs included in the plan – The transparency of current status determinations would be increased if the y-axis of these graphs were converted to a continuous distribution of probability extinction (i.e., 0 to 1). At a minimum the non-linear nature of extinction risk categories should be explained in the figure title and perhaps shown on the graph using risk category 'brackets' that are proportional to the range of probability each represents. Also, not all risk categories are marked on the current graphs (e.g., the very high category is not shown in Figure 4-1) and it is difficult to tell how the current y-axis labels relate to the range of probabilities they represent. Including some description of how solid and dashed lines relate to the extinction probability distribution in the figure title would help clarify how readers should interpret the y-axis.
- Pg. 4-5: With regard to the following sentence – '*The remaining 11 populations were all non-viable, with extinction risk classifications mostly in the very high and high categories.*' Figure 4-3 does not show the very high extinction category on the Y-axis.
- Pg. 4-9: In the last line the word 'cases' should be singular.
- Pg. 4-10: The paragraph beginning '*Three different PVA models….*' is fairly convoluted and could be edited to clarify exactly why only one PVA model was used to determine A/P conservation gaps.
- Pg. 4-20: In Table 4-6 the relative size of the basins should be included in the table title or footnotes.
- Pg. 4-21: Table 4-7 would be easier to read if several acronyms (e.g., VH, H, M, CRT) were defined.

- Pg. 4-25: In the second paragraph there is an extra period and space between "probabilities" and "Therefore".

Chapter 5:

- Pg. 5-1: In the paragraph beginning '*Because of the lack of quantitative data*…' – the first sentence seems to be missing some critical words or punctuation such that it is difficult to determine its meaning. In the second sentence – does the word considered imply that '*localized models*' were actually used in some cases, or simply contemplated?
- Pg. 5-9: In the last paragraph October is misspelled 'Octoer'.
- Pg. 5-10: It would be useful if '*Zone 6a*' were marked on Figure 5-3.
- Pg. 5-12: It would be useful if the box presented on this page had a figure number and title so it could be cross referenced in the text of the Plan. Also, it would be good if the text under '*US v. Oregon*' listed the four tribes involved in the described treaty. There is a typo '*tas*' in the first sentence under '*North of Falcon*'.
- Pg. 5-23: A more accurate figure title for Figure 5-13 might read 'Locations of hatchery releases in the Columbia River basin'.
- Pg. 5-24: In the last paragraph the first sentence should read either 'While this ranking…' or 'While these rankings…'.
- Pg. 5-64: First paragraph, second line – the word recent is misspelled. In the paragraph under Coho – the verbs make up and comprise follow each other in the same sentence.
- Pg. 5-72: The LCREP 2007b citation is not included in the literature cited section.
- Pg. 5-79: Under water quality there is a misspelling in '*...endosulfan, reached concentrations great than Oregon DEQ...*'
- Pg. 5-82: Under Harvest Management there is a misspelling in '*These fish are also impact by mainstem Columbia...*'
- Pg. 5-91: There is an extra verb in the first sentence of the first paragraph "*There is little or no data are available...*"

Chapter 6:

- Pg. 6-14: Second paragraph, first sentence – there is a misspelling in '*...to the extent that survival will increased for some specific...*'
- Pg. 6-18: The intended meaning of the following sentence is unclear. Does this mean the Hood and Upper Gorge are themselves impacted disproportionately, or does it mean that these populations impact other populations? *For example, the Hood and Upper Gorge populations have larger harvest impacts than other*

populations due to their greater longitudinal exposure to fisheries in the mainstem Columbia River.

- Pg. 6-55: Reporting values in Table 6-38 to a 1/100 level of precision may be misleading given the high level of uncertainty associated with the analyses used to determine these values.
- Pg. 6-57: What are the units for the two right-hand columns in Table 6-40?
- Pg. 6-64: The title of Figure 6-5 contains a typographical error, "tream" instead of "stream".

Chapter 8:

- Pg. 8-5: There is an extra word in sentence '*...it is necessary to scale the average abundance targets to ~~annua~~l an annual index of climate*.'
- Pg. 8-11: There may be extra words in first sentence of second paragraph '*Because adult and juvenile salmon and ~~habitat~~ often rely on ...*' Should this actually read "salmon and steelhead"?
- Pg. 8-17: There is a word missing in first sentence under Priorities '*the cost (of) doing business*'.
- Pg. 8-18: Is the reference to '*the MPG scale*' a typographical error?
- Pg. 8-18: The paragraph at the end of the page references a Table 2, but should this be Table 8-2?
- Pg. 8-20: First paragraph. Singular verb does not match plural noun in '*...habitat conditions is needed'*.
- Pg. 8-27: Last paragraph. The sentence '*PIT tagging could be used as well, but would provide as much resolution*.' Should this sentence read "would <u>not</u> provide"?
- Pg. 8-33: What is an HGMP?
- Pg. 8-34: Bullet 2 – the tense is incorrect on 'Conducted'.
- Pg. 8-35: Second full paragraph - there is an extra word in '*PNAMP ~~is~~ currently has a...*'

