Independent Multidisciplinary Science Team (IMST)

State of Oregon

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Dear Sue,

In your November 6, 2007 letter to the Independent Multidisciplinary Science Team (IMST), you requested that the IMST review the scientific underpinnings of the draft Recovery Plan for the Oregon Unit, Middle Columbia (Mid-Columbia) Steelhead Distinct Population Segment (DPS). You asked that the IMST's review focus on the Distinct Population Segment (DPS) Structure, Desired Status, Current Status, Viability Gaps, Limiting Factors and Threats, Recovery Strategies and Management Actions, and Management Action Effectiveness sections of the draft Recovery Plan. While reviewing these sections, IMST found that preparation of an adequate response required that the Team review the entire draft Recovery Plan.

We have completed our review of the draft document titled *Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Distinct Population Segment* (November 2007 draft; hereafter the Plan). This letter along with attachments contains our assessment of the science underpinning the Plan, as well as additional suggestions relevant to the use of best available science in recovery planning. Specifically, this IMST review addresses whether the Plan's analyses and approach are consistent with accepted scientific standards, whether Plan assumptions are supported by best available science, and whether uncertainties are adequately characterized. IMST approached these issues from the perspectives of both federal Endangered Species Act and Oregon Department of Fish and Wildlife's Native Fish Conservation Plan goals.

Initial work on this review was carried out by an IMST subcommittee consisting of Carl Schreck (Chair) and Vic Kaczynski with Susie Dunham providing technical support. During the preparation of our initial draft Vic Kaczynski declared a possible conflict of interest and recused himself from further participation in the review on February 19, 2008. This action should not be construed to mean that the Team determined there was an actual conflict of interest. The IMST's review of the Plan is the product of the entire Team, not just the subcommittee.

In general, the IMST believes that, for the most part, the Plan reflects the professional scholarly effort put forth by the authors. The Plan is thorough, and we sincerely appreciate the effort that ODFW authors expended during its development. We also appreciate the effort made by ODFW staff to provide clarifications during our review process. The clarity of presentation and flow of information are significant strong points and result in a highly readable Plan despite its length. This Plan provides a useful model for forthcoming recovery plans.

Areas where IMST believes the Plan would benefit from either additional information or clarification include:

- The validity of fundamental assumptions which, if incorrect, may have significant consequences for recovery of the DPS.
- Description of cooperative efforts between the States of Oregon and Washington critical to recovery and delisting of the entire DPS.
- Description of criteria that will be used to evaluate broad sense recovery goals and objectives listed in the Plan.
- Documentation of both the uncertainty related to current status assessments, limiting factors analysis, management action implementation and effectiveness and the potential consequences of uncertainty for recovery of the DPS.
- Consideration of compounding errors associated with complex recovery scenarios.
- Consideration of synergistic or antagonistic effects among factors that limit recovery of the DPS.
- Addition of trend analyses to recovery criteria.
- Description of how results from Ecosystem Diagnosis and Treatment and All-H Analysis modeling efforts were used to identify management decisions listed in the Plan.
- Consideration of future population growth.
- Consideration of the consequences or effects of future climate change.
- Description of how adaptive management will be executed during the recovery process.
- Demonstration that proposed Research, Monitoring, and Evaluation will be sufficient to detect changes in population status in time to implement alternative management strategies.
- Documentation of the Plan's financial feasibility via a complete economic analysis.

The review section titled *Overarching Issues* summarizes IMST's concerns related to these issues. Sections of the Plan where these issues are directly applicable are identified by way of specific comments organized by sections and page number.

As a part of this review, the IMST has directed one recommendation to the State of Oregon, one recommendation to the Oregon Plan Core Team, and five recommendations to Oregon Department of Fish and Wildlife (ODFW). The recommendations are meant to assist the State of Oregon and ODFW with the preparation of future native fish recovery and conservation plans. As you are aware, Oregon Revised Statute 541.409, requires agencies and state entities to formally respond to recommendations made by the IMST. Responses are generally expected within six months after a recommendation is issued. Appendix A of the review provides information on IMST's process for developing recommendations and for evaluating responses. Please do not hesitate to contact us if we can provide clarification on the intent of our recommendations.

The IMST unanimously adopted the final draft review at its April 24, 2008 public meeting. There were no dissenting opinions amongst the IMST regarding the review. The review was adopted by six of the seven Team members because Kaczynski's recused himself as explained above. The IMST does not normally release reviews to the public or post them to our website for 30 days after sending the review to the requesting group or agency. If you would like the Team to post or release the review publicly at an earlier time, please let Kathy Maas-Hebner (541-737-6105) know.

We would be happy to answer any questions that this review may raise and hope these comments and suggestions are useful in increasing scientific rigor of the draft Plan and future native fish recovery and conservation plans.

Sincerely,

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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)

Released on May 8, 2008

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Review Preparation: This review was prepared by the IMST based on an initial draft by an IMST subcommittee (Carl Schreck with Susie Dunham providing technical support). During the review process, Vic Kaczynski declared a potential conflict of interest and voluntarily stepped down from the original subcommittee and recused himself from the review. Rich Carmichael and/or Bruce McIntosh (ODFW) discussed the preparation, goals, and intended use of the reviewed document at the IMST's November 29, 2007, January 24, February 19, and March 11, 2008 meetings. IMST discussed review comments at its March 11 and April 24, 2008 meetings and unanimously adopted (Kaczynski did not vote) the final review at its April 24, 2008 meeting.

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ACRONYMS AND ABBREVIATIONS

AHA	All-H Analyzer
BACI	Before-After Control Impact design
BiOp	Biological Opinion
CI	Confidence Interval
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
DPS	Distinct Population Segment
EDT	Ecosystem Diagnosis and Treatment
EMAP	Environmental Monitoring and Assessment Protocol
ESA	Endangered Species Act, United States
ESU	Evolutionary Significant Unit
FCRPS	Federal Columbia River Power System
GAO	Government Accountability Office, United States
GIS	Geographic Information System
GNRO	Governor's Natural Resource Office
HSRG	Hatchery Scientific Review Group
ICTRT	Interior Columbia Basin Technical Recovery Team
IEAB	Independent Economic Analysis Board
IMST	Independent Multidisciplinary Science Team
IMW	Intensively Monitored Watershed
ISAB	Independent Science Advisory Board
MaSA	Major Spawning Area
Mid-C	Middle Columbia River
MPG	Major Population Group
NFCP	Native Fish Conservation Plan
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPMP	Northern Pikeminnow Management Program
O.	*Oncorhynchus* genus
ODFW	Oregon Department of Fish and Wildlife
PACFISH	Pacific Anadromous Fish Strategy
PGE	Portland General Electric
PIT	Passive Integrated Transponder tags
Plan	Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Distinct Population Segment
SMU	Species Management Unit
TBD	To Be Determined
UPA	Updated Proposal Action
US	United States

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INTRODUCTION

The Independent Multidisciplinary Science Team (IMST) reviewed the Oregon Department of Fish and Wildlife's (ODFW) November 2007 draft document titled *Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Distinct Population Segment* (hereafter the Plan) at the request of the Governor's Natural Resource Office (GNRO; letter from Suzanne Knapp dated November 6, 2007). IMST received the Plan in November, 2007 and an additional appendix (Appendix H) during the second week of February, 2008. The GNRO requested that the IMST's review focus on the scientific underpinnings associated with sections covering Distinct Population Segment (DPS) Structure, Desired Status, Current Status, Viability Gaps, Limiting Factors and Threats, Recovery Strategies and Management Actions, and Management Action Effectiveness. However, the IMST determined that an adequate response to this request required that the Team review the entire Plan.

Many scientific details supporting the Plan are not developed in the Plan per se but rather come from numerous documents cited in the Plan that were originally developed for the purposes of recovery planning. These supporting documents include, but are not limited, to several Interior Columbia Basin Technical Recovery Team (ICTRT) reports and many National Marine Fisheries Service (NMFS) documents. 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 portrays the information in those reports.

This IMST 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 approaches these issues from the perspectives of both the federal Endangered Species Act (ESA) and ODFW's Native Fish Conservation Plan (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 the Mid-Columbia Steelhead DPS. IMST also does not intend to imply that alternative scientific data 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 Mid-Columbia Steelhead 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 these subsequent sections. The purpose of this repetition is to highlight where in the Plan comments made in the overarching issues section arose and to provide additional details and examples relevant to overarching concerns.

Throughout this review, IMST poses many questions to ODFW. The intent of these questions is to help ODFW enhance the transparency and clarity of the Plan, rather than give the impression that IMST believes the Plan to be insufficient. IMST recognizes that

the Plan represents a tremendous and very professional effort by ODFW employees. It is obvious that the Plan is based on a strong science foundation and careful thought. IMST recognizes the numerous constraints, beyond the control of ODFW, placed on the planning process by requirements of both the NFCP and ESA processes. Consequently, there are numerous areas in the Plan where ODFW did the best it could given existing constraints. While rigorous science serves as the Plan's foundation, 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.

OVERARCHING ISSUES

Fundamental Assumptions

One of IMST's primary concerns with this Plan, as well as other recovery plans, is the consideration or lack of consideration of the validity of fundamental scientific assumptions upon which planning is based. Recovery plans should be very explicit about the current state of the science underlying fundamental assumptions upon which many proposed recovery measures are based. Assumptions that form the basic scaffolding of recovery plans may be based on the best science available, but even the best science is comprised of imperfect data or incomplete information. Explicit expression of confidence in fundamental scientific assumptions and discussion of consequences of potentially incorrect assumptions would strengthen the case that the Mid-Columbia Steelhead Plan or any other plan will lead to recovery. If ODFW takes a precautionary approach, then discussing their confidence in such scientific assumptions would be appropriate. Assumptions notable in this regard are those concerning *Oncorhynchus mykiss* taxonomy and population, Major Population Group (MPG), and DPS boundaries.

Taxonomic Considerations: The Plan's scientific underpinnings would be strengthened if ODFW considered the consequences of applying listing criteria, current status assessments, and recovery scenarios to populations comprised of both resident rainbow trout and anadromous steelhead forms of *O. mykiss*. At present, there is insufficient information to determine whether resident rainbow trout and anadromous steelhead interbreed anywhere in the Mid-Columbia DPS. Genetic (McPhee *et al*. 2007), isotopic (Zimmerman & Reeves 2000), and behavioral (McMillan *et al*. 2007) data from river systems outside of the Mid-Columbia DPS provide mixed evidence on this question. For example, Zimmerman & Reeves (2000) used otolith microchemistry to identify resident rainbow offspring of anadromous steelhead mothers and anadromous steelhead offspring of resident rainbow mothers in the Babine River system in British Columbia. The same study produced evidence that resident rainbow and anadromous steelhead in the Deschutes system do not interbreed, yet this conclusion can only be applied to females (Zimmerman & Reeves 2000). For the remainder of the Mid-Columbia DPS, it is unknown whether resident rainbow males spawn with female anadromous steelhead and vice versa. As defined in the Plan, independent populations are '*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' (pgs. 1-8 and 4-1). The definition specifies (pg. 4-1) that '*substantial degree*' refers to groups isolated to such an extent that exchanges of individuals do not substantially affect the population dynamics or extinction risk of the independent populations over a 100-year time frame. Is ODFW confident that resident and anadromous life history variants of *O. mykiss* in the Mid-Columbia DPS meet this definition? If ODFW is not confident then it should consider the implications of overlapping life histories for recovery planning and present these considerations in the Plan.

IMST is aware that ODFW is adhering to a federal decision to exclude resident rainbow from the DPS. However, given the overlapping distributions of varied *O. mykiss* life histories and potential for interbreeding, the Plan would be strengthened if the following questions were considered during future revisions.

- What would be the consequences to the delisting criteria and the recovery prognosis if
    - Males exhibiting varied life history forms spawned across the entire DPS?
    - Some MPGs had intermixing of the two life history forms, while other MPGs did not?
    - Different life history forms do not respond independently to hydrologic, habitat, hatchery, and harvest issues in the Mid-Columbia DPS?
- In the absence of such knowledge, is it more biologically defensible to split or to combine resident and anadromous life histories for management purposes?
- Would the management actions taken by ODFW be any different if they were directed towards simultaneous management of resident and anadromous fish, versus only anadromous runs?

If ODFW believes that the DPS would be at lower risk if resident and anadromous fish do actually interbreed but recovery criteria assume that resident and anadromous fish do not interbreed, then addressing the issue of potential interbreeding within the Plan should be straightforward.

<u>*Independent Population, MPG, and DPS Boundaries*</u>: Another fundamental assumption underlying the Plan is that independent populations ascribed to the Mid-Columbia DPS are correctly identified. There is compelling support for this assumption, but it is an assumption nonetheless. Hypothetically, what would the consequences to recovery be if there were actually fewer MPGs or more MPGs, fewer populations in an MPG, or more populations in an MPG? In other words, how would a different population structure affect the nature and outcome of current status assessments and recovery planning for the DPS?

The genetic and demographic tools used to determine population-level boundaries are constantly changing and taxonomic classifications are frequently revised as new

techniques become available. For example, it was not long ago that 'steelhead trout', a taxon for which there is a rather well-established definition, were reassigned to an entirely different genus (i.e., moved from *Salmo* to *Oncorhynchus*). Limited resources and insufficient information hamper determination of clear boundaries between levels of organization such as MPGs and populations or the nature of interactions among these operational units. In such cases, classifications really depend on fundamental philosophical considerations, i.e., is one a splitter or a lumper? Taxonomic misclassifications have led to undesired consequences for ESA-listed taxa. Misclassification of the few existing populations of greenback cutthroat trout (*O. clarki stomias*) as hybrids greatly increased the subspecies' risk of extinction. This subspecies was listed as 'endangered' and subsequent protection improved the population status so that it could be downgraded to 'threatened'. Later, and on the basis of the most recent genetic data, the subspecies was erroneously classified as a hybrid which resulted in delisting. Removal of protective measures led to a severe downturn in population status. A subsequent court ruling found that the original classification had been correct and the extant populations of greenback cutthroat trout again have legal standing (Behnke 2007).

With regard to the Mid-Columbia Steelhead DPS, it is difficult to evaluate the scientific analysis used to delineate the population structure adopted by ODFW from information provided in the Plan. Section 4 of the Plan summarizes the findings from an ICTRT (2003) draft report on the data and analyses used to determine Mid-Columbia Steelhead population boundaries. The draft document (ICTRT 2003) was reviewed by the Independent Scientific Advisory Board (ISAB 2003) but IMST was unable to determine whether comments provided by ISAB were reconciled prior to ODFW adopting the population structure for the Plan considered in this IMST review. Relevant comments summarized from ISAB (2003) include:

- That decisions about what constitutes an independent population have a large subjective component based on a process not well described in the ICTRT (2003) draft document.
- That the ICTRT (2003) draft report does not contain an explicit explanation of how analyses were interpreted to make decisions about population structure. In other words, they did not provide a set of decision rules that would allow for consistency in data interpretation within the Mid-Columbia and across all recovery domains.
- The ICTRT (2003) report provided little or no explanation on how data of different quality were weighted during the decision making process.
- That information on fish migration among populations is scant making it difficult to determine geographic distances that typically separate independent populations. Given the quality of dispersal data available, the small distances used to identify population boundaries were questionable and a range of dispersal distances should be considered when setting population boundaries.

IMST considers the MPG viability criteria (ICTRT 2005; Figure 5-4) to be based on sound biological and conservation principles. However, population-level viability assessments form the basis for evaluating both MPGs and DPS viability. Therefore, any error in delineating population boundaries could affect MPG and DPS-level viability

assessments. For example, given the small number and sizes of some MPGs, one misclassification resulting in ranking one population as highly viable (e.g., Figure 5-4, pg. 5-14) instead of two populations as viable could change the MPG or DPS viability determination. Addition of a table or other descriptive summary of the data types and decision criteria used to determine the adopted population structure (for each population) would further clarify the scientific underpinnings of the Plan. The Plan would also be strengthened if some of the following questions were considered during future revisions.

