Independent Multidisciplinary Science Team (IMST)

State of Oregon

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Virgil Moore
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Dear Mr. Carrier and Mr. Moore,

The Independent Multidisciplinary Science Team (IMST) has completed an unsolicited review of the draft document titled *State of Oregon Conservation Plan for the Oregon Coast Coho Evolutionarily Significant Unit* (dated September 20, 2006) and Appendix 2 (dated September 20, 2006), *Measurable Criteria for the Oregon Coast Coho ESU*. The IMST has undertaken this review as a follow up to its review of the State's Oregon Coastal Coho Assessment in 2005 that was requested by the Governor's Natural Resource Office.

The Team concentrated its review on Appendix 2, including additional sections (dated October 6) addressing the productivity criterion not included in the September 20th draft. Since updated versions of these documents have become available for public review, we wish to underscore that these comments apply only to the content of the drafts that were available to the IMST at the time of its review.

This letter along with attachments contains IMST's assessment of the State's Conservation Plan and associated measurable criteria for the Oregon Coast Coho Evolutionary Significant Unit (Coho ESU), as well as suggestions for how the State might strengthen the Plan. As part of our review, IMST has directed three recommendations to ODFW and the Oregon Plan Core Team. Recommendations issued by the IMST require formal responses from state agencies or entities as per ORS 541.409 (see Appendix B for details).

The IMST commends ODFW for drafting a detailed, science-based policy document that clearly articulates the State's conservation goals for the Coho ESU. The IMST recognizes that these documents represent a significant effort to integrate stakeholder opinion into the planning process. The document's organization and descriptions are appropriate for a broad audience, are for the most part convincing, and capture

relevant findings related Coho ESU recovery. Overall, the IMST feels that, in terms of Coho ESU management the State is headed in a direction supported by available science.

The IMST has identified several points where we feel the State could strengthen the Conservation Plan. These points are summarized briefly in this letter, and are developed in more detail in the attached review. The Team wishes to emphasize that even though the review identifies areas we feel need improvement, the overall Conservation Plan sets a new standard with respect to the establishment of measurable goals in salmonid recovery.

- The Conservation Plan's description of adaptive management does not sufficiently address all the needs of a complete adaptive management plan. The IMST commends ODFW for its efforts in monitoring and regular reassessment of Coho ESU status. What is missing is an actual adaptive management plan that includes a substantive description of actions to be taken in the event that the measurable criteria described in Appendix 2 are not met, and a discussion of the factors that may affect the effectiveness of those actions.

- A significant omission identified by the IMST is the lack of a higher-level (across agencies) analysis of proposed actions. The plan does not describe how various agency actions will be integrated into management of the Coho ESU, or how the State will determine if the sum of independent actions carried out by individual agencies meet the comprehensive goals of the Conservation Plan. There were no objectives directed along these lines, and no single agency has been identified that might undertake such an analysis and oversight. While the section pertaining to ODFW objectives are quite explicit and clear, those presented by other agencies with responsibilities to the Oregon Plan for Salmon and Watersheds, are not very explicit. The lack of an integrated look at objectives of key agencies introduces considerable uncertainty into the Conservation Plan.

In Appendix 2, ODFW proposes a measurement period of 12 years (approximately 4 coho salmon generations) for the measurable criteria. However, the longer period Pacific Decadal Oscillation and shorter period El Niño-Southern Oscillation occur at periodic, yet irregular intervals that could occur both within and beyond this measurement period. Such changes in ocean conditions can greatly affect coho salmon abundance positively or negatively and have the

potential to mask the effects of management actions in freshwater. Although annual monitoring gives early indications of short-term trends, multiple monitoring timeframes may be needed to sort out what is actually happening with the Coho ESU in light of ocean conditions, The rigor of the State's monitoring approach would be strengthened if it employed multiple measurement and evaluation timeframes.

- The Conservation Plan assumes freshwater habitat quantities and qualities are limiting Coho ESU productivity. This assumption is scientifically sound during periods when marine conditions and corresponding coho salmon survivals are moderate to good. The IMST feels, however, that this assumption may not be valid when poor marine conditions result in extremely low marine survival of coho salmon. The State's desired status for the Coho ESU, during times when marine conditions are poor, requires doubling abundance over that observed during the 1990's period of poor marine survival. The IMST believes that periodic unfavorable conditions in the California Current may create a marine bottleneck that will complicate freshwater recovery efforts. Lack of knowledge about how the Coho ESU will actually respond to various combinations of limiting factors in freshwater and marine environments creates uncertainty regarding the goal of doubling coho salmon populations during an extended period of poor marine conditions. The IMST believes that the inherent variability in the coho salmon life cycle (switching between spawning and recruitment dependency) may set the State of Oregon up to fail on some of its recovery goals.