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APPENDIX A: IMST recommendations from previous conservation and recovery plan reviews

IMST Review of ODFW's draft Native fish Conservation Plan for the Spring Chinook Salmon: Rogue Species Management Unit (February 28, 2007 draft)

The Native Fish Conservation Policy requires ODFW to solicit scientific review from the IMST and other scientists (Oregon Administrative Rule 635-007-0505(8)(b)). Recommendations 1–6 are meant to facilitate the scientific review process and are pertinent to the draft Rogue River spring Chinook conservation plan and future ODFW native fish recovery and conservation plans. See IMST review dated May 30, 2007 for full context of recommendations (available at http://www.fsl.orst.edu/imst/reports/Review_Rogue_CHS_2007.pdf)

Recommendation 1. IMST recommends that ODFW's native fish conservation plans should contain sufficient information on data, data analysis, variance estimates and other critical information, to demonstrate whether or not the plans are scientifically rigorous.

Recommendation 2. IMST recommends that ODFW should follow steps to ensure statistical best practices are used in the conservation planning process.

Recommendation 3. IMST recommends that ODFW should include measurements of habitat variables as well as monitoring of fish abundances.

Recommendation 4. IMST recommends that ODFW investigate alternative models and relationships to explain trends and variability in observed data. For example, straight-line models might not be the "best fit"(e.g., Figures 5–7).

Recommendation 5. IMST recommends that ODFW should provide clearly defined measures and criteria for recovery in all conservation plans.

Recommendation 6. IMST recommends that ODFW should not recommend the killing of native predators without adequate research on the effectiveness of predator control. Control of non-native species should include both non-game and game fish.

Recommendation 7. IMST recommends that if Lost Creek Dam is the factor most strongly associated with the decline of spring Chinook salmon in the Rogue River, ODFW should list and evaluate all options relative to retention and operation of the project and prioritize those that would most benefit naturally produced spring Chinook salmon.

IMST Review of ODFW's draft Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct Population Segment (November 2007 draft)

The Native Fish Conservation Policy requires ODFW to solicit scientific review from the IMST and other scientists (Oregon Administrative Rule 635-007-0505(8)(b)). Recommendations 1, 3, 4, 5a, and 6 are meant to facilitate the scientific review process and are pertinent to the draft *Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Distinct Population Segment* and future ODFW native fish recovery and conservation plans. See full review dated May 8, 2008 for context of recommendations (available at http://www.fsl.orst.edu/imst/reports/review_mid-c_steelhead_5-8-08.pdf)

Recommendation 1 IMST recommends that Oregon Department of Fish and Wildlife include in the Mid-Columbia Steelhead Recovery Plan and all future recovery and conservation plans an explicit analysis or discussion of uncertainty associated with fundamental assumptions or conclusions regarding management action effectiveness that are likely to have significant consequences to recovery if the assumption or conclusion was incorrect.

Recommendation 2 IMST recommends that the Oregon Plan Core Team further demonstrate how the multi-agency monitoring activities proposed in the Mid-Columbia Steelhead Recovery Plan will detect change in status and trends of populations and habitat in the DPS.

Recommendation 3 IMST recommends that in all future recovery and conservation plans Oregon Department of Fish and Wildlife include a monitoring plan sufficient to demonstrate that trends departing from recovery targets could be detected in time to allow changes in recovery strategies or tactics intended to respond to such trends. This would require clear objectives and milestones for monitored parameters, as well as a description of monitoring plan design, implementation, and identification of resources required to implement the monitoring plan.

Recommendation 4 IMST recommends that in each recovery and conservation plan Oregon Department of Fish and Wildlife include the specific management actions to be taken if the status and trends of populations and habitat diverge significantly from recovery goals or predicted trends.

Recommendation 5a IMST recommends that in each recovery and conservation plan Oregon Department of Fish and Wildlife thoroughly consider projections of future changes to landscape or limiting factors, including land use and climate changes, when establishing recovery actions and formulating adaptive management strategies.

Recommendation 5b IMST recommends that the State of Oregon integrate monitoring and evaluation into state initiatives in the area of climate change to allow for scientific evaluation of recovery and conservation plans.

Recommendation 6 IMST recommends that Oregon Department of Fish and Wildlife ensure that time and cost estimates of recovery plans include costs for recovery actions listed in the plan.