- What confidence does ODFW have that the population structure defined in the Plan will facilitate recovery of the DPS?
- How might low confidence in some of the population boundary determinations affect current status and viability assessments at the MPG and DPS levels?
- Are there alternative population structures with strong biological support? If so, how would the ability to meet viability goals of MPGs and the DPS change under these alternate structures?
- Is there any way to incorporate measures of confidence in independent population boundaries, current status, and viability assessments at the MPG level?

ODFW could address issues related to taxonomic classification by playing some 'what if' games and determining how results affect the probability of recovery. For example, if the Hood River population of steelhead was considered part of the Mid-Columbia DPS, then the risk status of the DPS would likely be lower than with the current structure of the DPS. Hence, erring in this direction would not affect the recovery actions or criteria.

Steelhead populations in the Hood River are geographically proximate to the Mid-Columbia DPS and consist of summer steelhead, a life history found more frequently among eastside than west-side steelhead populations. What confidence does ODFW have in the determination that the Hood River is isolated from the Mid-Columbia DPS? How would current status and viability assessments presented in the Plan change if Hood River populations were included in the Mid-Columbia DPS?

Cooperation with the State of Washington

Recovery of a DPS or Evolutionary Significant Unit (ESU) under the ESA often requires measures implemented in different states and delisting of the Mid-Columbia Steelhead DPS requires measures in both Oregon and Washington. The IMST recognizes that ODFW is only responsible for those MPGs that reside in Oregon. However, the Team's ability to evaluate the strength of the case that Oregon's Plan will lead to recovery of the DPS would be enhanced if the Plan included some discussion of the consequences of Washington failing to adequately implement its recovery plan or of Washington producing an inadequate recovery plan. It would be informative if the discussion of such consequences pertained to both the Oregon portion of the DPS, and delisting of the entire DPS. With regard to the Mid-Columbia Steelhead DPS, IMST recognizes that NMFS is engaged in developing a 'roll up' process that addresses these inter-state recovery issues.

A short section summarizing these efforts would increase transparency of this process as it relates recovery across the entire Mid-Columbia DPS. Additional questions that ODFW might consider during future revisions to the Plan include:

- Are the MPGs in Oregon sufficient to allow for recovery of the DPS if all MPGs in Washington go extinct (or vice versa)?
- Could DPS-level recovery be achieved if, for example, 50% of the MPGs in each state went extinct?
- From a scientific perspective, what is the bare minimum number of MPGs needed across the entire range of the DPS to achieve recovery of the DPS?

Broad Sense Recovery Goals and Objectives

The Plan would be more transparent if the broad sense recovery goals and recovery objectives (e.g., pgs. 1-12 & 1-13) were more explicit. For example, what criteria will be used to determine when Mid-Columbia Steelhead populations have reached a point where they are capable of contributing ecological, social, cultural, and economic benefits? How will the capability of populations to provide these benefits be determined and quantified? How does the objective that the National Oceanic and Atmospheric Administration (NOAA) will '*define a suite of additional land and water resource management principles and practices that when followed will alleviate liability for possible ESA regulatory consequences to landowners and resource managers*'(pg. 1-13) relate to Oregon's NFCP and the Oregon Plan for Salmon and Watersheds?

If ODFW has not yet gone through the process of defining the broad sense recovery goals, it would be useful to include a short discussion of the future process that will be used for this purpose and the timeline for implementation.

Presentation of Uncertainty

The Plan as written leaves the impression that ODFW is exceptionally confident in conclusions derived from expert opinion, various data analyses, and modeling efforts. This leaves the reader with an overly-optimistic impression that proposed management actions will be funded, implemented, monitored, and will result in achieving desired status for the DPS. However, the IMST believes that there are numerous uncertainties, of various degrees, associated with the contentions presented in the Plan. These uncertainties may be statistical in nature (e.g., quantitatively determined 95% confidence bounds around an estimate of current abundance or productivity) or may simply reflect the intellectual confidence ODFW has in parameter values determined by expert opinion or population-level modeling efforts. Such uncertainty is an inherent component of the risk that a population, MPG, or DPS might decline to extinction despite management efforts. Consequently, suspected limiting factors and proposed management actions should be treated as testable hypotheses and presented as such. Quantitative assessments (where possible) or explicit descriptions of confidence relevant to major analyses would strengthen the scientific rigor of the Plan. This would include consideration of uncertainty relevant to current status, desired status, limiting factors, probabilities of

various management actions being carried out, the biological response to the management actions, and the fundamental knowledge about the biology of *O. mykiss* populations in the DPS. It is possible these uncertainties have been addressed in supporting references used to develop the Plan that IMST has not had the opportunity to review. From the standpoint of scientific credibility, the Plan would be greatly enhanced if relevant summaries of how uncertainty was treated were included within the Plan as well.

An excellent example of rigorous assessment and presentation of uncertainty already in the Plan is the presentation of abundance and productivity estimates in the current status assessment (Section 6). The Plan also addresses uncertainty associated with implementation of prioritized management actions, ocean conditions, and biological response time (Section 10). These treatments of uncertainty provide good models for how ODFW might address uncertainty throughout the entire document.

The inclusion of the 'Certainty of Outcome' for management actions (Tables 9.3.1–9.3.10) is also a good start, even if it is speculative. However, does this evaluation of certainty include the likelihood of funding? In other words, is the likelihood the action will occur factored into the certainty of outcome? For example, some of the actions that are highly dependent on private landowner action have a high certainty of outcome, yet in many places these tables list landowner reluctance, or need to increase participation, as an important factor.

Areas where additional quantitative analyses or explicit, qualitative descriptions of uncertainty would greatly strengthen the Plan include, but are not limited to:

- Limitations imposed by incomplete knowledge of *O. mykiss* population biology. For example, how long is a steelhead generation? Do calculated steelhead generation times account for the life history diversity potentially present in *O. mykiss* populations within the Mid-Columbia DPS? How would potential bias in generation time estimates affect viability assessments?
- Confidence that individual ranks (Table 5-4) that comprise structure and diversity viability criteria measure independent characteristics of populations.
- Confidence that individual ranks (Table 5-4) and cumulative structure and diversity assessments are correctly assigned to each population.
- Confidence in fundamental assumptions such as independent population boundaries or contributions of resident fish, and some description of how these assumptions affect estimates of the gap between actual abundance and productivity and predicted threshold abundance (Table 7-1). Examination of confidence in these variables might be particularly informative for populations where measured productivities are well above the minimum required for viability but estimated abundances are very low (e.g., upper mainstem of the John Day, Walla Walla, South Fork John Day, Middle Fork John Day, lower mainstem John Day, westside Deschutes).
- The likelihood that all critical factors limiting recovery have been identified.
- Confidence that anadromous steelhead populations can be established above the Pelton-Round Butte hydroelectric complex.

- Current understanding about the interactive relationships among threats, limiting factors, and population viability including estimates of the risk magnitude imposed by different threats or limiting factors (e.g., Table 8-1).
- How implementation timing of proposed management actions might affect the likelihood of reaching recovery goals. For example, if certain critical actions do not occur for many years, regardless of how they have been prioritized, then could recovery be achieved in a 25 or even a 100-year planning horizon by a Plan initiated in 2008?
- Confidence that the highest priority management actions will actually yield the greatest beneficial effect. What is the minimum number of management actions necessary to achieve recovery and how might different mixes of actions achieve the same recovery goals? IMST recognizes that the answer to this question is difficult, but consideration of the answer could help set priorities for recovery actions.
- Confidence in estimates of the direction and magnitude of management action effects, particularly related to modeling results presented in Section 10 of the Plan and how these results might be validated.
- Confidence that current land use, ocean conditions, and climate patterns will persist throughout the period over which the Plan is implemented.
- How limits on funding might hamper the feasibility of implementing actions critical to achieving recovery goals.

Multiplication of Errors

The Plan does not adequately address compounding or multiplication of uncertainties associated with inter-dependent factors. Using a hypothetical example, suppose that we are:

- 90% certain that the population structure defined in the Plan is correct,
- 90% certain that current status assessments are accurate,
- 90% certain that a proposed action (e.g., tributary habitat restoration) based on the above information will have the desired effect (e.g., increased productivity), and
- 90% certain that some prediction about recovery would happen if this proposed action were taken.

This scenario is based on high certainty about each factor. However, the overall certainty in the effect of the action on recovery would be 0.9 X 0.9 X 0.9 X 0.9, which equals 66%. In other words, one could conclude that there is a 1/3rd chance that doing this action would not reach the desired recovery target. This example is based on a very short string of factors each with uncertainty. The elements in the Plan are based on a comparatively large number of factors, each with some element of uncertainty.

Has ODFW considered modeling how compounding uncertainty might affect viability assessments at the population or MPG-level? Such an exercise with one or two recovery scenarios could be insightful, particularly if the scenarios selected were those where ODFW had the least confidence *a priori*. Failure to address compounding uncertainties could raise the question of whether or not recovery actions in the Plan are based on the best available science. This issue, as it relates to use of the precautionary approach under the ESA, is addressed in two National Research Council reports (1995; 2004). An additional example of such uncertainty analysis can be found in Currens & Busack (1995). IMST strongly urges that ODFW review these publications while considering revisions to the Mid-Columbia Steelhead Plan or development of any future recovery plans.

Interacting Variables

It is not readily apparent whether or how the potential for synergistic or antagonistic 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 (e.g., prolonged drought and increased fires limiting freshwater productivity coupled with a period of poor ocean conditions). Alternatively, interdependent effects could also result in highly favorable conditions for steelhead when the effects of multiple limiting factors are concurrently reduced. For example, an increase in flow could positively affect habitat quality directly but it could also increase access to habitats normally blocked by lower flow barriers. This issue is particularly relevant to the All-H Analysis (AHA) presented in Section 10 of the Plan. Because this analysis models the effects of sequential management actions that address several limiting factors, various actions are only assessed in combination with one specific set of additional variables, but not on their own (with the exception of tributary habitat actions) or in combination with all possible sets of actions. It is difficult to understand how such a sequential analysis would yield information about the effectiveness of individual actions or synergistic benefits derived from unique combinations of actions (e.g., tributary habitat and hydropower actions).

Recovery Criteria

IMST recognizes that ODFW requires numeric recovery goals. However, some discussion of the objectivity involved in derivation of threshold abundance and minimum productivity criteria would greatly strengthen the scientific credibility of the Plan. For example, why are the breaks in threshold abundance set at 500 and 1,000? Such round, even numbers suggest quite a bit of subjectivity rather than science. Why not 425 or 533, for example? Is there robust scientific information that supports the numeric break points used in the viability criteria recommended by the ICTRT (pg. 5-15)? What is the scientific basis for rating a population that has a 24.9% chance of extinction within 100 years as ‘maintained’ or ‘not a significant population sink’ (Figures 5-3; 5-4)? This type of pass/fail approach can result in equivalent viability determinations for populations that may be recovering at very different rates. For example, two populations with minimum threshold abundance ratings of 500 would both be considered viable if their abundances

were at 501 and 800, even though these abundance values likely have different implications for long-term population persistence. IMST believes that the rigor of viability assessments would be enhanced if trend analyses of abundance and productivity data were added. IMST recognizes the difficulties associated with trend analyses. However, the population, MPG and DPS trajectories in abundance and habitat quality would likely be more informative than threshold numbers.

The structure and diversity criteria appear to include metrics that are spatially dependent [e.g., number of Major Spawning Areas (MaSAs); quantity of habitat outside of MaSAs; change in occupancy across ecoregion types; Table 5-4]. How are these criteria adjusted for comparison across populations with different histories and that occupy different sized areas? For example, the lower John Day population covers considerably more area than Fifteenmile Creek. Reduction in variation (e.g., ecoregion occupancy) may be small if there was little to lose to begin with but this assessment does not mean the same thing in a large population that spans several ecoregions. Even if populations are not directly compared to each other, they are presumably evaluated against the same baseline. Should these criteria be weighted by how much diversity a population contained historically? If they are not, bias may be introduced when assessing the viability of populations where more or less diversity existed historically. Alternatively, specifying how baseline values used to assess metrics are determined for individual populations may clarify how issues related to spatial dependency have been considered when constructing these viability criteria. For example, are metrics that measure change in occupancy or variability judged against historical values or more contemporary information? Are metric ranks assessed using thresholds or trend analysis?

Models

The actual decisions reached from Ecosystem Diagnosis and Treatment (EDT) and AHA model results are not obvious in the Plan. If one takes the Plan literally, it appears as though the models are used to base decisions and major conclusions about the effectiveness of proposed actions and how they relate to recovery goals. As ODFW knows, both of these models have strengths and weaknesses (e.g., ISAB 2001 review of EDT and other models). The Plan would be well served by including:

- very explicit recognition that the scientific precision and accuracy of the models may not be very robust,
- a thorough explanation of the scientific shortcomings of the models so that readers can judge for themselves the faith that they would have in the output from the models.

For example, it would be useful to know how ODFW interprets model results when the system modeled does not function in a linear way yet the model structure is essentially linear. In the real world, different limiting factors often exhibit synergistic interactions (both positive and negative) under certain conditions while under other conditions there is no synergy. How are such dynamics handled in the EDT and AHA models or in the interpretation of model results? For example, can these models realistically analyze the consequences of very bad freshwater habitat conditions, happening at exactly the same

time as very bad ocean conditions for the duration of several generations? We are under the impression that ODFW ran various 'worst case scenarios' through the models, but this is not explicitly stated in the Plan. It would be useful if ODFW provided some scientific description or analysis of how interactions among the major variables modeled with EDT and AHA can result in negative or positive feedback and how such considerations influence ODFW interpretations of model results.

Demographic Futuring

An implicit assumption made throughout the Plan is that land use practices, laws, and ordinances will all be favorable to salmon in the future. Is this likely as Oregon grows by more than a million residents between 2000 and 2030 (US Census Bureau 2005)? On page 1-23 of the Plan the authors state that '*The Mid-C Expert Panel identified land use as having the most key concerns of any of the threat categories*' However, the Plan does not appear to address the eventuality that changing demographics of Oregon could affect the possibility of implementing the recovery actions. Data from the 2000 census indicate that population growth in Jefferson and Deschutes counties was 39% and 54%, respectively. Recreational use of these areas by the increasing populations of Bend, Madras, and Redmond will place increased pressure on the ecosystems inhabited by the Mid-Columbia DPS. This may be a significant issue given that recovery of every single MPG is crucial to meeting recovery criteria thresholds. Has there been any consideration given to the possibility that human population growth associated with the mid- to upper Deschutes basin could affect water availability or the timing of when water might be in the rivers and the potential consequences to steelhead? Similarly, has there been any forecasting done to see if there are any trends associated with agriculture in the land associated with this DPS? Does ODFW have any understanding of how changes in agricultural practices might affect groundwater availability, the timing when water withdrawals are made, the nature of chemicals put onto the landscape, and the amount of impervious surface and its location within a basin?

Climate Change

The Plan does not consider the consequences or effects of climate change or global warming. Given that the Plan uses a 25 and 100-year recovery period, a changing climate could have considerable effects on both water availability and temperature over these periods (ISAB 2007). Years such as 2001, when steelhead survival was estimated to be one-third that of 1998 (due to extreme low flows, high temperatures, and limited spill at BPA hydropower facilities) exemplify why incorporating some discussion of uncertainty related to climate change is critical if the Plan is to be based on best available science. Hypothetically, what would the consequences for recovery of the DPS be if there were 5-6 consecutive years with these sorts of conditions? Are any of the large or very large populations upon which delisting depends inhabiting lower elevation reaches (e.g., Lower Mainstem John Day; Umatilla) that are more likely to experience temperatures lethal or injurious to salmonids as warming trends continue?