- The IMST disagrees with the usefulness of the diversity criterion presented in Appendix 2. This criterion is not independent of the abundance criterion. Diversity is certainly important for persistence of an ESU but for this criterion to be truly independent, a quantitative link between abundance and heterozygosity must be established for the Coho ESU. The IMST does not believe that abundance is a good surrogate for within-population heterozygosity. The State could improve the independence and usefulness of this criterion by defining the aspect of diversity it wishes to monitor (e.g., life-history characteristics or allelic diversity) then working to develop scientifically defensible measures of that diversity.

In general, the IMST believes that the approach and measurable criteria described in the Conservation Plan are scientifically valid. The Team applauds The State of Oregon and ODFW on their rigorous efforts to

include stakeholder opinion in the planning process for recovery of the Coho ESU. The Team would be happy to answer any questions that this review may raise and hope these comments and suggestions are useful to helping increase the scientific rigor of the Conservation Plan.

Sincerely,

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IMST Co-Chair

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IMST Co-Chair

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IMST Review of:

State of Oregon Conservation Plan for the Oregon Coast Coho Evolutionary Significant Unit (September 20 and October 6, 2006 Drafts).

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Review Preparation

This review was prepared by the IMST based on an initial draft by an IMST subcommittee (Vic Kaczynski, Carl Schreck, Robert Hughes, Michael Harte). Susie Dunham was the IMST Research Assistant working on this review. The subcommittee held public meetings to discuss the draft documents and to prepare a draft review on September 27 and November 15, 2006. Jay Nicholas and/or Kevin Goodson (Oregon Department of Fish and Wildlife) discussed the preparation, goals, and intended use of the reviewed documents at the IMST's October 16 and November 16, 2006 public meetings. The draft review was discussed at the October 16 and November 16, 2006 IMST public meetings and unanimously adopted (M. Harte was absent from the final vote) at the November 16, 2006 IMST public meeting. M. Harte subsequently approved the draft by e-mail.

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INTRODUCTION

In this review, the Independent Multidisciplinary Science Team (IMST) provides technical comments on three draft documents produced by the State of Oregon (from here forward, referred to as "the State") for the Oregon Coast Coho Conservation Plan. The reviewed documents include the:

- **Conservation Plan** – *State of Oregon Conservation Plan for the Oregon Coast Coho Evolutionarily Significant Unit.* September 20, 2006 Draft.
- **Appendix 2** – *Desired Status: Measurable Criteria for the Oregon Coast Coho ESU Conservation Plan.* September 20 and part of the October 6, 2006 Drafts.

The IMST conducted an independent review of the draft document titled *State of Oregon Conservation Plan for the Oregon Coast Coho Evolutionarily Significant Unit [ESU]*, from here forward referred to as the "Plan". The IMST previously reviewed the State's Oregon Coastal Coho Assessment in 2005 (IMST 2005) at the request of the Governor's Natural Resource Office (letters from Mike Carrier dated December 17, 2004 and February 1, 2005). The Team concentrated its current review on Appendix 2 (dated September 20, 2006), *Measurable Criteria for the Oregon Coast Coho ESU*. The Team received a revised Appendix 2 (dated October 6) and reviewed its productivity criterion, which was not included in the September 20th draft.

The Oregon Department of Fish and Wildlife's (ODFW's) part of the Plan is centered on monitoring and assessment of stocks within the "Oregon Coast Coho ESU", from here forward referred to as "Coho ESU" ("coho salmon" will refer to the species), to determine if they meet certain criteria that relate to the ESU's ability to persist and potentially thrive. These are discussed by ODFW in Appendix 2. Success of the Plan, of course, depends on the (1) quality of data derived from the monitoring and assessment efforts, (2) validity of the assumptions made in the models that will be used to assess population trends, (3) accuracy and precision of the models used, and (4) appropriateness of the criteria used. The IMST addresses these in its review of Appendix 2.

IMST comments in this review apply only to the three draft documents listed. Commenting on the other technical documents associated with the Plan was not possible within the Team's current work schedule.

The IMST concludes its review by issuing three formal recommendations (see Recommendations section). IMST considers recommendations important to accomplishing the overall mission of the Oregon Plan for Salmon and Watersheds. 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. Oregon Revised Statute (ORS) 541.409 requires that state agencies or entities (e.g. Oregon Plan Core Team) respond to recommendation issued by the IMST.