The scientific rigor of the Plan would be strengthened if it included some analysis of how delisting criteria and assessment of recovery potential could be modified in the face of different potential climate change scenarios. For example, Flebbe *et al*. (2006) and Rieman *et al*. (2007) regressed current and predicted distributions of trout as a function of air temperature, latitude and longitude and found that over 90% of suitable and large habitat could be eliminated and increasingly fragmented with projected climate changes. If it were possible for ODFW to include different scenarios of climate change in their analyses, model results presented in section 10 might change. In the absence of modeling, the Plan could be revised to include some narrative regarding how climate change might alter the management plan. A summary that covered the 'best science' currently available would include: A relatively comprehensive review of literature on the likely effects of a changing climate on Northwest salmonids and watershed health, including a discussion of what is specifically relevant (or not and why) to the eastside Mid-Columbia DPS populations. Appropriate material might include, but is not limited to, recent reports by the ISAB (2007) and peer reviewed literature (e.g., Flebbe *et al*. 2006; Battin *et al*. 2007; Rieman *et al*. 2007) and the references cited therein. This need not be long but would be most useful if it provided evidence upon which to base a discussion of how the management effectiveness analysis (Section 10) might be influenced by climate scenarios other than 'current conditions'.

A discussion (possibly in Section 9) covering how actions might be prioritized or implemented differently (e.g., type, amount, location, timing, intensity) under a changing climate. A conceptual discussion on managing watershed and aquatic resources in the face of change would also be highly desirable. Recent papers by Millar *et al*. (2007) and Pressey *et al*. (2007) contain conceptual approaches that could be used as a foundation for such a discussion (e.g., resilience vs. response). In order to strengthen scientific credibility, it is important for ODFW to demonstrate a greater grasp of the broader environmental context that will likely influence the outcomes of its recovery plans.

Some of the discussion points suggested would, by necessity, be speculative, and would be couched as such. However, IMST believes that there is sufficient information from which to construct a narrative 'futuring' analysis. While lacking analytical rigor, such a discussion would highlight potential variation (and likely sources thereof) around projected outcomes and would greatly aid interpretation of monitoring data.

Adaptive Management Planning

An explicit description of how agencies responsible for the recovery of the Mid-Columbia Steelhead DPS intend to execute adaptive management is an important component of a recovery plan. It is difficult for the IMST to assess the strength of the case that a recovery plan will achieve stated objectives if the adaptive management plan is not present when the plan is reviewed. In general, the Plan's adaptive management approach assumes that if and when a situation arises where alternative actions may be required an appropriate 'plan-B' will be formulated. This assumption and approach represent weak points in ODFW's ability to make a strong case that the Plan will lead to recovery. An explicit adaptive management plan should include a description of how population trends will be tracked by an oversight entity. The large number of agencies

and interest groups responsible for implementation of actions and management of fish makes the provision for oversight and control an essential component of any recovery plan. The adaptive management plan should also specify the criteria that an oversight entity might use to determine when population trends have significantly diverged from desired status such that a new status assessment or suite of actions would be implemented. The Plan would be strengthened by the inclusion of an explicit description of how this type of oversight and evaluation process might be carried out for the Mid-Columbia Steelhead DPS.

Sufficiency of Monitoring

It appears highly unlikely that the monitoring actions described in Section 12 of the Plan will provide data sufficient to detect changes in population status in time to implement alternative (adaptive) management options if such alternatives become necessary. It appears that within any MPG, not all populations will be equally monitored and the viability status for some populations will be inferred using data from neighboring populations that are more intensively monitored. This impression is drawn from several statements made throughout Section 12.2 on monitoring of the John Day River MPG. The following are selected examples from the Plan:

- Pg. 12-3: *Not all populations are equally monitored but could be assessed inference through ongoing monitoring of neighboring populations or with expansion of ongoing efforts in the populations that have inadequate monitoring.*
- Pg. 12-5: *Redds are counted bi-weekly on 2-km reaches selected by using a four-year rotating panel design with 50 randomly selected reaches sampled per year in the John Day River MPG. Ideally, sampling using this design would also be conducted at the population scale which would require a separate sample draw and additional samples.*
- Pg. 12-6: *Population-level sampling has been conducted for the South Fork population during 2006 and 2007 and may be rotated annually to other populations. However, additional funding would be required to conduct population-level sampling for the larger populations (Lower Mainstem, North Fork) within the MPG.*

IMST believes this presents a significant limitation for assessment of current status, future viability, and habitat condition. If individual populations that by definition are demographically independent from their neighbors have not been monitored, how can one assess their status and subsequently the status of the MPG? The Ecosystem Monitoring and Assessment Protocol (EMAP) monitoring design specified for the John Day MPG may be sufficient to yield current status and trend estimates for the entire basin but it is difficult to reconcile how this strategy will yield the population-level information required to carry out the viability assessment strategy outlined in Section 5 of the Plan.

The scientific rigor of the Plan would be enhanced if Section 12 contained an explicit explanation supporting the assumption that the monitoring efforts specified are adequate to capture the variation in abundance, population growth, or recruit to spawner ratios typical of steelhead. Questions that might be considered during future revisions include:

- Are the EMAP sampling strategies (e.g., pg. 12-7; within the John Day MPG – *Fifty sites sampled annually using a three-panel rotating panel design. Panels include annual, every four years, and one-time visit selections*) sufficient to allow detection of changes in abundance, productivity, spatial structure of individual populations, habitat condition, phenotypic life history diversity, and habitat restoration effectiveness over a timeframe appropriate for adaptive management (i.e., in a timeframe short enough so that something can be done about it)? That is, what is the rationale for 50 sites in the basin, how many sites are proposed for each of the three panels, and will those numbers provide sufficient statistical power for the basin, let alone the five populations (each of which may require 20 to 50 sites)?
- Does ODFW have data to determine either the range of temporal or spatial variation or how well temporal or spatial variation needs to be sampled in order to adequately characterize trends in abundance, productivity, or habitat condition?
- Has ODFW estimated how long EMAP sampling will need to continue in order to adequately account for natural variation in trend analyses?
- How were specific periods (e.g., pg. 12-5; 10-year geometric mean, five-year trend in abundance, 20-year population growth rate) selected for different population monitoring questions?

Many of the monitoring objectives are so broadly stated that it is very difficult to assess whether or not they can be accomplished. For example, one of the objectives for the Umatilla River population (pg. 12-24) is as follows:

> ***Objective 8: Determine the effect of habitat degradation and habitat restoration activities on the abundance, productivity, and distribution of the natural-origin population.***
>
> *Timeline: Long term.*
>
> *Monitoring questions:*
>
> - *Status & Trend Monitoring—What is the current status and trend of steelhead habitat?*
> - *Implementation and Compliance Monitoring—Have the management actions been implemented in the prescribed manner and achieved the desired objectives?*
> - *Effectiveness Monitoring—Have the management actions significantly influenced steelhead viability and steelhead habitat conditions?*

This objective has an indefinite timeline and includes five different types of monitoring. The few paragraphs that follow the objective hint at how the approaches and analyses might be structured, but are too vague to assess whether the monitoring goals are appropriate. The revelation (throughout Section 12) that project effectiveness monitoring is not funded and that habitat monitoring is neither implemented nor funded is especially troubling. The Plan includes a number of objectives that will be difficult to accomplish because they lack focus, specificity and/or adequate funding for monitoring activities.

IMST recognizes that adequate monitoring is an expensive, long-term endeavor. However the monitoring strategy that ODFW has implemented for coastal coho salmon appears to be providing very useful information. That strategy offers a useful model for the Mid-Columbia Steelhead DPS. Moreover, if the monitoring is insufficient there is inadequate scientific or technical basis for future decision making.

Organization

Lengthy recovery plans could be organized numerous ways. The organization used in the Mid-Columbia Steelhead Plan makes sense from the perspective of highlighting the underlying science. From the perspective of local interests (e.g., landowners, watershed council members) however, this structure may present a barrier to participation. IMST is aware that ODFW appreciates that this format makes it more difficult to track any particular population or MPG through all sections of the Plan.

Tables 9.3.1 through 9.3.10 contain the largest amount of information related to uncertainty of recovery outcomes in the Plan. This information is critically important so clear presentation is highly desirable. Both table structure and constant references to appendices make it difficult to gain a clear sense of the certainty that important actions will be implemented, and if implemented that the list of actions will be sufficient for recovery and over what timeframe. For those working in individual watersheds, this structure may be sufficient. However, this structure makes it very difficult for anyone reviewing the Plan to determine the sufficiency of proposed actions. This type of information could be included in an influence diagram depicting steelhead life history stages, primary limiting factors and threats, the eight strategy categories and the limiting factors and threats they address, an overall ranking of the outcome certainty and sufficiency, and a timeframe over which the strategy will be implemented.

With respect to Section 12, the stylistic inconsistency among MPG sections is distracting, especially given the repetition of objectives and methods among MPGs and populations. For example, Critical Uncertainties were presented for some MPGs but not for others, the distinction between Critical Uncertainties and Objectives was not always clear across MPGs, and the apparent definition of Critical Uncertainties (e.g., number of spawners vs. functional relationships) seemed to differ across MPGs and populations. These inconsistencies are more distracting than the redundancies. A summary matrix table (e.g., objectives on lines and approaches in columns) for each basin would clarify issues.

Economic Analysis

ESA section 4(f)(1) requires that recovery plans include '*estimates of the time required and the cost to carry out those measures needed to achieve plan goals and to achieve intermediate steps towards those goals*'. Section 11 and Appendix I of the Mid-Columbia Steelhead Plan attempt to fulfill this requirement. Elements of the Plan that have been costed amount to roughly $513,000,000. The IMST notes, however, that many costs are classified as 'To be Determined' (TBD). Costs in this category include land acquisitions or easements, water rights purchases necessary to maintain instream flows, juniper removal, removal of fish passage barriers including dams, culverts, irrigation structures,

etc. Water right purchases, easements, juniper removal and engineering activities are regularly carried out in the Pacific Northwest and their approximate costs should be discoverable. IMST does not believe that the Plan as currently drafted contains sufficient information on all reasonable costs associated with proposed actions to allow scientifically defensible analysis of recovery action effectiveness for actions that will realistically be implemented in a reasonable timeframe.

Without cost and time estimates for TBD actions, it is impossible to calculate the Plan's total cost and time required to meet the Plan's objective, making it impossible to judge whether the proposed recovery actions are both technically feasible and economically feasible. Any recovery plan will be unsuccessful if the resources needed to carry out recovery actions are beyond the means of implementing agencies and/or the costs of complying with the plan are prohibitive for the private sector. The time and cost estimates are very sparse and appear short of the standard needed for economic impact or financial analysis. Are these financial analyses adequate for agency, state, and federal budgeting purposes?

The Independent Economic Analysis Board (IEAB 2003) describes the type of financial information required by the Pacific Northwest Electric Power Planning and Conservation Act to determine the cost-effectiveness of fish and wildlife mitigation and enhancement. Cost-effectiveness analysis is a way to assess how to get the biggest 'bang for the buck' and is appropriate for alternative actions that

- produce the same or similar type of output,
- have costs and output that can be measured or reasonably estimated, and
- have costs large enough to justify the additional analysis.

A number of actions that achieve progress towards a recovery objective are generally available, but not all actions need be or can be implemented. Recovery objectives may be reached with a subset of proposed actions, or a limited budget may preclude taking all feasible actions. Cost-effectiveness analysis may help the reader understand how the State would prioritize recovery alternatives.

Because adequacy of a recovery plan is contingent upon the certainty that it can be carried out, IMST believes that some discussion of financial feasibility should be an integral part of any recovery or conservation plan. This discussion should be of sufficient detail and completeness

- for state and federal agencies or stakeholders to conduct a cost-effectiveness analysis of the Plan's proposed recovery actions,
- to determine future resources required to carry-out proposed monitoring and recovery measures,
- to determine costs relevant to the formulation of an adaptive management 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.

Section 1:

- Pg. 1-13: With regard to the eight recovery objectives stated in the Executive summary:
    - What criteria will be used to determine when populations are '*capable of contributing ecological, social, cultural, and economic benefits on a regular and sustainable basis*'? How far is the entire DPS below target levels that would achieve the broad sense recovery goals?
    - How does Objective 5 '*Working in concert with existing agreements and collaboratively with landowners and resource managers NOAA will define a suite of additional land and water resource management principles and practices that when followed will alleviate liability for possible ESA regulatory consequences to landowners and resource managers*' relate to the Oregon Plan for Salmon and Watersheds?
- Pg. 1-17: What are the implications of assuming a metapopulation structure when assessing the DPS-level viability criterion?
- Pg. 1-17: What is the biological justification for requiring that one-half of populations in an MPG must meet viability standards and that one must be highly viable?
- Pg. 1-18: Will iteroparous adult or juvenile life history strategies be considered when determining whether all major life history strategies historically present in a MPG still exist? Is the historical frequency distribution of years spent in the ocean before maturity considered variation in life history worth maintaining?
- Pg. 1-18: IMST finds that the following statement is based on sound biological and conservation principles. *The combined effects of requiring each MPG to sustain a minimum number of viable populations, a representation of larger size classes of populations and major life history patterns, and the maintenance requirement provide for a network of populations that would sustain the DPS.* However, the strength of this approach depends on correct identification of independent population boundaries. Revisiting the validity of population boundaries as new information becomes available would be a useful component of an adaptive management plan.
- Pg. 1-18: In the last paragraph on this page, the Plan indicates that targeting only the minimum number of populations for recovery would likely result in failure to

recover the DPS. The intended goal to target more than the minimum number of populations for recovery actions is appropriate given the uncertainty that exists in any conservation endeavor of this magnitude. However, the MPG-level recovery scenarios presented do not clearly indicate which or how many additional populations will be targeted beyond those identified using ICTRT criteria; can these populations be identified?

- Pg. 1-23: It is difficult to understand why the Mid-Columbia Expert Panel identified land use as having the most key concerns of any of the threat categories when hydropower may affect a much larger fraction of the DPS (e.g., Table 8-1). If the scientific basis of this determination were better explained in the Plan, it would be easier to understand why management action effectiveness models and other aspects of the Plan appear disproportionately focused on tributary habitat actions.
- Pg. 1-31: In the section titled '*Building on Current Efforts*' the Plan states '*Spreading the responsibility among a range of parties lessens the cost to any one group, increases the certainty of success, and compounds the benefits of moderate improvements in each factor*'. This approach will require significant oversight to be successful. Description of this oversight as part of an adaptive management process would greatly enhance the reader's ability to determine the likelihood of success with such an approach.

Section 2:

- Pg. 2-3: The paragraph below seems to indicate that the steelhead population boundaries determined by the NFCP are different from those in the Plan. Was the NFCP population structure considered for use by this Plan? If so, why was it rejected? What are the potential consequences of this incongruence for the recovery of populations under either structure? *Status assessments conducted under the NFCP resemble assessments for ESA recovery in that they focus on groups of populations from a common geographic area with similar genetic and life history traits called Species Management Units (SMUs). Oregon, however, believes there are ecological and adaptive differences between summer and winter forms of steelhead (as well as spring and fall Chinook) and separates them into different SMUs. Populations delineated within Oregon's Mid Columbia summer steelhead SMU are similar to those defined for the Cascade Eastern Slope Tributaries MPG, except that the Deschutes Eastside and Westside populations are combined into a single population and the Fifteenmile Creek winter steelhead population is included in the Lower Columbia winter steelhead SMU. Oregon currently considers both SMUs as "At Risk".*

Section 3:

- Subsections 3.3 and 3.4: IMST is aware that the decision to delineate steelhead-only DPSs was made by NMFS. However, the scientific rigor of the Plan would be strengthened if Section 3 of the Plan included discussion of the implications of

this decision for both steelhead delisting and ODFW's perspective toward managing resident *O. mykiss* populations where listed anadromous steelhead populations are present. This might include a table summarizing the life history variants present in each Mid-Columbia population and nature and timing of potential interactions among life history variants.

Section 4:

- Pg. 4-1: What confidence does ODFW have that populations ascribed to the Mid-Columbia Steelhead DPS represent independent demographic units? Research by Issak *et al*. (2003) has shown that demographic synchrony among Chinook salmon populations can change as population sizes fluctuate. What confidence does ODFW have that the data used to determine Mid-Columbia populations accurately represent historical patterns of population synchrony?
- Pg. 4-1: How confident is ODFW that the data used to determine MPG boundaries reflect processes that drive differentiation among steelhead populations? What are the odds of misclassification at the MPG level of DPS organization? How do they compare to the odds of misclassification at the population level? What are the implications of misclassification at either of these levels for delisting of the DPS?
- Pg. 4-1: What is the current understanding about the role of natural (wild) strays in maintaining genetic variation within independent populations?
- Pg. 4-2: Is the ICTRT (2003) draft document the most recent information on Mid-Columbia Steelhead population structure? Where are the data and analyses that were used to define Mid-Columbia populations published or presented in detail sufficient to allow an independent review of the analysis? To what extent were the different types of information (genetic, straying distances, abundance correlations, habitat characteristics, etc.) available at different taxonomic levels identified within the DPS? How was the information from each data source weighted or interpreted? Were the results of determining the DPS population and MPG structure clean cut or were there areas of uncertainty? The Plan indicates (pg. 4-7) that the upper boundary of the Lower Mainstem John Day River is in question, are there other areas where population boundaries are uncertain?
- Pg. 4-8: The following paragraph indicates that genetic data from resident *O. mykiss* were used to determine population boundaries for anadromous steelhead. Is this truly the case? If so, to what extent were genetic data from resident fish used to determine population boundaries in other areas of the DPS? What is the biological justification for using data from a life history variant not included in the ESA listing to determine population structure within a DPS? *South Fork John Day River: This population occupies the South Fork John Day River drainage. Genetic data from South Fork John Day River* O. mykiss *samples, which may include the anadromous form, indicate that the population is differentiated from those in other parts of the John Day (Currens et al. 1985). The independent population was defined based on genetic information and basin topography.*

Section 5:

- Pg. 5-3 (also see pg. 1-14): The abundance viability criterion is defined as the average number of spawners in a population over a generation or more. Given *O. mykiss* life history variability, how long is a steelhead generation? Could this population parameter be variable across populations or MPGs? If so, would using the same estimate across all populations introduce a source of bias in estimates used to determine viability?
- Pg. 5-3: In subsection 5.1.2, the Plan reiterates the following guidelines for maintaining population level viability
    - *have high probability of surviving environmental variation observed in the past and expected in the future;*
    - *be resilient to environmental and anthropogenic disturbances;*
    - *maintain genetic diversity; and,*
    - *support/provide ecosystem functions.*

  While specific population-level criteria (abundance, productivity, spatial structure and diversity) are rigorous, benchmarks set for these criteria by the ICTRT against which population viability will be judged assume '*recent historical patterns of environmental variability*'. It is difficult to understand how the first two guidelines can be followed when the Plan does not address future changes to climate or human population size in Oregon. At least two (Lower Main John Day, and Umatilla) very large or large populations upon which MPG and DPS viability assessments depend are in lower elevation reaches that may be vulnerable to warmer temperatures and/or development.
- Pg. 5-5: What is the biological justification for selection of 1%, 5%, and 25% as extinction risk thresholds? Pg. 5-8: How was a 95% probability of persistence over 100 years selected as appropriate for use in viability assessments?
- Pg. 5-5: Have any of the Geographic Information System (GIS) data used to calculate intrinsic spawning habitat potential or results from these analyses been validated? What level of error is associated with these analyses?
- Pg. 5-6: How was expert opinion used to identify natural barriers (i.e., what criteria were used to determine blocked passage)?
- Pg. 5-6: What is the biological justification for setting thresholds of 50 or 500 spawners in the definition of a spawning branch and major spawning areas (MaSAs)? Did ODFW accept these ICTRT thresholds or reach the same conclusion after independent analysis?
- Table 5-2: Does the Plan consider uncertainty in population spatial processes related to the structure and diversity guidelines? Also, the term '*substantially*' is used in several guidelines, what amount does this imply?
- Table 5-4: It is difficult to tell whether spatial dependency has been fully accounted for in all spatial structure and diversity parameters (i.e., number of life

history strategies, genetic and phenotypic variation, use of major habitat types). In order for the ranks (i.e., very low – high) to mean the same thing in every population, the level of diversity present historically should be accounted for when determining the baseline against which measurements are compared.

- Table 5-4: What is a natural spawner that is an unnatural out of ESU/MPG spawner? How are these fish identified? How well understood is the rate of among ESU/MPG dispersal of natural (wild?) fish? Without such information, how can one determine if a fish spawning in the ESU is there '*unnaturally*'?
- Pg. 5-13: What is the biological justification for determining that a population with a 24.9% chance of extinction is maintained?
- Pg. 5-13: It would be useful if ODFW modeled uncertainty in MPG viability assessments derived from multiplicative errors that arise when assessing viability of individual populations.
- Pgs. 5-13 & 14: Is the assumption stated below valid given the potential for climate or land use change in the DPS? *In developing these criteria, the ICTRT assumed that catastrophes do not increase dramatically in frequency, that populations are not lost permanently (due to catastrophe or anthropogenic impacts) and that permanent reductions in productivity, including long-term, gradual reductions in productivity do not occur (ICTRT 2005).*
- Pg. 5-15: What is the biological justification supporting the numeric thresholds used in MPG-level viability criteria outlined by the ICTRT and adopted in the Plan? As with population-level viability assessments, these criteria would be strengthened by inclusion of trend analyses conducted at the MPG level.
- Pg. 5-17 (Figure 5-5): How is '*proper functioning*' of the DPS to be determined? This implies some processes will be restored if viability targets are met within populations. How will the restoration of processes be determined after all management actions are taken to restore patterns?
- Pg. 5-18: The Plan states that meeting the broad-sense recovery goals '*will require actions that preserve, enhance, and restore healthy watershed conditions where ecosystem functions, processes, and dynamics are intact (including instream conditions, riparian habitat diversity and complexity, and upland watershed health)*. Does this statement have implications for prioritization of management actions among watersheds? How are ecosystems with '*intact functions, processes, and dynamics*' identified?

Section 6:

- Throughout Section 6, confidence intervals (CI) used to determine current status are reported inconsistently, i.e., 99% and 95% for some and what appears to be only 95% for others. Can ODFW explain the reason for this inconsistency? Only Figures 6-1 and 6-2 show both CI types in the legend making it difficult to determine what type of CI is shown in subsequent figures.

- Pg. 6-1: A more complete explanation of how abundance and productivity values were calculated from existing data would strengthen Section 6. Appendix B shows that reduced data sets were selected for analyses. Discussion of the criteria used to select data for analyses and the implications of these criteria for current status and associated estimates of statistical uncertainty are sufficiently important to warrant inclusion here.
- Pg. 6-2: The current abundance estimate for Fifteenmile Creek is not above the minimum of 500 by very much. This is an example where an accompanying trend analysis would greatly strengthen current status estimates.
- Pg. 6-7: How will historical genetic variation be determined?

Section 7:

- Pg. 7-1: The section under the title '*Gaps Approach*' would be greatly strengthened if it contained some discussion of the implications of future climate change for the gaps analyses.
- Section 7.2: The spatial structure and diversity gaps for several populations seem to have significant overlap. For example, both the *Genetic variation* and *Spawner composition* metrics for the lower mainstem John Day appear to be ranked as moderate or high for reasons related to out-of-DPS strays. Does this effectively overweight (i.e., double count) this risk factor in lower mainstem John Day viability assessments? Similarly, the *Spatial Extent or Range of Population* and *Increase or decrease in gaps and continuity* are both ranked as moderate in the Umatilla River population due to loss of occupancy in Butter and McKay creeks. Explicit explanations describing how these rankings were determined might reduce the appearance of redundancy in these measures.

Section 8:

- Many of the statistical analyses presented in Section 8 either lack statistical rigor or are graphed such that interpretation or comparisons are difficult (e.g., Figures 8-6 to 8-10). The proper reporting of means (i.e., reporting some measure of variation such as the standard deviation (SD), standard error, or 95% CI) is also inconsistent throughout this section. The section would benefit tremendously from a review (including reanalysis of several data sets which are identified in additional comments below) by an experienced biological statistician. Please refer to related comments and recommendations made by IMST as part of its review of the Rogue Spring Chinook Conservation Plan (IMST 2007).
- Is there any quantification of the severity of individual primary limiting factors and threats at the population level (e.g., pg. 8-5 for Fifteenmile Creek)? The content of Section 8 would be clarified by inclusion of one or more influence diagrams depicting the relationships among threats and population viability, the strength of the threats, and uncertainty about threat strength. One figure per population would provide an effective summary tool.

- Pg. 8-2: What is the evidence that sufficient water is available to improve modified and reduced stream flows resulting from past and present land use? Have all water rights within the Mid-Columbia DPS boundary been adjudicated? Are there more water rights than there is water? How many legal and illegal head dams are there?
- Table 8-1: This table contains valuable information that might be reported more clearly.
    - For some factors, value ranges are reported, but can CIs or standard deviations around mean values also be reported? How were values used to construct ranges reported originally? Are these means from various studies or years? What confidence does ODFW have that these values are accurate?
    - Do the reported reductions apply to fish entering the Mid-Columbia region or to those in tributaries and the ocean as well?
    - How were latent estimates for hydropower mortality estimated? With such large ranges (e.g., 5-29% for fish that pass four dams) it would be very useful to see a mean with a 95% CI. What confidence does ODFW have that these estimates are accurate? Why aren't the latent mortality estimates presented here greater than direct hydropower mortality as mentioned on page 8-85?
    - Is barging of steelhead an option? Is survival of barged steelhead greater than that of fish that pass through the hydropower system? The relatively recent NMFS review of barging advantages (Williams *et al.* 2005) is primarily focused on Snake River fish and is more complete for Chinook salmon than steelhead. However, if responses of fish originating in the Mid-Columbia DPS are comparable, is it possible that barging could increase survival of steelhead collected at McNary Dam during low flow years?
- Pg. 8-9: What confidence does ODFW have that all factors limiting Mid-Columbia Steelhead populations have been identified? For example, recent PIT tag data suggest that > 50% of John Day adult steelhead do not find the river on the first upstream migration, and some never home back to the John Day. This seems like a considerable problem, which may not have received adequate attention in Section 8 of the Plan.
- Pg. 8-14: The paragraph beginning '*Conditions in these tributary drainages*' gives the impression that actions required to improve tributary habitat are already in place, have changes in land owner attitudes and practices or the success of regulatory programs been quantified in the Mid-Columbia DPS? If so, how and was the information included in action effectiveness models presented in Section 10?
- Pg 8-18: With regard to the paragraph beginning '*Habitat conditions in the Fifteenmile Creek watershed*, how were habitat condition improvements in

Fifteenmile Creek quantified? Is there any evidence that fish metrics have responded to improved habitat?

- Table 8-12: Were protection and restoration-benefit ranks derived from EDT analyses? If so, this is not clear from reading the table title or the text preceding the table. An explicit explanation of how EDT results were used to prioritize actions and the confidence in these results would strengthen this section.
- Pg. 8-71: The discussion presented in Section 8.3.1 would be strengthened by acknowledging that steelhead are iteroparous and that restricting downstream passage considerations to juveniles neglects a component of their life history diversity of unknown importance that may have been lost in many populations (e.g., Narum *et al.* 2008).
- Pg. 8-73: With regard to hydrosystem actions currently implemented under the 2004 Biological Opinion (BiOp) and Updated Proposal Action (UPA).
    - What is the evidence that removal spillway weirs improve juvenile survival?
    - Are spill and flow augmentation actions adequate to improve salmonid survival?
    - How do fish transportation modifications affect the Mid-Columbia Steelhead DPS?
- Figures 8-3 to 8-5: The statistical rigor with which these data are presented is weak and could lead to biased interpretation. All analyses contain a single point that clearly has a large influence on regression line slopes and y-intercepts. Proper presentation of these data would include influence statistics (e.g., leverage) as well as alternate analyses including and excluding any data points that exert significant influence (see Ramsey & Schafer 2002). As presented, these analyses are not very convincing.
- Table 8-44: The results presented in this table would be more convincing if the analyses were presented graphically so that the reader could determine if Pearson's correlation is an appropriate analysis. P-values should also accompany correlation statistics.
- Pg. 8-90: The discussion of changes to the Pelton-Round Butte hydroelectric complex would be strengthened if it addressed the likelihood that new facilities will be successful in passing either juvenile or adult steelhead.
- Pg. 8-100: How was the uncertainty associated with unknown steelhead bycatch rates in unmonitored fisheries and hooking mortality (e.g., pg. 8-108) considered when calculating harvest impacts?
- Pg. 8-110: The section titled '*Trout Harvest Management*' would be strengthened if it contained some discussion of how confident ODFW is that wild fish will recover rapidly enough to sustain a fishery that will compensate for reduced hatchery releases.

- Figure 8-17: It is not clear that three data points warrant a separate regression line. Is this a data set with two trends or simply two influential points (e.g., 1993 and 2000)? What is the biological explanation for these influential points? What are the alternative and more parsimonious explanations for these data? Proper analysis of this data set would include calculation of influence statistics (see above) and repeating the analysis with and without any significantly influential points.
- Pg. 8-118: Recent genetic studies (Araki *et al.* 2007) have documented rapid and significant reductions in reproductive capabilities of captive reared fish subsequently released to breed in the wild. What confidence does ODFW have that the use of Round Butte hatchery stock to establish steelhead populations above the Pelton-Round Butte Complex will not simply place more hatchery phenotypes in the system to spawn with wild fish below the complex? Some discussion on this point would greatly strengthen parts of the Plan that cover the Pelton-Round Butte reintroduction project.
- Pg. 8-139: It is difficult to understand why a discussion of steelhead interactions with the resident form of *O. mykiss* is included in a section titled '*Competition with Other Species*'. The context for discussing resident fish as a limiting factor or threat would be clarified if a more detailed summary of interactions among *O. mykiss* life history variants that occur in the Mid-Columbia region were included under current status descriptions (Section 6).

Section 9:

- This section contains specific information that is helpful in understanding when and where intended actions will be taken. However, the case that the Plan will lead to recovery of the Mid-Columbia Steelhead DPS would be better supported if, in addition to describing the intended actions and the rationale for their selection, this section also included some discussion of the evidence and likelihood that actions will:
    - occur as envisioned;
    - have the intended effect, particularly under a scenario of climate change.
- Pg. 9-2: In the first full paragraph, the description of how the Plan will interface with actions taken by local watershed councils, and state and federal agencies is not clear. This paragraph reads as if the Plan is operating at a spatial scale broader than the watershed and that there is implicit trust that all entities operating within watersheds will follow the framework laid out in this Plan. What confidence does ODFW have that other entities will follow this Plan and what are the implications of any uncertainty for the likelihood that the Plan will result in recovery of the DPS?
- Pg. 9-2: The six key principles outlined from Meffe & Carrol (2002) represent a systematic approach to conservation of the Mid-Columbia DPS. However, this approach appears to be based on the assumption that threats to the DPS are either

static or contracting. Consequently, this approach may not sufficiently address future potential threats like those posed by climate or land use change. For example, how certain is ODFW that habitat conditions can be prevented from degrading further or that critical ecological processes can be maintained over the Plan's implementation period? IMST believes that recognizing and addressing limiting factors and threats that stem from past and contemporary sources is critical, but equally important is anticipating the nature and magnitude of future threats (see Pressey *et al.* 2007 for additional discussion). Section 9 would benefit from additional discussion of climate and land use change as discussed in the '*Overarching Issues*' section of this review.