REVIEW OF THE COASTAL COHO CONSERVATION PLAN

This section constitutes the IMST's scientific review of the State of Oregon's draft Coastal Coho Conservation Plan *State of Oregon Conservation Plan for the Oregon Coast Coho Evolutionary Significant Unit* [September 20, 2006 Draft]. The Plan builds on decisions by state and federal agencies that the Coho ESU is viable, and describes policy actions to conserve the viability and improve Coho ESU productivity. The IMST congratulates the State on its extensive effort to synthesize biological information on the Coho ESU with stakeholder input during the two-year process that resulted in this Plan.

Overall, the IMST commends the authors on the ambitious nature of these conservation objectives. The Plan is impressive relative to what has been attempted before with respect to the establishment of measurable goals in salmonid recovery. The majority of this review focuses on places where the IMST believes it is critical that the draft be strengthened. This is not intended to reflect on the overall merit of the Plan. Rather, the IMST acknowledges that it is commenting on a draft Plan and intends this critical review to help the authors make the final Plan as rigorous and scientifically defensible as possible.

This IMST review begins with technical comments and concerns followed by general editorial comments. Technical comments cover topics related to the following assumptions that it appears are inherent in the Plan:

- The Coho ESU is viable;
- Freshwater conditions are limiting Coho ESU productivity;
- Improving freshwater habitats will improve Coho ESU freshwater survival;
- With improved freshwater survival, Coho ESU abundance will double during low marine survival periods;
- Existing regulatory programs and non-regulatory conservation work will be sufficient to achieve conservation goals.

Note: While the IMST was conducting this review, a more recent draft of the *State of Oregon Conservation Plan for the Oregon Coast Coho Evolutionarily Significant Unit* became available for public review (http://www.oregon-plan.org/OPSW/cohoproject/coho_proj.shtml). Some comments may not apply if relevant revisions are included in this newer version. Therefore, the IMST emphasizes that these comments apply only to the specific content of the September 20, 2006 draft of the Plan.

Technical Comments:

Major Strengths of the Plan: The Plan is a science-based policy document that clearly articulates the State's conservation goals for the Coho ESU. The document's organization and descriptions are appropriate for a broad audience, are convincing, and capture relevant findings from previous reports related to this issue (including: IMST 2002, 2005; Coastal Coho Assessment Overview, http://nrimp.dfw.state.or.us/OregonPlan/). Overall, the IMST feels that in terms of Coho ESU management, the State is headed in a direction supported by available science.

General Concerns about the Plan: The document contains many vague, unclear, or value-laden words that obscure the precise meaning. For example, on page 5 (near top) what do the terms "science-based" and "social consensus" mean? Also on page 5 under "Desired Status Vision", what is meant by the phrase "conceptual statement"? What is meant by "abundant numbers" (middle page 19), is this the number that will prevent listing, allow increased harvest levels, or some other management action? How "far" is "far more" (top page 20), an order of magnitude, two orders of magnitude? More explicit descriptions of these terms/statements would strengthen the Plan. Also, an explicit statement of the desired status goal would more clearly link the Plan to the criteria that will be measured.

From a science perspective, objectives are most useful when worded in such a way that one can readily determine when they have been met. The section pertaining to ODFW objectives are quite explicit and clear. In comparison to the ODFW objectives, those presented by other agencies with responsibilities to the Oregon Plan for Salmon and Watersheds, are not very explicit. Successful implementation of the Plan would be more likely if all key agencies provided explicit objectives.

The IMST suggests that the State be more definitive concerning what it means by a "conceptual classification" regarding the status of the Coho ESU (page 16). Likewise, "Conceptual steps of biological status" related to conservation (Table 2). The word "conceptual" does not inform the reader if the classification or status assignments are based more on knowledge or belief. Perhaps it would be simplest to replace the word "conceptual" with another word or phrase that more accurately depicts what is meant.

By design, the Plan contains minimal scientific support through citations because it is primarily a policy document. However, this sparse use of citations throughout the document leaves the reader wondering which assertions have the support of data or model simulations, which are expert opinion, and which are unsupported assumptions. Clarifying these different levels of confidence for the reader would help tremendously. In particular, highlighting assumptions and discussing consequences of potentially incorrect assumptions would strengthen the document.

Success of the Plan (page 13 on) is contingent on correct classification of the Coho ESU/SMU [evolutionarily significant unit/species management unit] and correct assignment of constituent populations into categories regarding independence. As pointed out in the earlier review of the State's Coho Viability Assessment (IMST 2005), some scientific discussion and/or analysis should be provided regarding the confidence level that the State has that its classification and assignments are correct and what the consequences would be if it is wrong.