- Pg. 9-2 and 9-3: Is there any evidence that the highest priority actions selected using the outlined prioritization guidelines would actually produce the greatest beneficial effect? What is the scientific basis for this prioritization scheme?
- Pg. 9-4: The assumptions listed in the paragraph beginning '*Recovery of the Mid-C steelhead DPS is predicated on assumptions*' are key to the scientific argument that the Plan will lead to recovery, yet there is little discussion or evidence presented about whether these assumptions are valid. The transparency of the Plan would be enhanced if uncertainties surrounding these assumptions and their implications for recovery of the DPS were addressed more explicitly.
- Table 9-1: The integrated nature of the list of actions presented in this table isn't entirely clear. What seems to be missing is a description of how actions will be prioritized or integrated using the strategic guidelines outlined earlier in Section 9. Addition of some explicit examples might make the presentation of this information more clear. The table contains a confusing mix of very explicit and very general descriptors for a broad range of actions that would be implemented over a variety of temporal and spatial scales. For example, the actions associated with '*operating the FCRPS to more closely approximate the shape of the natural hydrograph*' are specific, while actions listed to '*implement restoration of degraded upland processes or to improve degraded water quality*' are very general. Other questions regarding the information in this table include:
    - Under tributary habitat: What is the evidence that Best Management Practices and existing laws will be sufficient to protect ecological processes that support population viability?
    - Under Estuarine and Plume Habitat: Can a biologically significant percentage of estuary area actually be restored via these actions?
    - Under Hydropower System: What if attempts to meet seasonal and weekly flow objectives in the lower Columbia during July and August fail a couple of times? What if flows during the lowest 20^{th} percentile years are dramatically reduced by climate change?
    - Under Harvest: How can expanding creel surveys improve the quality of harvest and natural origin fish in the John Day subbasin?

    - Under Hatcheries: Why is the reduction of interactions between residual hatchery steelhead and natural steelhead in the Umatilla subbasin listed as a strategy if there are no consensus actions to be taken?

- Pg. 9-7: With upcoming and ongoing federal forest plan revisions what is the likelihood that the Pacific Anadromous Fish Strategy (PACFISH) and federal forest plan protections will continue as currently envisioned?
- Pg. 9-7: What is the evidence that past and current efforts have already improved population viability and habitat conditions in the Mid-Columbia?
- Pg. 9-8: What confidence does ODFW have that the strategies and actions proposed in Section 9 will protect and improve ecosystem function in the Mid-Columbia DPS? The following sentence might be tempered with a statement that reflects this uncertainty. *The suites of strategies and actions proposed in this section will protect and improve ecosystem functions and restore normative ecological processes to levels that support recovery of Oregon's Mid-C steelhead populations.*
- Pg. 9-9: To what extent does achievement of the Plan's goals depend on '*local groups using individual population action tables for development of specific implementation plans*' and what happens if this does not occur?
- Pg. 9-179: How does the failure of parties to agree on the BiOp associated with hydropower actions affect the ability of this Plan to succeed? If possible, some discussion of this would address a significant area of uncertainty and increase transparency of the Plan.
- Pg. 9-179: How confident is ODFW that Federal Columbia River Power System (FCRPS) management actions will be successful in more closely approximating the shape of the natural hydrograph?
- Pg. 9-181: How long will it take to reintroduce steelhead populations to blocked habitats in the Deschutes and Crooked Rivers? Is the success of the Deschutes MPG dependent on these actions and are these actions likely to occur during the implementation time of the Plan? What is the likelihood that transfers of *M. cerebralis* or other pathogens to sites above the dams can be avoided?
- Pgs. 9-182 and 9-183: The management actions listed under '*Estuarine and Plume Habitat Strategies and Actions*' are excellent, but how certain is ODFW that these actions will be sufficient given major modification that have taken place in the Columbia River?
- Pg. 9-185 and 9-186: If there is no sounding board consensus on hatchery strategies and actions, then what is the timeline for these actions? The list of management actions is not clear with respect to what might be done to alleviate limiting factors and threats imposed by hatcheries. The first two are monitoring actions, the third is technologically infeasible at this point and the fourth seems to be in conflict with increased smolt transportation actions identified in the section on hydropower. What is the plan for addressing uncertainty imposed by lack of

sounding board consensus and technological difficulties that limit these management actions?

Section 10:

- Pg. 10-1: Have results from EDT or AHA models been validated? Has anyone ever validated these models and documented success with using them to recover an ESU, DPS, or population?
- Pg. 10-1: Did the previous versions of the EDT and AHA models undergo any type of validation or sensitivity testing? If so, is it assumed that the models will behave similarly after modifications were made for use with the Plan?
- Pg. 10-1: EDT assumes marine survival is density independent. This presents an element of uncertainty that would be useful to point out in the description of the model.
- Pg. 10-1: What is the biological justification for modeling only tributary habitat independent of all other major limiting factors and for always modeling this factor first in sequential AHA models? ODFW explained to IMST that the model outcomes would be similar, independent of the order in which they appear in the model. Mention of this with some explanation would be useful in the Plan.
- Pg. 10-2: Is the extensive reliance on the EDT model for subbasin planning in the Mid-Columbia DPS scientifically justified or out of necessity (i.e., because better quantitative options do not exist)? If the latter is true, confidence in the results of this model should be qualified as such.
- Pg. 10-2: According to the Plan, ODFW's application of the EDT and AHA modeling platforms assumes that each provides a useful assessment of how management actions can be expected to effect steelhead population performance relative to a '*baseline*' and avoids the question of how well EDT output represents actual performance levels. However, the estimates of relative change are reported as point estimates in tables and figures throughout Section 10 (e.g., pgs. 10-65 to 10-96 for the AHA models). This reporting precision gives the appearance of confidence in the accuracy of these models. It is difficult to determine how to interpret such point estimates without some measure of statistical uncertainty or a statistical method for determining whether point estimates differ from each other. According to a 2001 ISAB review, EDT is best used as a method for providing tentative answers to management questions that need quick answers and is designed to evaluate the effects of large-scale habitat management alternatives over large areas. The ISAB (2001) found that when comparing major management alternatives using EDT the relative rank of predictions, not the accuracy of predicted numerical values is the best use.

  In the Plan, EDT model results do not appear to be presented as relative ranks. The figures presented show relative change in abundance and productivity as compared to a '*baseline*' for individual populations. It is not entirely clear how this approach circumvents the issue of reporting actual performance levels for

populations. The Plan acknowledges that EDT and AHA models do not predict actual population performance levels well. If this is true, why should these models perform any better at calculating the relative change between a baseline and a set of modeled conditions? What are the assumptions about the accuracy of model structure inherent in this approach and are they realistic? What confidence is there that these parameters can be used to generate accurate relative predictions when the entire model cannot be used to estimate accurate population performance levels? Discussion of these points would greatly clarify the science underlying application of these models in recovery planning.

- Pg. 10-3: What is the scientific basis for choosing a 75-year gap between modeling endpoints? Given uncertainty related to climate and land use change over 100 years, statistical error associated with model results for the 25-year and 100-year model runs would likely be very different (i.e., more variable for 100-year runs). Can these differing levels of confidence be better addressed in the verbal presentation of model results? Is it quantitatively possible for the EDT or AHA models to run to extinction under any of the scenarios modeled, particularly the 100-year scenarios?
- Pg. 10-5: With EDT there may be a problem with fitting numerous model parameters to a much smaller number of fish count estimates. This means that no unique solution is likely. The model may be over-parameterized (meaning there is an excessive number of predictor variables compared to the response being predicted), and one can obtain reasonable fit with the wrong variable combination. The descriptions of the EDT and AHA modeling platforms give the impression that EDT is far more heavily parameterized than the AHA components. If this is true, how might differences in the level of model parameterization affect model results? Do these results really mean that mainstem actions are less effective than tributary habitat actions or simply insufficiently modeled? Because it is possible that consistent identification of tributary habitat as a major driver in recovery is the result of linking models with very different levels of parameterization, it would be useful to point out that other corroborating evidence exists to support the findings of the model.
- Pg. 10-6: What is the biological justification for comparing action effects to only baseline or current conditions? The utility of this method is unclear because baseline and current conditions represent a static view of relatively short periods that contain some very poor ocean years. How does (or can) this approach account for concepts of intrinsic potential, historical range of variability, or sustainability? Is the concept of a static baseline realistic for systems as dynamic as the relationships between anadromous salmonids and their environments or might this be more effectively viewed as a range or some other parameter of variation?
- Pg. 10-6: With regard to the list of prospective actions for the mainstem Columbia River and estuary, what is the evidence that the effects of any of these actions can be quantified sufficiently for use in the AHA modeling platform?
- Pg. 10-6: How was the ordering of stepwise AHA model scenarios determined? Does it have anything to do with steelhead life history or primary threats? Since

the analysis is sequential, various actions are only assessed in combination with a set of other variables and not on their own (with the exception of tributary habitat actions) against baseline/current conditions. Were alternate sequences modeled and would model ordering affect the results? How does this approach to modeling address potential synergistic effects (positive or negative) among variables? For example, the benefits that might be gained from either hydropower modification or tributary habitat actions are probably interdependent at some level. Modeling order might matter if these types of interactions were accounted for in the model structure.

- Pg. 10-7: Were +/- 25% ocean conditions applied to all 25 or 100-year model runs as fixed conditions or were cyclical patterns of good and bad conditions modeled? How would either approach affect model results?
- Page 10-8: Although it can be teased out of the text, it would be helpful to state up front that '*effectiveness*' is couched in terms of the potential to return to pre-altered conditions, rather than to some other suite of goals. What are the consequences of using pre-altered conditions, as opposed to some other set of conditions, as the reference? While a strong argument can be (and needs to be) made for using pre-altered conditions, that approach does have some limitations, especially given the potentially changing climate.
- Table 10-2: For each reach, how are the effects of these actions input into the EDT model? What units are used? What is the statistical uncertainty or confidence (in the case of expert opinion) associated with each measurement and can it be modeled? What is the effect of multiplying errors associated with estimating each variable on the confidence in model outputs for a reach? What is the effect of multiplying errors associated with estimating numerous variables on the confidence in model outputs for a population where as many as 1,158 (John Day, pg. 10-11) are modeled simultaneously?
- Pg. 10-11 and 10-12: It would be useful to know what level of sensitivity testing was used to develop the scalars used in EDT and to what extent the various scalars influence the outcome for each subbasin or population. The utility of the modeling method would be increased if a discussion of scalar importance in determining management action effectiveness were presented. For example, are there tradeoffs between *Lag* or *Schedule* and *Intensity* or *Effect* that might identify weaknesses important to consider during formulation of an implementation plan?
- Pg. 10-14: How was the '*pre-altered state*', used to set EDT scalars, determined and what assumptions were made in the process?
- Pg. 10-14: What confidence does ODFW have in the scalar levels assigned during the EDT model parameterization? Was any sensitivity analysis considered with regard to setting these parameters? IMST recognizes the need for consistency in model parameterization, but how rigorous is this approach?
- Table 10-3 and similar scalar tables: Were the values in these tables validated in any way? How were the values in these tables derived and what were the biological justifications for the specific values selected? Is the metric used to

determine scalar values skewed so consequences of actions are always overestimated (e.g., a moderate effect for potential effectiveness equates to 1-0.38 or 68% no effect; a moderate effect for intensity is 85% no action)? The number of levels assigned to various scalars is not consistent (e.g., potential effectiveness has 5 levels; action intensity has 6 levels). What information is used to determine how finely a scalar is partitioned?

- Pg. 10-14: With regard to the following sentence, how confident is ODFW in this assumption and how well is it supported by biological information? What are the implications for these types of assumptions for the confidence in EDT results given that EDT cannot incorporate uncertainty ratings associated with scalar or any other input values? *Lacking some detailed planning information, we assigned an assumed level of intensity for each action, depending on action type and our understanding of how such actions have been implemented in the past.*
- Pg. 10-14: The area populated varies dramatically across populations. What are the biological consequences of assuming identical intensity scalar values for large or small populations that populate large or small geographic areas? An explicit set of hypotheses would strengthen the use of such an assumption.
- Pg. 10-14: What are the biological implications of assuming that all tributary habitat actions will be fully effective after 100 years? Is this realistic? What is the biological justification for this assumption?
- Pg. 10-15: Does the implementation schedule scalar account for interactions among management actions (i.e., reduce the potential effectiveness of an action if a complementary action is not implemented until much later)?
- Pg. 10-15: Was the sensitivity of the EDT model tested with respect to the attribute scalar for attributes that effect sediment, flow, and temperature? What is the biological justification for setting the attribute scalar to 0.75 for attributes that respond to watershed-scale conditions?
- Pg. 10-16: What are the assumptions made about the nature of fish responses to EDT scalars? Are they assumed to be linear or gradual? Are any assumed to have threshold responses? Calculation of the '*realized effectiveness*' represents another type of point estimate generated, in this situation, by expert opinion. How certain is ODFW that such estimates are precise (i.e., can they be repeated if ranks are set by a different panel of experts) or accurate (i.e., is there any quantitative data demonstrating the magnitude of change after restoration actions similar to the tributary habitat actions proposed here)?
- Pg. 10-18: What is the biological justification for assuming a 50% floor on fitness? Is this well supported by biological information on the effects of hatchery fish on wild populations? Without additional information on model parameters and assumptions it is difficult to evaluate this assumption.
- Pg. 10-19: What confidence does ODFW have that the BiOp survival improvement values will result in recovery? The confidence that can be placed in

model results would be clarified if an explicit statement on this issue were included.

- Pg. 10-19: Are there non-genetic effects of hatchery fish that were not modeled? If so, can these be listed so readers can gain a sense of that the model leaves out? If not, is ODFW certain that there are none?
- Figure 10-5: Bar graphs like this and others presented in Section 10 lead readers to compare the heights of individual bars to each other in an attempt to determine significant differences among treatment categories (e.g., 25-yr P1 vs P2; or 25-yr P1 vs. 100-yr P1). This is particularly likely when presentation of model results provide no clear discussion of
    - statistical uncertainty associated with quantitative data used to parameterize models,
    - confidence in expert opinions used to parameterize models,
    - aggregating error across reaches,
    - historical condition or range of variation.

  With no measure of how the results presented here might vary (e.g., standard deviation, 95% CI), it is impossible to determine if differences in bar heights are meaningful. IMST realizes that EDT is not designed to model this type of parameter uncertainty but as presented (i.e., without appropriate cautions about certainty) these figures can be misleading or create a false sense of security about the relationship between management actions and fish response.
- Pg. 10-30: Are the interactions among *O. mykiss* life history variants understood well enough to support the assumption that interactions among resident and anadromous fish would always act as constraints?
- Pg. 10-62: It is difficult to understand why tributary habitat actions emerged as a primary factor in almost all subbasins when Section 8 (limiting factors; Table 8-1) identifies mainstem dams as an important mortality source. The results presented in Section 10 would be more easily understood if this section contained an explicit discussion that addressed this discrepancy. For example, a comparison of threshold ratios across all subbasins (if possible), accompanied by summary comments at the end of Section 10 would be helpful.

Section 12:

- The uncertainties in Chapter 12 (conceptual models, research needs, monitoring priorities, objective specificity, available funding, etc.) make it very difficult to assess whether the Research, Monitoring, and Evaluation component of the Mid-Columbia Steelhead Recovery Plan is sufficient. It is particularly troublesome that most of the proposed monitoring (for model development, rehabilitation, effectiveness, status, trends) is unfunded. This will make it very difficult to determine the accuracy of current status estimates, let alone how status is changing. An assessment of what *must be monitored*, what would be *useful to*

know, and what *might be interesting* could prove helpful in establish monitoring priorities for each population, MPG, and the combined Mid-Columbia DPS. The addition of a table with populations as columns and questions, design, indicators, and funding as rows, would efficiently highlight commonalities and differences in how limiting factors in different populations and will be addressed. For example, how many research questions within each and across all basins are focused on understanding the ecology of hatchery fish versus wild fish? More importantly, how many of each type are currently funded or likely to receive funding?