The State also needs to put the Plan in the context of the Pacific Fisheries Management Council's Amendment 13 to the Pacific Coast Salmon Plan and the options therein. Commercial fishery harvest levels discussed in the Plan are taken from a revision to Amendment 13 that is not easily

obtained by members of the general public. This part of the Plan would be more transparent if the revised harvest matrix were included in the Plan and/or made available on a website and referenced in the Plan.

Higher Level Oversight and Adaptive Management: The Plan lacks a section describing how various agency actions will be integrated into management of the Coho ESU. Also, regarding scientific analysis of the Plan, one aspect the IMST found lacking is a higher level analysis across agencies. If all of the goals and objectives of the various agencies involved in the Plan are met, would this be sufficient to ensure that the goals of the overall Plan are met? In other words, do the sum of all of the parts add up to the desired whole? There were no objectives directed along these lines, and no single agency has been identified that might undertake such an analysis and oversight.

The overall success of the Plan relies on voluntary compliance (e.g., the private lands initiative) or on policy option packages that will be used to request funding for further action. The Plan would be strengthened if it proposed that the effects of higher, and lower, levels of expected voluntary actions would be evaluated for their effects on Plan success. For example, Yoder et al. (2005) reported that voluntary increases in conservation tillage were associated with a 10% improvement in median index of biotic integrity scores in Ohio agricultural rivers. What has been learned about the effect of voluntary land use changes on salmonid populations in Oregon? What are the possible consequences of doubling or halving expected levels of voluntary compliance or funding?

The section titled “Assessment of the Conservation Plan” indicates that achievement of the desired status will be accomplished in part because the Coho ESU currently is considered viable and that adaptive management has eliminated some adverse impacts. From a science perspective there is danger in any plan aimed at a conservation goal of long term sustainability if one starts from the premise that the Coho ESU is “viable”. Is it “just barely viable” or is it “so viable that it is near its desired status”? Would answers to those questions affect which management actions would be necessary? In other words, what would the likelihood of meeting the conservation goals be if the Plan were enacted and the Coho ESU was, in reality, not viable at this time (akin to committing a type two statistical error)?

The IMST does not have the same level of confidence that the State of Oregon appears to have with declaring the Coho ESU viable (IMST 2005). However, accepting that the Coho ESU is viable, this Plan would be more complete if it also addressed how decisions will be made regarding relaxation or elimination of current restrictions, or outlined which management tactics are no longer required once the Coho ESU reaches its desired status. In other words, how will agencies identify actions that are “above and beyond” those needed to attain desired status? Such scientific analysis coupled with an economic analysis would be beneficial and promote the most prudent and cost-effective management strategies and tactics.

While the IMST certainly agrees that the impacts of commercial fishery harvest and hatchery programs have been reduced, it is unclear if any true “adaptive” management has occurred. The section titled “Application of Adaptive Management” (page 42) does not fulfill all the needs of a complete adaptive management plan. The IMST commends ODFW and the State for its efforts in monitoring and reassessment of Coho ESU status, but what is missing is an actual adaptive management plan. Walters (1986, 1997) describes the components necessary to achieve adaptive

management. Adaptive management calls for planning alternative management actions that can be instituted in response to observed (i.e., through monitoring) departures from expected results (e.g., Appendix 2 of the Plan). To achieve this, the Plan would need to outline what substantial changes will be made if the measurable criteria described in Appendix 2 of the Plan are not met.

A related issue arises in the section 'Prioritizing Conservation Investment'. This section is vague and noncommittal. It is difficult to understand how the funding priorities outlined will achieve the restoration goals.

The State appears to underestimate the complexity of landscape/habitat interactions, its ability to restore them, and to document the level of restoration achieved. For example, in a study in the Oregon and Washington Coast Range, habitat predictors of fish assemblage condition were found to change with natural differences in geology, stream size, and slope (Hughes et al. 2004; Kaufmann and Hughes 2006). Anthropogenic effects were revealed only after factoring out those natural differences. For cutthroat trout, Gresswell et al. (2006) reported that habitat is best viewed as matrices of suitable habitat patches connected through space and time by fish movement. The same is likely true for coho salmon, and human activities impeding movement among patches reduce persistence. In coldwater Wisconsin and Michigan streams, Wang et al. (2006) found that as disturbance increased in catchments and riparian areas, the relative importance of local/site factors on fish assemblages declined and that of catchment factors increased. This means that rehabilitation (or restoration) at the site scale is most effective in relatively undisturbed catchments, but that catchment-scale rehabilitation is necessary where entire catchments are degraded. These confounding habitat characteristics and rehabilitation measures are likely also true for coho salmon.