- Section 12 emphasizes a decision framework conceptual model (e.g., Figure 12-1). Description of the model structure is difficult to understand from the provided description and may require that readers refer to the cited literature (http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/upload/Adaptive_Mngmnt.pdf) for clarification. In contrast, the EDT and AHA models (Figs. 10-1 and 10-2, pgs. 10-3 and 10-5) constitute a cause-and-effect conceptual model. Given that the two conceptual models have comparable components, they are compatible. The choice of conceptual model affects the approach to research, monitoring and evaluation. For example, with the decision framework, critical uncertainties are simply listed (e.g., Figure 12-1). As one moves through the Section 12, one encounters these lists along with various monitoring efforts, some involving research needs, some status monitoring, and some trend description. In some cases, it appears as if the terms *objectives* and *critical uncertainties* are intended to mean the same thing (i.e., used interchangeably). In contrast, with a cause-and-effect conceptual model, one first identifies gaps in knowledge that limit ability to predict ecosystem response. Having defined knowledge gaps about functional relationships among ecosystem components and/or processes, one can then design research and monitoring to address critical uncertainties. The transition between Sections 10 and 12 would be clarified if the type of model ODFW has adopted for research, monitoring and evaluation was more explicitly stated earlier in Section 12.

- Throughout Chapter 12, individual monitoring objectives address two or more types of monitoring. The predominant types, status monitoring and trend monitoring, are generally lumped as '*status and trends monitoring*' or '*long term monitoring*'. As a result, there is little description of how trend analyses are used to address why the status of an important parameter has or has not changed. In a few instances there appears to be an assumption that any positive trends ***must*** be the consequence of management actions, when in fact the two could be unrelated. Including multiple types of monitoring under a single objective makes it difficult to accomplish the objective and increases the chance of overlooking some aspect of data collection or analysis. A clearer distinction among monitoring types would enhance Chapter 12. Status monitoring efforts could be discussed separately from trend monitoring and analysis. Similarly, cause-and-effect monitoring could be partitioned into separate treatments of effectiveness monitoring and validation monitoring. Focusing specific monitoring goals under each objective decreases the chance that something will 'fall through the cracks'.

- The lack of stylistic consistency among MPG sections presents a negative distraction, especially given the repetition of objectives and methods among MPGs and populations (pg. 12-1). Critical uncertainties are presented for some MPGs but not for others, the distinction between critical uncertainties and objectives is not always clear, and the apparent definition of critical uncertainties (e.g., # spawners vs. functional relationships) seemed to differ across MPGs and populations. For example, there are a number of differences among and within the John Day MPG, Umatilla/Walla Walla MPG, and Cascades East MPG with respect to the way in which critical uncertainties are presented (or not), the relationship between critical uncertainties and objectives, and the detail with which specific objectives are presented and discussed. These inconsistencies were more distracting than were the redundancies.
- Objectives throughout Section 12 would be more clear if terms like '*long-term*' were defined and if the section included discussion of the evidence supporting the assumption that these time frames are sufficient to capture the variation in abundance, population growth, or recruit to spawner ratios.
- Pg. 12-6: If only known sites are sampled, how will ODFW be able to determine the locations of new spawning and rearing areas or when a population's distribution has expanded? Do juveniles populate areas where spawning has not occurred? How will this sampling design document the potential movement of juveniles among habitats? What are the implications of this sampling framework for assessing structure and diversity viability criteria?
- Pg. 12-20: In addition to EDT and AHA model revisions and updates, will the adaptive management program developed for the Mid-Columbia Steelhead DPS include a sensitivity analysis of these models aimed at determining limiting factors that have disproportionately large effects on population viability?
- Pg. 12-35 & 12-41: It is clear from the discussions on these pages that validation of EDT results is limited. If it is clear that significant uncertainty exists in how well existing data represent habitat and fish assemblage condition, of what utility are the EDT analyses presented in Section 10? The four data needs identified (pg. 12-35) would better represent ODFWs confidence in EDT results if they were also presented in Section 10. What are the potential consequences of using an unvalidated model to select the attributes identified as primary limiting factors?

Appendix B

- Pg. B-8: Given data limitations, how confident is ODFW that '*current spawning distributions mirror the historic distribution*' or that '*there have been little change in gaps between current and historical distributions*' or that changes have not likely influenced major life history strategies? This question applies to all populations for which statements similar to this are made and data are limited.
- Pg. B-53: Is the population productivity analysis for the Lower Mainstem John Day realistic? The estimated proportion of naturally spawning hatchery fish used in this analysis (2–18% hatchery) is much lower than observations reported (e.g.,

pg.8-127; 38–46% hatchery). Evidence suggests a high proportion of naturally spawning fish in the Lower Mainstem John Day streams are strays (possibly including wild strays, in addition to known hatchery strays). Given the high stray rates, are spawner-recruit curves (based solely off expanded redd counts) an appropriate measure of the productivity of this habitat? This is a concern, because the high estimate of productivity (recruits per spawner) for the Lower Mainstem (highest of all the John Day populations) pulls the viability ranking of this population up.

- Pg. B-120: The following statement is applied to each population despite the number of dams fish have to migrate through. This seems to suggest that the selective constraints imposed by passage through the Columbia River hydropower system are the same regardless of the number of hydroprojects fish must migrate through. How confident is ODFW that this is the case, especially given that the rate of iteroparity is not well understood for steelhead? '*Hydropower system: The hydropower system and associated reservoirs impose some selective mortality on smolt outmigrants and upstream migrating adults. The magnitude of selective mortality and the proportion of population that is affected is unknown. The selective mortality is not likely to remove more than 25% of the affected individuals, thus this metric rated at* ***low risk****.'*

SPECIFIC COMMENTS BY SECTION:

Section 1:

- Figure 1-1: Are resident fish present in populations marked extirpated? This figure would impart more detailed information if areas where only anadromous runs of *O. mykiss* have been extirpated were differentiated from areas where all *O. mykiss* have been extirpated.
- Pg. 1-11: Under '*Delisting Goals*', the term '*ecological function*' is vague. What does this mean exactly? What criteria are used to ascertain that '*function is sufficient*'?
- Pg. 1-12: In the section titled '*Broad Sense Recovery Goals*', the Plan states that '*Recovery of Mid-Columbia steelhead populations will require actions that preserve, enhance and restore healthy watershed conditions where ecosystem functions, processes and dynamics are intact*'. What criteria are used to identify ecosystems with *intact* functions, processes, and dynamics and how were these criteria quantified?
- Pg. 1-17: What exactly is meant by the term '*proper functioning*' in the following sentence '*All extant MPGs and any extirpated MPGs critical for proper functioning of the ESU or DPS should be at low risk*'.

Section 3:

- Pg. 3-8: In the following sentence, it is unclear what is meant by '*exclusive*'. *The Mid-Columbia River steelhead ESU included all natural populations of steelhead in streams within the Columbia River basin from above the Wind River in Washington and the Hood River in Oregon (exclusive), upstream to, and including, the Yakima River in Washington, excluding steelhead from the Snake River Basin.*
- Pg. 3-12: Defining the term '*vacated*' as used in the first sentence of Section 3.5 would be useful.

Section 4:

- Pg. 4-4: Does the structure of Figure 4-3 have any particular meaning? Is this a phenogram or a cladogram? If so, what is the data source? Do the lengths of the lines mean anything?
- Pg. 4-6: Are fish in the Deschutes River Westside Tributaries summer or winter runs?

Section 5:

- Pg. 5-3: What is meant by the term '*population segment*' in the following sentence? *Current populations and population segments must be preserved*.

- Pg. 5-3: In the section titled '*safety factors*': How many more and which populations must be recovered in order for recovery efforts to be successful?
- Table 5-2: How is information on Chinook salmon related to the recovery of steelhead?
- Table 5-3: What is the actual definition for '*Threshold Abundance*'?
- Pg. 5-9: The first two paragraphs on this page are difficult to follow. For productivity calculations, were hatchery parents weighted the same as wild parents? Do parents spawning in low abundance have higher productivity because density dependence patterns/pressures are lower? How were recruit-per-spawner values adjusted for smolt-to-adult return rates? In the second paragraph, how was the multiplicative factor used to establish CIs derived?
- Pg. 5-10: Is there evidence from research on salmonids to back up the following statement, '*Populations exhibiting greater diversity are generally more resilient to short-term and long-term environmental changes*'?
- Table 5-4: What exactly is meant by use of the header '*mechanism*' in Table 5-4? The text in boxes beneath this header indicate patterns, not mechanisms.
- Table 5-4: It is difficult to determine the baseline against which several metrics in this table will be compared. For example, what is the baseline for metrics that measure change in occupancy of MaSAs or ecoregions?
- Table 5-4: For mechanism B3 shouldn't the metric measure occupancy across habitat types rather than ecoregions? Is this a typo? For factor B4a, what exactly is meant by use of the term '*selective*'?

Section 7:

- Pg. 7-1: In the following sentence what exactly is meant by '*alternative climate regimes*'? *We only present observed gaps in this section. The influence of alternative climate regimes, hydrosystem scenarios, and other management actions on observed gaps is presented in Section 10 "Management Action Effectiveness.*"
- Pg. 7-3: In the gap calculation example, what does the term '*model capacity*' mean?
- Pg. 7-3: In the following sentence, what does the term '*effective capacity*' mean? *The calculated gaps are expressed as the proportional increase in productivity, but can also be considered the proportional increases needed in effective capacity of the population.*
- Pg. 7-3: In the following sentence, what is meant by the term '*Zone C*'? *Because the threshold abundance levels are equal at the 5% and 1% risk levels, populations that reside in Zone C have the same point estimate gaps at these two risk levels.*

- Pg. 7-3: In the following sentence, what exactly is meant by the phrase '*an intrinsic moderate risk for the metric*'? *For the metrics rated moderate, determine if the rating is a result of changed status from intrinsic conditions or if the rating is a result of an intrinsic moderate risk for the metric.*

Section 8:

- What exactly is meant by the phrase '*considerably improved over historic practices*' in the following sentence? What degree of improvement does *considerably* imply? *Panelists noted that current land use practices are considerably improved over historic practices.*
- Pg. 8-3: What is meant by the phrase '*historically available nutrients*' in the following sentence? Available where and from what source? *Specific viability concerns identified by the Mid-C Expert Panel related primarily to effects of delayed upstream passage (adults), direct and indirect mortality on downstream migrants (juveniles), alteration of the hydrograph (mainstem and estuary flow regime), depletion of historically available nutrients, and degraded rearing and food resources for both presmolts and smolts in the Columbia.*
- Pg. 8-15: With reference to the following sentence, land use conversion from and to what? *Nevertheless, two emerging threats — forest health and land use conversion — need to be acknowledged*.
- Table 8-12: Questions regarding this and all similar tables constructed for other populations include:
    - What do open versus closed circles mean?
    - What do the numbers in geographic area priority names mean?
    - To what do column headers refer?
    - A note at the bottom of Table 8-14 indicates that some factors apply only to freshwater. Does any of this information apply to salt water?
    - A note at the bottom of Table 8-22 indicates that channel landscape applies to estuary areas. How can one discern from these tables where the problem is or which habitat to fix? If estuarine areas are limiting for the north fork John day population then why is this not identified similarly for all populations since they all use the same estuary?
- Pg. 8-23: With regard to the following sentence, what exactly is meant by the phrase '*high drainage densities*'? *The eastside streams are very flashy due to their high average slope, high drainage densities, and occasional severe thunderstorms.*
- Table 8-14: Predation is identified as a low to medium threat but this mechanism is not discussed in the text preceding this table. Why is this topic omitted? If it is covered elsewhere in the Plan it would be useful to make some reference here.
- Pg. 8-59: Could excess ammonia in the Umatilla River also be caused by nitrogen input, as opposed to excessive temperatures, or a combination of the two?

- Pg. 8-74: Is there a citation or other evidence to back up ODFW's contention that '*is likely due to additional mortality incurred from passage at three mainstem dams (John Day, The Dalles, and Bonneville) for Umatilla steelhead vs only one dam (Bonneville) for Hood River steelhead*'.
- Pg. 8-88: Is there a citation to support the following sentence? *There is some evidence that survival consequences of high temperature exposure may be greater for obligatory migrants like Chinook salmon than for steelhead, which migrate many months in advance of spawning*. Adult spring Chinook can migrate in freshwater for as many months as steelhead (Quinn 2005), although it is true that egg yolk formation, final egg maturation, and ovulation can take place in Chinook salmon recently exposed to warm summer temperatures.
- Pg. 8-88: The discussion under '*Effects of Dams and Operations*' would be strengthened if it were better supported by literature citations. For example, the following sentence: *Research found that fish that took a relatively long time to pass individual dams were less likely to migrate successfully to spawning tributaries.* Several sections (e.g., juvenile barging; flow and survival) contain information for Chinook. It is difficult to determine how this information relates to the Mid-Columbia Steelhead DPS and requires additional context. There may be some useful information in the recent publication by Keefer *et al.* (2008) on survival of steelhead holding and migrating in the Columbia hydropower system, including Mid-Columbia stocks.
- Pg. 8-88: Of what relevance to the Mid-Columbia Steelhead DPS is the section on juvenile barging?
- Pg. 8-91: The statement that '*reintroduction of steelhead to historical habitats upstream of Round Butte Dam in the Deschutes River subbasin may expose existing resident populations to diseases*' is vague – what is the probability that this will occur?
- Pg. 8-91: How much upstream habitat do insufficient flows in the Umatilla and Walla Walla Rivers block?
- Pg. 8-97: On what basis has ODFW determined that a 2% impact limit for the mainstem fishery could be '*reasonably anticipated*'?
- Table 8-47: Are the '*estimated impacts*' equivalent to the percent of the run taken?
- Table 8-49: What aspect of selectivity (e.g., size?) does this table refer to?
- Pg. 8-112: With regard to the section titled '*CTUIR Tribal Steelhead Harvest*', how did ODFW determine that harvest is not a significant threat?
- Pg. 8-125: The following sentence reports a mean that would be more informative if it were accompanied by some measure of variation (e.g., 95% CI or standard deviation). Also, Carmichael (2006) is not included in the literature cited. *Carmichael (2006) reports that the proportion of hatchery spawners in the Lower*

Mainstem population ranged from 0.01 in the early 1990's to 0.18 in 2004, with a mean of 0.07.

- Pg. 8-132: The presentation of results from Chess *et al.* (2003) is difficult to interpret as written. Is the intended meaning that 69.3% of wild summer steelhead were females and 57% of hatchery fish were females? Revision of this paragraph to increase clarity would be helpful.
- Pg. 8-134: A more explicit description of what a '*small-grade*' steelhead is would increase clarity in the first paragraph.
- Pg. 8-138: Regarding the section titled '*Predation by Avian Predators*', citing the actual percent of salmonid smolts consumed that were steelhead would be more informative.

Section 9:

- Pg. 9-2: In reference to the 6th key principle identified by Meffe & Carrol (2002), management must be minimally intrusive to what exactly?
- Pg. 9-2: What exactly is meant by the phrase '*normative natural ecological processes*'?
- Pg. 9-2: What is a '*primary life history strategy*' versus a secondary or tertiary life history strategy?
- Pg. 9-2 and 9-3: Is there any explicit connection between the 6 key principles identified by Meffe & Carrol (2002) and the guidance and criteria outlined under '*Prioritization Considerations*'?
- Pg. 9-3: How exactly does ODFW envision accomplishing the following goal? *We strive to ensure that all recovery actions effectively complement and support each other in achieving the broad sense recovery goals.*
- Pg. 9-7: What percentage of the total Mid-Columbia stream miles do 1,760 miles represent? What proportion of average Mid-Columbia stream flow does 85 cubic feet per second represent?
- Regarding Tables 9.3.1 through 9.3.10:
    - What types of actions fall under the category of '*protection*'? How will protection be achieved and with what guarantee over the implementation time of the Plan?
    - How does protecting high quality habitat reverse degraded flood plain connectivity and function, degraded channel structure and complexity, degraded riparian areas, altered hydrology, degraded water quality, or altered sediment routing?
    - How were the ranks in the '*certainty of outcome*' column determined?
    - Exactly what time frames are indicated by implementation time ranks of *'long-term', 'intermediate',* etc?