The State is relying on existing regulatory programs and long-term non-regulatory conservation work. What is the evidence that these measures will provide a sufficient quantity of appropriately distributed, high quality freshwater habitat that will buffer the Coho ESU through future ocean cycles, urbanization, and climate change? Given that coho salmon in Oregon are near the southern end of the species' range, climate change could have significant implications for this Plan. What is the evidence that existing regulatory programs and long-term non-regulatory conservation work will protect the Coho ESU in the face of urbanization and rural residential development? Have all the present, and future factors likely to limit productivity of the Coho ESU been addressed?

Freshwater Management of Coho Given Variable Marine Conditions: Throughout the Plan is the implicit sentiment that the State of Oregon has the ability to effectively manage the Coho ESU in the face of fluctuating ocean conditions. In fact, the Plan is predicated entirely on freshwater habitat protection and restoration. The IMST feels that the State has not fully acknowledged the level of variability in coho salmon survival it has the power to change (see Peterson et al. 2006; Appendix A of this review) by improving fresh water habitat. The IMST feels that, for the benefit of the broader public, ODFW needs to state more explicitly how fluctuations in coho salmon marine survival will affect its ability to be successful with this Plan. The IMST expressed similar concerns in the review of the State's Coho Assessment (IMST 2005). These concerns included:

- That 1990-1997 data on salmon populations do not clearly indicate a new equilibrium is reached under unfavorable ocean conditions;

- That the current understanding of how ‘poor’ ocean conditions can become and how long such conditions can persist is insufficient to use in population persistence models

Specific Comments: The IMST believes that the overall clarity of the Plan could be improved if more detailed descriptions or explanations were provided on the following topics:

- Page 4. The life history described here may be a bit simplistic. Juvenile coho salmon appear to also use estuarine environments for extended rearing periods (several months) before migrating back upstream to over-winter (Miller and Sadro 2003). In addition, coho salmon from the ocean have been known to enter the mouth of an estuary, presumably taking advantage of feeding opportunities in that ecotone. This has been observed at the mouth of Coos Bay; the phenomenon appears to happen at irregular times a few years apart and is exhibited by fish approximately 15 inches (37 cm) in length (Michael Gray, Personal Communication[1]). The significance of such life history variability is that population viability models that do not consider such variants may inaccurately estimate the importance of good freshwater habitat types during certain ocean conditions.
- Pages 7, 21, 23, 25 & 46. Which ecological processes/functions must be restored, and to what rates (compared with current rates)?
- Page 12. Are there citations for historical Coho ESU run sizes? One million coho salmon spawners and 4000 miles of spawning habitat equates to an average of 250 spawners per mile. This is very different compared to the distribution criterion of four spawners per river mile. Does 250 spawners per mile seem high? Would not historical disturbances in time and space result in naturally varying habitat quantities and qualities across the Coho ESU? The IMST feels there is no logical connection between the historical conditions and the number of spawners stated in the distribution and abundance criteria.
- Page 12. Substitute “winter habitat” for "stream complexity" if that is what is meant by stream complexity.
- Page 19. If hatcheries and commercial fisheries harvest have adverse effects on wild coho salmon (p. 7), briefly explain why hatchery production is continued to support harvest.
- Page 21. Some examples of future actions taken to minimize adverse stressors such as fisheries harvest (particularly ocean fisheries), nonnative species (particularly on the lake populations), and hatcheries (particularly on the Salmon and North Umpqua) would make the paragraph more informative. Hatcheries, harvest, and nonnative fish species are directly regulated by ODFW, unlike habitat, and it seems wise for ODFW to directly reduce those three limiting factors.
- Pages 20 & 21. Measurable ecological criteria and monitoring are needed for 1–8. It would also be helpful to include a table here listing the criteria for 1–5, instead of referring the reader to Appendix 2.
- Pages 23 & 41. Indicate that ocean habitat is a greater bottleneck than freshwater winter habitat or stream habitat conditions. Also note that ocean warming of 1–2 degrees for a

[1] Mike Gray, November 17, 2006. Oregon Department of Fish and Wildlife, Charleston, Oregon.

species near the southern extent of its range may leave the Coho ESU in a permanently impaired state.

- Page 25. Is there evidence that actions benefiting coho salmon will benefit other fish and move processes towards a pre-disturbance state? Will promoting stream habitats for coho salmon adversely affect other species? If so, could this be significant and can this be evaluated? Improving riparian habitats and stream conditions across the landscape should lead to improvements in water quality. These improvements could well benefit other species. However, if habitat that favors coho salmon were greatly increased would that be to the detriment of species that compete with coho salmon such as cutthroat or steelhead, or species such as lamprey that have different habitat requirements? Also, how can the proposed actions improve process rates?
- Page 28. How will hatcheries improve Coho ESU production in the Nehalem, Tillamook, Siletz, and Alsea, but limit Coho ESU production in the Salmon and North Umpqua?
- Page 37, DOGAMI. Although sediment was not listed as a limiting factor, water quality was and excess sediment is considered in that category.