- Is the information reported in the '*expected biophysical response time*' supported by monitoring data?
- Can information in referenced appendices be summarized and included in this table?
- What types of actions will be taken to '*promote the maintenance and creation of beaver dams*'? This action descriptor is not very specific.
- Many action descriptors are specific (e.g., increase instream habitat through manual placement of structures), while others are vague (e.g., stabilize streambanks). The table would be easily followed if the specificity of action descriptors were consistent throughout.
- What types of actions will be used to '*eradicate invasive plants*' and what is the biological justification for ranking the certainty of outcome as high for this notoriously difficult action (GAO 2005)?
- Why is the certainty of outcome for '*implementing urban conservation measures*' ranked as high when the certainty of outcome for assessing existing and future water needs (upon which this would seem to depend) is ranked as moderate?
- Who is monitoring or going to be able to reduce chemical inputs to streams in 0-5 year? Is the moderate certainty of outcome for this action realistic?

- Pg. 9-180: As written, the first management action listed under strategy 2 is vague. Can an explicit list of actions be included somewhere in the Plan? The additional action under strategy 2 reads such that the needs of fish can be overridden by barge transport and irrigation needs. Is this the case? What actions will occur if high total dissolved gas saturation levels and adult fallback problems cannot be remedied?
- Pg. 9-182: '*Should*' or '*will*' bypass reach flows and fish passage facilities for the Boyd Hydro Project be modified?
- Pg. 9-183: '*Should*' or '*will*' the strategy identified under '*Mainstem Harvest*' be considered after new harvest biological opinions come into effect?
- Pg. 9-184: How does regulation of the fishery in the Lower John Day impair the ability to remove hatchery strays from this population?
- Pg. 9-192: What evidence is there that volitional migrants do not stray as much as those that do not leave?
- Pg. 9-195 and 9-196: What is the evidence that any of the management actions listed under '*Predation by Pinnipeds*' actually work?
- Pg. 9-196: What effect does the relocation of Caspian tern colonies have on stocks of marine species? What is the timeline for developing a plan to address cormorant predation?

- Pg. 9-197: What is the evidence that after more than a decade of implementation the Northern Pikeminnow Management Program (NPMP) has been successful? What is the evidence that any of the management actions listed under strategy two can be achieved or will be successful at reducing salmonid predation by nonnative fishes?

Section 10:

- Pg. 10-8: The following sentence is rather vague. This section would be strengthened if an explicit description of 'considerations' used to address various issues was provided. *(Aspects of some actions overlapped with others, which required some consideration in assigning effectiveness values to reduce redundancy and overestimation of action benefits.)*
- Pg. 10-8: Part 1 of the EDT analysis seems like a valuable tool for detecting locations where tributary habitat actions might be overly redundant or insufficient.
- Pgs. 10-8 through 10-21: These sections contain many vague descriptors including, reasonably expected, fully as feasible, and maximum yet reasonable. Can methods on the EDT parameterization process by clarified by using more explicit language.
- Pg. 10-15: It would be helpful if a list of attributes were provided along with the description of the attribute scalar.
- Pg. 10-17: Are there any data or modeling results to support the passage effectiveness values supplied by Portland General Electric (PGE)?
- Pg. 10-18: What are the Hatchery Scientific Review Group (HSRG) default parameter settings?
- Pg. 10-18: What is an explicit definition for '*optimal trait value*'?
- Table 10-9: The number of priority 1 and priority 1+2 actions is equal for each population. One would expect that priority 2 actions differ from priority 1 and that adding priority 2 actions should increase the total number of actions. If this is not the case (e.g., priority 2 actions are the same set but applied in lower priority locations within a population) it has not been made clear in the text of this section.
- Pg. 10-62: Are ratios truly '*relative*' measures of risk? For example, is a ratio of 3.0 really three times better than a ratio of 1.0?
- Table 10-37: Estuary and harvest actions always yield identical results. Why report both?

Section 11:

- Table 11-1: It might be more informative if this table reported a range of potential costs including average values, upper potential cost estimates and lower potential cost estimates.

- What are the relative costs of sampling targeted and random sites?

Section 12:

- It would be useful if the Research, Monitoring and Evaluation section considered other diseases in addition to whirling disease and also considered the use of Before-After Control Impact (BACI) designs for some rehabilitation actions.
- Figure 12-1: The concept of '*decision-questions*' is not clear from Fig 12-1 and text alone. It was necessary to refer to the source document to understand how this concept relates to research, monitoring, and evaluation.
- Pg. 12-4: Is the heading '*Critical Uncertainties*' correct? The items listed appear to be objectives rather than critical uncertainties. What are the critical uncertainties? The first sentence of the paragraph mentions six critical uncertainties but the list of nine items below seem to be very broad, and often mixed, statement of objectives. The last five '*Critical Uncertainties*' (Objectives?) appear to be a restatement of Statutory Listing Factors (Figure 12-1). Seven of nine objectives involve long-term status and trends monitoring. The seventh objective addresses short-term disease research (Critical Uncertainty?) and long term predation monitoring while the ninth involves monitoring implementation and compliance, long term effectiveness, and long term status and trends. The relationship of the objectives to cause-and-effect models (AHA and EDT; Figs 10-1 & 10-2) and the ESU/DPS listing decision framework is implied but not explicitly stated.
- Pg. 12-8: How are smolts distinguished from other migratory *O. mykiss* that are not headed out to sea?
- Pg. 12-11: With regard to the paragraph beginning, '*ODFW currently conducts annual collections of smallmouth bass*' how can this objective be accomplished if the distribution or population size of steelhead is poorly understood?
- Pg. 12-15: Unlike the John Day MPG, critical uncertainties are provided for the Umatilla River population but not for the Walla Walla population. Does this mean that there are no critical uncertainties in the Walla Walla Research, Monitoring and Evaluation plan? In addition, the links between the 7 critical uncertainties and the 14 objectives for the Umatilla River population are not always clear. In some cases, the connection is fuzzy while in other cases it is non-existent. For example, does Objective 14 address any of the Critical Uncertainties?
- Pg. 12-18: Objective 3 is an example of very broad, mixed objective that will be difficult to accomplish. A larger number of specific focused objectives covering the same areas would be preferable.
- Pg. 12-20: With regard to the statement '*The revised EDT model will be updated in the future as habitat actions begin to improve conditions and additional data are available*' are limiting factor analysis and model revision dependent upon habitat actions that improve conditions? If not, this statement might be overly optimistic.

- Pg. 12-21: Objectives differ markedly in detail (e.g., compare objective # 6 with objective #7.
- 12-38: What is a '*geostatistical estimator of population variance*'? Is this a valid technique? Further explanation might increase clarity.

Appendix B

- Figure 2: Does ODFW understand the cause of the precipitous declines in the late 1980's and 2004/05? Is this due to variable ocean conditions? Some discussion of these patterns would be useful in the figure title.
- Pg. B-6: What is an explicit definition for '*moderately variable*' with reference to steelhead abundance in recent years?
- Table 2: Does the footnote for this table explain why only a subset of years is selected to calculate viability curves? If so, this deserves some treatment in the main text related to current status (Section 6).
- Pg. B-7: How was '*historic major production*' determined and over what time frame?
- Pg. B-10: How much is a '*substantial*' reduction?
- Pg. B-11: Does the statement implying that habitat changes '*do not impact a substantial component of the population*' contradict modeling results that identify tributary habitat actions as an important? This question applies to all populations for which similar statements are made.
- Pg. B-14: It is difficult to determine how the curves presented are fit with any confidence. Can additional explanation of the methods used be provided?
- Pg. B-134: With regard to habitat, how was the 25% mortality estimate determined? '*Although any single one of these mortality factors may not result in greater than 25% mortality of an individual population component, there are multiple life stages which are affected and the affects have occurred for many generations, thus the rating is* ***moderate risk*** *for this metric*'

EDITORIAL COMMENTS:

A major strength of the Plan is the quality of writing and the logical ordering in which information is presented. However, there are numerous figures and tables where the legends are not clear or labeling is insufficient. The following are examples:

Entire Document:

- The word 'data' is plural. There are numerous places where it is used in the singular.
- The words historic and historical are used interchangeably throughout. These words do not impart the same meaning to readers. The adjective historic is typically used to describe an event of historical significance, while historical is typically used to denote preceding events. Where the word historic is used within the Plan, the word historical would be the correct term in most situations.
- Most of the color figures are excellent and easy to read in the electronic format – however if hard copies of the Plan will be distributed it would be useful if alternative colors were selected that print well as shades of grey.
- The terms '*out-of-DPS strays*' and '*out-of-DPS-hatchery strays*' appear in some cases to be used interchangeably although it is not clear if they are always intended to mean the same thing. For example, it is not always clear if out-of-DPS strays might also include wild fish from populations outside of the DPS (e.g., pg. 7-5 under genetic and spawner composition headings). Clarity of the Plan would be enhanced if these phrases were explicitly defined early in the Plan and checked for usage consistency throughout.
- Throughout the document, figure titles and table legends relay insufficient information for these items to stand on their own. The Plan would greatly benefit if all figures and tables were reviewed to ensure that
    - All titles and legends adequately describe the information figures or tables are intended to relay,
    - Typographical and formatting errors are corrected,
    - All abbreviations or acronyms are clearly defined.

Section 1:

- Figure 1-1: White Salmon and Fifteen-mile river systems are not shown but they are listed in the text referencing this figure. The Naches River is marked on Figure 1-1 but not mentioned in the text – although it is mentioned in subsequent figures.
- Table 1-1: The minimum productivity for the U. Main John Day River is 1.19. All other intermediate populations with abundance thresholds of 1000 have minimum productivities of 1.35. Is this a typo?

Section 2:

- Pg. 2-3: Are management units, ESUs, and DPSs defined or determined?

Section 5:

- Pg. 5-2: A citation for the ISAB review of ICTRT viability criteria would be useful.
- Table 5-2: It is not clear what the header '*ABOVE to 25 m*' means. Abbreviations used in the table (e.g., BF) should be defined in the table header or legend. The units associated with width measurement are not identified consistently throughout the table.
- Table 5-4: Why is the abbreviation ESU used as opposed to DPS?

Section 6:

- Pg. 6-2: Should the definition for CI be included in the list of abbreviations?
- Pg. 6-4 (Figure 6-3): Is the legend for this figure complete? Why is there no 99% CI for this population? Why is 95% CI, if that is what is shown in this figure, not in the legend?

Section 8:

- In general Section 8 contains more typographical errors (e.g., repeated phrases, missing words) and misused words (data = plural; less dams vs. fewer dams) than other sections. Consequently, the clarity and readability of this section would greatly benefit from some editorial attention. In addition, this section contains several large tables (e.g., 8-36, 8-51, 8-53, 8-54, 8-61, and 8-62) that would be more effectively presented as figures.
- Pg. 8-2: The numbered list of concerns in the second paragraph skips from number 1 to number 3, i.e., there is no number 2.
- Table 8-17: Why are there so many empty cells in this table?
- Table 8-32: Reference to the narrative in the sediment portion of this table is not very useful. Can additional information be provided?
- Table 8-33: The '*degree*' header in this table is vague. What is the baseline to by which partial or complete degrees are assessed? Letter codes under the priority header require definition.
- Table 8-35: Under life stages affected, how does '*all life stages*' differ from '*egg incubation, juvenile, rearing, spawning*'?
- Table 8-36: This table would be difficult to interpret by anyone not intimately familiar with the Walla Walla subbasin. Since spatial coordinates are included it

might be more effective to present this information as a map with a numeric key to passage barriers.

- Pg. 8-78: The following sentence does not appear to be complete. *Currently, there are inadequate data to estimate juvenile survival of Mid-C steelhead because very few of these fish have been PIT-tagged, and only steelhead from the Umatilla and John Day rivers*.
- Table 8-46: What does the header '*Final S*P*' stand for and to which columns does it refer? The second table footnote refers to fish being separated because of the potential for overwintering mortality. What were these fish separated from?
- Figures 8-6 through 8-10: Comparison of these figures is extremely difficult.
    - Reducing the graph heights such that all graphs can be fit on one page would relay additional information.
    - Reporting these data with consistent x and y-axis scales would facilitate among year comparisons.
    - Important details that should be included in figure titles include whether data collection extended for the same periods in 2001 and 2002 but fish migration timing was different or if the period for data collection differed among years.
    - An excellent example of how these figures could be more effectively presented is figure 8-19 on page 8-133.
- Figure 8-11: What type of error bar is shown (e.g., 95% CI or standard deviation)? Also it appears there is statistically significant inter-annual variation. Discussing the source of this variation in the text or in the figure title would enhance the presentation of this information.
- Pg. 8-87: Under pinniped predation – sea lions vs. seal lions.
- Pg. 8-98: Use '*creel census*' vs. '*creels*' to avoid jargon.
- Table 8-52: The structure of this table makes it difficult to tell if the results of one run or two runs are reported.
- Figure 8-17: Not all points on this graph are labeled with a year and the figure legend does not give a very clear explanation of what the graph actually shows.
- Pg. 8-125: Carmichael (2006) is not listed in the literature cited section.
- Pg. 8-131: DeBano et al versus Debano et el.

Section 9:

- It is difficult to track individual populations and treatment of their limiting factors and threats through Sections 9, 10, and 12. IMST realizes that limiting factors and threats identified by both the Mid-Columbia recovery planning team and the Mid-Columbia expert panel were listed early in Section 8 but there are differences in

how limiting factors and threats were ranked by these groups. Synthesis by ODFW is in the lengthy and dense text of Section 8. A concise summary table that includes all populations (column headers) and primary and secondary limiting factors and threats (rows) as determined by ODFW would be extremely useful at this point in the document.

- Regarding Tables 9.3.1 through 9.3.10:
    - It would be helpful to have a key to the acronyms of the various agencies and organizations associated with these tables.
    - There are many blank spaces in the '*sufficient*' column. What do these blank spaces mean?
    - There is an asterisk in the '*sufficient*' column heading that does not appear to have a footnote associated with it.
- Pg. 9-179: It would be easier to follow the Plan if the ordering of information in the remainder of Section 9 (i.e., pg. 9-179 onward) matched that of Table 9-1. In addition, it is difficult to tell if all the actions described in Section 9 were included in the AHA analysis presented in Section 10. Some statement or method of identifying which actions were included in that analysis would increase transparency of the Plan.
- Pg. 9-189: The url mentioned at the end of the last paragraph appears to be missing.

Section 10:

- Figure 10-1: Additional information in the title for this figure would increase its utility. The arrows suggest that the 2 models only address 6 of the 13 factors listed. Is this true, or does it only miss the ocean component and within basin rearing? What smolt to adult ratio was used to model the ocean?
- Pg. 10-6: The relevance of the Beverton & Holt (1957) and other references cited at the top of the page is unclear. These authors did not modify the AHA platform. What aspect of the following sentence does each reference actually refer to? *Therefore, the AHA platform was modified by first disaggregating output from EDT into life stage segments (Beverton and Holt 1957; Moussalli and Hilborn 1986; Mobrand et al. 1997), then linking AHA inputs to the appropriate segment and re-computing end of spawning population parameters by reaggregating across the full life cycle.*
- Pg. 10-6: Are the baseline conditions mentioned in the following sentence the same as the ICTRT baseline mentioned on the previous page? *A set of scenarios was modeled using AHA representing baseline conditions, current conditions, and combinations of actions aimed at tributary habitat, mainstem Columbia River factors, and hatchery fish management.*
- Figure 10-4: This figure would benefit from a more detailed figure title that identifies the differences between the solid and dashed lines, a more explicit

definition of '*fitness*' as it is used here, etc. understanding the current figure requires several re-reads of the text.