Editorial Comments:

The text of the Plan would benefit by having the document edited for readability. Many sentences include repetitive words or phrases that slow the reader down. Soliciting the services of a professional editor may be an efficient solution to these issues. The following are some examples rather than a complete listing.

Page 3, In Table 1, the word “Spawners” is used. Technically this should have been “Escapement” which was used in Table 2. This would then be consistent.

Page 11, Last sentence. This sentence is incomplete and reads as though a word is missing.

Page 11, Three lines from bottom. Note, however, not "Oregon, note, however"?

Pages 12 and 24. Stream complexity is defined on both pages but the two definitions differ slightly.

Page 21, Line 10. double the capacity, not "twice the capacity"

Page 23, Line 12 from bottom. their lives, not their life.

Page 26, Line 13. Delete "t" from "will t support"

Page 44, Line 14, Governor's, not "vernor’s".

Table 3, Delete line below Lower Umpqua.

REVIEW OF APPENDIX 2: Desired Status

This section contains the IMST's review of the State of Oregon's draft Appendix 2: *Desired Status: Measurable Criteria for the Oregon Coast Coho ESU Conservation Plan* [September 20 Draft]. The IMST was subsequently asked to also review a new section "Criterion 3 – Productivity" in an [October 6, 2006 Draft] of Appendix 2. Therefore, the following review concerns the earlier draft except for comments pertinent to the productivity criterion. In the preceding section, the IMST reviewed the more general Conservation Plan that is the foundation for these criteria. The IMST commends the State for its efforts in integrating stakeholder opinion in the delineation of measurable criteria to determine the success of conservation efforts aimed at Coho ESU freshwater habitat.

The following review begins with a description of general concerns about the measurable criteria followed by specific comments relating to each of the measurable criteria included in both versions of Appendix 2. Because the heading numbers are different in the September 20 and October 6 documents the headers in this review are not numbered.

Technical Comments:

The ODFW measurable criteria are relevant to achieving the desired status for the Coho ESU and do appear measurable. The IMST fully supports the four critical considerations (listed on page 1) used to guide the development of these measurable criteria. Measuring six criteria for the independent populations will be a challenging undertaking.

General Concerns: The criteria appear to define end-point goals, but it is unclear if true endpoints will be measured or monitored or if measurements are actually "trends". In Appendix 2, trend analyses also are suggested to observe positive trends along the way. The IMST urges the State to look for negative trends also. The two measurable criteria (spawner trends and habitat conditions) for *truly* dependent populations will document trends. These criteria are sufficient if the State has high confidence that assignment to independent/dependent categories are robust (see comments on independent/dependent population assignments in IMST 2005). The success of the final Plan in achieving its goals depends on the independent populations meeting six criteria and dependent populations meeting two criteria. The IMST concurs that this approach is supported by the best available science.

The measurable criteria for independent populations include abundance, persistence, productivity, within-population distribution, diversity and habitat. Monitoring indicators typically are more effective if they are based on variables with relatively low levels of variability in the data sets. If too much variability in the data set exists then they don't make very good high level management indicators.

The IMST agrees with these multiple criteria except for the diversity and habitat criteria as written. The diversity and habitat criteria are not independent of the abundance criterion. Weighting these three criteria equally may result in an inflated estimation of success, especially when the Coho ESU varies markedly in size among basins and years.

A weakness identified for several criteria is that they are evaluated using a pass/fail system across a 12-year period. What is the scientific justification for using a categorical system rather than analysis of trends? This approach will potentially sum pass/fail evaluations across years

with both good and unfavorable marine survival years. It may be more useful to adjust the evaluation system for good, moderate, and unfavorable years. Some parts of the document begin to address this issue but other areas sections are overly absolute.

What is the scientific basis for the '6 times in any 12-year period' evaluation used in many of the pass metrics? Is the intention that benefits should be provided in more than 50% of the years or at some higher frequency? Also, the rationale behind the 12- year time frame requires better explanation. This timeframe may not be long enough to encompass the variability in most ocean cycles (Peterson et al. 2006). It is unclear if this is intended to relate to coho salmon generation time or life cycle. The scientific defensibility of relevant criteria would be strengthened if the measurement timeframe was increased to accommodate various ocean cycles.

Adult Abundance: The IMST has reservations about the goal of doubling the average abundance. This goal appears to focus on a measure of central tendency rather than on measures of variability that may matter more to salmon persistence.

To increase the margin of safety the State might also consider developing a measurable criterion that considers the low end of the abundance threshold. The average is likely not a suitable criterion because of the range of variability possible.

The discussion of 'false positives' seems circular. This section reads as if the habitat criterion will be used to determine if increased habitat is driving changes instead of ocean conditions. It reads as though the Plan authors are saying, freshwater habitat was rehabilitated and the Coho ESU abundance increased so the State plans to measure the rehabilitated habitat to determine if this is why more fish returned. This seems doubly circular when abundance is used to assess habitat. Again, given that ocean cycles are at scales of multiple decades, is 12 years long enough to determine if habitat rehabilitation is increasing Coho ESU numbers beyond that of ocean conditions?

The abundance goal of doubling the average escapement during extremely low (about 1% average) marine survival periods (e.g. to 101,000) is extremely ambitious. The science behind the goal is not well substantiated (see Appendix A). The low (4.4%) survival escapement goal of 371,000 is possible but also very ambitious. The IMST feels that the State may have underestimated the marine bottleneck in setting this criterion.

The "Spawners" label in Table 1 should probably be 'Escapements'.

Persistence: Several apparent anomalies exist in Table 4 that, if explained, would strengthen this criterion. What is driving model results close to 0 for some populations? What is happening when there are large differences between QET (Quasi-Extinction Threshold)=1 and QET=50 and why should QET=50 give a lower probability (e.g. Salmon River)? Why are persistence probabilities consistently lower for the Beverton-Holt model and how do the assumptions of this model differ from the others presented?

The quasi-extinction values (1 and 50) are not self-explanatory. What are these? It would help readers if "quasi-extinction" was defined.

Using the average of the 4 models may not be better than using one model. The IMST suggests that using the most conservative model (in terms of predicting number of spawners) would

reduce the likelihood of poorly informed management decisions. If multiple models are to be used collectively, then an average weighted by confidence in the respective models or a confidence interval would perhaps be more appropriate.

Productivity: This criterion was presented in the October 6th draft. The IMST agrees that it is wise for the State not to use a criterion for productivity at this time because of difficulty in measuring it. The Team supports the State's and ODFW's efforts to develop such a criterion in the future and to use an interim approach until this is achieved.

What would the productivity criterion contribute that the abundance criterion does not? Are the proposed evaluation thresholds for the Coho ESU as a whole or for each independent population within the ESU?

The State might consider the different assumptions and potential usefulness of calculating the Net Reproductive Rate (Birch 1948; Molles 2005) compared to recruit to spawner ratio (R/S) calculated from recruits produced from parent spawners. The Net Reproductive Rate requires estimates of freshwater and marine survivals and female egg numbers by cohorts (year classes). Poor marine survival years usually correlate with smaller adults with fewer eggs. A pass threshold would be a net reproductive rate of 1 or greater over some time period. A failure would be less than 1 over a time period. During periods of good and moderate marine survivals, net reproductive rates will be higher than 1 and during poor marine survival periods net reproductive rates will be less than 1. This is in fact the same as using R/S values. If the resultant reproductive rates and recruits per spawners are a problem, perhaps productivity as a criterion is not useful. The calculated net reproductive rates will speak for themselves and could indicate the innate potential to rebound in moderate to good marine survival periods from lows reached in poor marine survival periods.

The Appendix 2 authors make the case that R/S values must be standardized for both marine survival and spawner density but they are not clear how the interim measure using the shape of recruitment curves accounts for these factors.

Within Population Distribution: The goal of this criterion is to 'identify when a restriction in spawner distribution is greater than expected for a healthy population under given marine survival conditions'. The measure is dependent on data obtained during the recent period of poor marine survival. This constitutes n=1 unfavorable ocean condition events for each population. The reach data used in regression analyses are not independent because they co-vary with changing ocean conditions.

With respect to the SVB (not defined by the Appendix 2 authors) statistic: Given the nonrandom distributions of many biological populations, what are the biological implications of assuming a random distribution in the regularity ratio? Can this tell us anything about the expansion or reduction of population boundaries and why those distributional changes might be occurring? Also, what does SVB stand for?

What would the consequence(s) to Coho ESU viability be if the occupancy threshold is not biologically viable?

In Table 5: How do the occupancy goals compare to the last period of unfavorable ocean conditions? Is there a biological explanation for rivers where the adjusted R^2 is low (e.g., Coquille, Salmon, Nestucca)?

Assuming the minimum 4 spawners per mile and 4,000 miles of spawning habitat, this yields 16,000 spawners. This is a low number of spawners and likely insufficient to make use of all available habitat in Coast Range streams. Is this lower than "minimum"? Perhaps the minimum number of spawners per mile needs to be more than 4. There seems to be a lack of connection between the abundance and distribution goals and the habitat improvement goal.