- Pg. 10-19: The phrase '*in no way*' is repeated in the paragraph below Figure 10-4.
- Table 10-5: This table title would be much more informative if it included an example of how to calculate and interpret % improvement.
- Page 10-20: Restating the meaning of the effectiveness value at the beginning of Section 10-2 would be helpful.
- Table 10-7: The titles associated with this and all subsequent figures and tables reporting EDT or AHA results would be an excellent place to point out how much confidence should be placed in point estimates of population performance.

Section 11:

- Table 11-1: Do estimates of $0 as a total cost estimate mean no action will be taken or that estimates have not yet been determined?

Section 12:

- Pg. 12-14: With regard to the sentence '*An IMW is planned for the Middle Fork watershed beginning in 2008 and for the Bridge Creek watershed on the Lower John Day River beginning in 1997*' – beginning in 1997? Something is inconsistent here.
- Pgs. 12-18 & 12-19: Objectives are not always written in the same voice. Compare Objective 3 Determine … with Objective 4 What is …
- Pg. 12-22: Are recent studies by the Yakima-Klickitat Fisheries Program published? If so, the citation or personal communication reference would be useful.
- Pg. 12-48: GSI is not given in the list of acronyms and abbreviations. While this might appear trivial, the historical and still currently acceptable use of this acronym in fisheries is for *gonadosomatic index.*
- Pg. 12-48: Is there a better descriptor for the fifteen-mile creek winter steelhead run, perhaps '*eastern extent of the winter run distribution*' or something similar.

Appendix B

- Table 5: Codes in table headers for this and other tables in this section are not sufficiently defined.
- Pg. B-18: By *expanding* redd observations to unsurveyed areas does ODFW mean *extrapolate*? By *expanding* redds to fish does ODFW mean *convert*?

RECOMMENDATIONS

IMST recommendations are based on our assessment of the best available science as it pertains to salmonid and watershed recovery and the management of natural resources. Recommendations are directed to one or more agencies or entities that have the ability to implement or to affect changes in management or regulation that are needed for implementation (see Appendix A for further discussion on development of IMST recommendations). The IMST considers each recommendation important to accomplishing the mission of the Oregon Plan for Salmon and Watersheds. Under Oregon Revised Statute 541.409, state agencies and entities (e.g., Oregon Plan Core Team) are required to respond to IMST recommendations (see Appendix A for information regarding formal responses, desired format, and evaluation of responses by IMST).

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.

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.

Recovery and conservation plans contain many assumptions that are based on limited or imprecise information. Uncertainty stemming from incomplete knowledge about a species can be just as critical to recovery as the limiting factors already identified by ODFW (e.g., tributary habitat condition, commercial harvest, hydropower). It is important to consider the compounding effects of uncertainties regarding status and trends, limiting factors, and effectiveness of recovery measures. Consideration of uncertainty also applies to confidence that the criteria used to judge recovery are correct and that models used in recovery plans have sufficient precision and accuracy.

In IMST's view, presentation of uncertainty includes both quantitative and qualitative aspects. For example, multiple data sets were used to determine independent population boundaries. What confidence does ODFW have that the overall analysis produced population boundaries that represent independent demographic units for Mid-Columbia Steelhead? ODFW should address how certain it is that any taxonomic divisions within a DPS or ESU (e.g., independent populations, MPGs) are correct and the consequences that uncertainty might have on the current status and viability assessments applied to these taxonomic

divisions. Taxonomy is not an exact science. Tools used in classification change through time and hence taxonomic relationships are frequently subject to revision. This problem is compounded by the fact that there are no rigorous or standardized criteria that actually define a DPS/ESU. By analogy, even the much more widely used term 'species' has numerous definitions and is the subject of considerable scientific literature. Divisions, such as MPGs and populations, are even less rigorously or consistently defined, and boundaries between one and the other are not based on explicitly stated, objective criteria. Given that decisions relative to recovery of a DPS/ESU can hinge on the status of one population that could affect the status of one MPG, correct classification of all three levels of organization becomes critical.

Similar discussions of uncertainty and confidence might also apply to finalized results from population or habitat modeling analyses, expert opinion processes, or other areas identified by ODFW where it would be important for the reader to have an understanding of the certainty or uncertainty associated with the issue(s). This is similar to the scientific publication process where an editor would ask the author(s) to describe their confidence in various conclusions drawn from data analyses.

While the examples provided below pertain specifically to the Mid-Columbia Steelhead Plan, they could also apply to future recovery and conservation plans if they included similar analyses. However, because recovery and conservation plans vary according to species and surrounding circumstances, it would be difficult for IMST to identify a complete list of topics where uncertainty should be addressed in every forthcoming recovery or conservation plan. Therefore it is necessary for ODFW to define a process to identify plan components where agency comfort level is not particularly high and the consequences of being wrong would significantly hamper recovery and then explicitly address agency confidence in any relevant assumptions, analyses, or conclusions.

Presentation of uncertainty and confidence within a recovery plan could be achieved several different ways depending on agency preference. Explanations could be provided on a case by case basis, in the form of a short preface to relevant sections of the Plan, or as a comprehensive appendix that highlights major plan assumptions and conclusions and agency confidence in each.

Areas where analysis or description of uncertainty is warranted for the Mid-Columbia Steelhead Plan include, but not limited to:

- Sufficiency of information used to determine current status and gaps between current and desired status including how contributions of resident fish might affect estimates of the gap between actual abundance and productivity and predicted threshold abundance.
- The likelihood that proposed monitoring efforts will provide information sufficient to determine changes in abundance, productivity, and habitat trends over a timeframe sufficient for adaptive management to occur.

- Confidence that all limiting factors and interactive relationships among limiting factors have been identified and that the magnitude of risk imposed by different threats or limiting factors adequately characterized (e.g., Table 8-1).
- Confidence that estimates of the direction and magnitude of management action effects are correct. In other words, will the high priority management actions yield beneficial effects sufficient for recovery of the DPS?
- Confidence in the precision and accuracy of results generated by any modeling efforts (e.g., EDT and AHA) including an explanation of the models scientific shortcomings sufficient for readers to judge the confidence that should be placed in model results.
- Confidence that current land use, ocean conditions, and climate patterns will persist throughout the period over which the Plan is implemented.
- Confidence that funding is sufficient for the implementation of actions critical to achieving recovery goals.

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.

This recommendation suggests that recovery plans need to demonstrate that their monitoring plans are sufficient to detect deviations from predicted trends and where possible, their likely causes in time for the State to respond with mitigating actions.

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.

The IMST recognizes that ODFW is in the process of developing an adaptive management strategy for the Oregon Management Unit of the Mid-Columbia Steelhead DPS. However, it is difficult to assess the scientific evidence that a recovery plan will result in achievement of its goals if such adaptive management strategies are not an integral part of each recovery plan. It is almost a certainty that there will be some difficulties encountered over the course of attempting recovery. It follows that such eventualities should be anticipated and proactive measures taken to ensure a timely response. An explicit adaptive management strategy would include a description of how an oversight entity will track status and trends of populations and habitat. The adaptive management strategy should also specify criteria that an oversight entity might use to determine when population trends have significantly diverged from desired status such that a new status assessment or suite of actions would be warranted.

The IMST recognizes that the timelines under which recovery and conservation plans must be submitted might be insufficient to accomplish development of thorough adaptive management plans. However, recovery and conservation plans at a minimum should present the process and timeline under which such plans will be developed if the proposed recovery measures are to be judged for scientific credibility.

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 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.

Climate change could change the demand for water storage (dams), quality of habitat, and the response of habitat and fish populations to recovery actions. Projected changes could be used to establish how recovery measures are implemented in terms of where limited resources would be most effectively expended under those conditions rather than under current conditions. Given the semi-arid nature of the landscape occupied by the Mid-Columbia Steelhead DPS, this appears particularly relevant to this and other DPS/ESUs in similar habitats. Similarly, changes in demographics should be taken into account for DPS/ESUs that occupy areas with large changes projected for the human population, such as urbanization in the Willamette Valley and Deschutes County. Changes in the environment or socioeconomic conditions could affect land use practices across certain landscapes, such as which crops are raised and how they are irrigated. Where projects or predictions of such change exist, they should be accounted for

when formulating recovery actions since they could involve increased water use and storage, road development, impervious surface development, chemical applications, and alien species introductions. Scientific journals provide multiple examples of how climate change can be expected to alter the distribution, abundance, and connectivity of cold water fish species and their habitats (e.g., Flebbe *et al.* 2006; Battin *et al.* 2007; Budy & Schaller 2007; Rieman *et al.* 2007). Similar research has been reported for the effects of urbanization on salmonids (e.g., Van Sickle *et al.* 2004; Stanfield & Kilgour 2006). It seems wise to conduct comparable studies for Oregon salmonids to understand how best to allocate conservation efforts and resources.

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.

Because adequacy of a recovery plan is contingent upon the actual ability that it can be carried out, IMST believes that analysis of financial feasibility should be an integral part of any recovery or conservation plan. Thorough time and cost estimates are useful:

- for state and federal agencies or stakeholder to conduct a cost-effectiveness analysis of the Plan's proposed recovery actions,
- to determine future resources required to carry-out proposed monitoring and recovery measures,
- to determine costs relevant to the formulation of an adaptive management plan.

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APPENDIX A: Recommendation Background

The IMST creates several types of reports[1]. The largest reports are created in response to the IMST's continuing evaluation of the State's science needs necessary to pursue the mission and goals of the Oregon Plan for Salmon and Watersheds (Oregon Plan). These reports are generally topic-oriented and often called "landscape-level reports". An example of this type of report is Technical Report 2002-1, *Recovery of Wild Salmonids in Western Oregon Lowlands*. The landscape-level reports present IMST's independent evaluation of the state of the science regarding the resources being considered and support the evaluations with a comprehensive scientific literature review. These reports also receive extensive peer and technical review[2].

A second type of report the IMST generates is in response to specific requests by the Governor's Office, Legislature, state agency, or other entity to either provide guidance or to review draft reports or proposals involving topics related to the Oregon Plan. An example of this type of report is our 2005 evaluation of the State of Oregon's draft *Viability Criteria and Status Assessment of Oregon Coastal Coho*, the draft *Policy to Evaluate Conservation Efforts (PECE) analysis*, and the draft *Synthesis of Viability Analysis and Evaluation of Conservation Efforts*. A third type of report is called a "letter report" that may be prepared in response to specific questions, such as IMST's 2002 report addressing issues related to instream aggregate (gravel and sand) mining regulated by the Oregon Division of State Lands and how operations may affect salmonid habitat.

In the second and third types of reports, the IMST is often asked whether the scientific approach, analyses, and/or interpretations are credible and consistent with accepted scientific standards, and whether the assumptions and uncertainties are reasonable and accurately characterized. In both of these two types of reports, the IMST generally evaluates the scientific literature being used to support the agency's or State of Oregon's draft report or proposed actions, rather than produce a comprehensive review of available scientific literature.

Depending on the nature of the report being generated (more commonly contained in the landscape-level reports), the IMST may develop a series of scientific questions and answers that help to organize the report and to aid a reader's understanding of the topic. The scientific questions are created by the IMST and are judged to be relevant and useful to understanding the issues, resources or subjects being analyzed. In general, IMST develops and answers each science question, then summarizes its findings and conclusions for each question. Next, the IMST develops recommendations from specific findings and conclusions or from a synthesis of several findings and conclusions. The recommendations are often grouped into broad subject areas for convenience and the order does not imply priority. The IMST considers each recommendation important to accomplishing the mission and goals of the Oregon Plan.

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[1] All three types of reports are an undertaking of the entire Team, although subcommittees often are assigned leading responsibilities; subcommittee composition is based on Team member expertise and interest with topic areas. Minority opinions may be appended or incorporated within any IMST report.

[2] Although technical reports may be subject to technical and peer review, release of draft documents is restricted by the IMST in order to insure accuracy of content prior to release to a wider audience. IMST's policy is stated in the Team's Charter and Operating Guidelines: http://www.fsl.orst.edu/imst/charter.pdf

Recommendations are based on IMST's assessment of the best available science pertaining to salmonid recovery, watershed function and the management of Oregon's natural resources. Recommendations are directed to one or more agencies (or entities) that have the ability to implement, or alter management actions or regulations that are needed for implementation. **The IMST emphasizes that it looks beyond the State's *current* ability to implement the recommendations because current legal, regulatory, or funding situations may need to be modified over time.** The IMST's believes that if an agency (or entity) agrees that a recommendation is technically sound and would aid the recovery of salmonid stocks and watersheds, the agency (or entity) would then determine what impediments might exist to prevent or delay implementation and work toward eliminating those impediments. The IMST also assumes that each agency (or entity) has the knowledge and expertise to determine how best to identify and eliminate impediments to implementation and to determine appropriate time frames and goals needed to meet the intent of the recommendation. The IMST also recognizes that an agency (or entity) may already have ongoing activities that address a particular recommendation; therefore, inclusion of such an "overlapping" recommendation should be seen as reinforcement for the continuation of such actions.

Formal Responses to Recommendations

Oregon Revised Statute (ORS) 541.409, which created the IMST, specifies that agencies are to respond to the recommendations of the IMST, stating "(3) If the Independent Multidisciplinary Science Team submits suggestions to an agency responsible for implementing a portion of the Oregon Plan, the agency shall respond to the Team explaining how the agency intends to implement the suggestion or why the agency does not intend to implement the suggestion". State agencies are expected to formerly respond to IMST recommendations within six months after a report is issued.

Once formal responses are received, the IMST reviews the scientific adequacy of each response and determines if further action or consideration by the agency (or entity) is warranted. Ultimately, each recommendation response is assigned to one of four general categories:

- **Adequate** means that the IMST supports the decision of the agency.
- **Intermediate** means that the IMST does not fully support the agency decision because the decision will decrease the likelihood of accomplishing the goals of the Oregon Plan in a timely manner, but not doom it to failure. IMST notes its concerns but stops short of suggesting that the recommendation be reconsidered.
- **Inadequate** means that the IMST feels the decision by the agency will seriously detract from achieving the goals of the Oregon Plan, and the IMST strongly suggests that the decision be reconsidered.
- **Indeterminate** means that IMST cannot tell what the agency decided to do with the recommendation, or lacks sufficient information to fully evaluate the response.

IMST believes that the key characteristics of a good response are:

- It includes a short, clear statement that the agency (or entity) (a) accepts or agrees with the recommendation or (b) that it rejects or disagrees with it. In some cases, an agency (or entity) may be reluctant to agree or accept a recommendation because it sees significant difficulties in implementing it. However, IMST believes if the recommendation is sound, then the agency (or entity) should work towards eliminating the impediments to implementation that it sees.
- It provides short, clear descriptions of what the agency (or entity) intends to do to implement recommendations it accepts (including how it might remove impediments) or, as required by ORS 541.409, that it provides specific reasons why it rejects the recommendations. Discussion betweens agency or legislative staff and Team members at IMST meetings should also help clarify agency (or entity) and IMST perspectives, and most importantly, advance the mission and goals of the Oregon Plan.

Responses that include these characteristics will be more easily characterized by IMST as ***Adequate, Intermediate*** or ***Inadequate***, avoiding the use of ***Indeterminate.***

The IMST evaluations of the responses are then delivered to each responding state agency (or entity) and the agency (or entity) has an opportunity to discuss the IMST evaluations of their responses. Agencies (or entities) are also encouraged to update the IMST their progress on implementing recommendations.

Finally, IMST includes any formal responses to recommendations and IMST's evaluation of the responses in its reports to the Governor and the State Legislature (e.g., Joint Committee on Salmon and Stream Enhancement or other natural resource committees as appropriate).