Distribution of 4 spawners/mile gives an abundance value but would be more appropriately stated as 'a minimum of 4 fish in every mile of spawning habitat'. As written the criterion doesn't really address the issue of spatial distribution. It also does not address the issue of the distribution of good spawning habitat and its relation to fish. Currently, it simply measures fish per mile of stream and doesn't account for how fish are distributed through the spawning habitat.

Diversity: IMST disagrees with the usefulness of the diversity criterion as presented. This criterion is not independent of the abundance criterion and does not describe how past hatchery and commercial fishery harvest practices have changed genetic variability in present Coho ESU populations. What are the spatial genetic and life history variability patterns in the Coho ESU throughout its range and how might they relate?

Diversity is certainly important for persistence of the Coho ESU. Perhaps some weighting factor could be applied to this criterion so that it could be included in the evaluation matrix. However, for this criterion to add novel information, a quantitative link between abundance and heterozygosity must be established. The IMST does not believe that abundance is a good surrogate for within-population heterozygosity. The criterion does not provide a science-based description for why abundance adequately monitors heterozygosity. The independence and usefulness of this criterion would be greatly improved if the State first defined the aspect of diversity it wished to monitor (e.g., life-history characteristics or allelic diversity). Subsequently, the State could develop scientifically defensible measures of that diversity.

Habitat Conditions: Overall, this criterion appears scientifically defensible, but the IMST questions some of the specifics of the criterion as currently stated. The IMST has already noted that the stream mile goals are tentative and may be refined with monitoring results, part of adaptive management. The IMST questions the assumption that smolts during unfavorable ocean conditions are only produced from high quality habitat. This assumption can be evaluated with further monitoring. IMST is concerned that habitat condition is measured only by another abundance metric. Some physical habitat metrics (large wood density, residual pool volume, summer temperatures, excess fines) also seem warranted. It is quite possible that smolt production varies among basins depending on ocean conditions; i.e., all basins may not respond in the same amount or even in the same direction to the same ocean. It also may be important to examine basin or sub-basin scales of variability to detect meaningful change. For example, fish IBI scores were affected by differing basin geologies, areas and slopes (Kaufmann & Hughes 2006). Basin lithology explained 75% of the variation in cutthroat abundance (Gresswell et al. 2006). Most variation in pool size was explained by basin area, while large wood density was

negatively related to percent sedimentary rock (Burnett et al. 2006). Gallo et al. (2005) reported that watersheds with 0.1 road mile per stream mile or 1-3 crossings per stream mile were in poor condition.

In Table 7, Footnote 1, could read:

> " Spawner goal @ 1.1% marine survival (Table 2) times 0.03/0.011."

Footnote 2 might be easier to understand if written as:

> "Spawner Goal @ 3% marine survival times 1.15. 15% is the maximum … etc."

Footnote 4 might need similar language (times 1.15).

Criteria for Dependent Populations: The IMST agrees that dependent populations are important and they need to be conserved. The Team agrees with the trend criteria (spawners and habitat conditions) and feels that the surveys described as beginning in 2006 will contribute significantly to our knowledge of coho salmon.

How can the authors explain the observation on page 17 (September 20 draft) that a similarity of trends of dependent and independent populations within a stratum is expected and is consistent with the defined population structure of the Coho ESU? The IMST suggests that the only common factor is the condition of the California Current in those years.

Editorial Comments on September 20 draft:

Page 9. Define QET in the title for Table 4.

Pages 10-11. Criterion 3, not "4", also please define SVB.

Page 11. line 19, key into, not "a key into"

Page 23. pairing, not "paring"

Page 28. by where, not "by the where"

Page 34. construct a curve, not "construct of curve"

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 B 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 B for information regarding formal responses, desired format, and evaluation of responses by IMST).

<u>Recommendation 1.</u> The IMST recommends that ODFW ensure that the adaptive management component of the *State of Oregon Conservation Plan for the Oregon Coast Coho Evolutionary Significant Unit* be developed consistent with current science literature on adaptive management. In particular, we recommend incorporating:

- **action plans for responding to departures from predicted trends in measurable criteria (and thus, conditions of the Coho ESU), both positive and negative; and**
- **a monitoring and analysis framework that is sufficiently robust to detect changes in those measurable criteria early enough for the State to respond if necessary.**

Adaptive management is viewed as a scientifically valid and prudent approach for managing lands and resources in situations where new strategies are being tried (Walters 1986; 1997), such as the Plan. The Plan recognizes this by proposing an adaptive approach to conservation of the Coho ESU. In "active adaptation", the adopted management strategy is viewed as a hypothesis to be experimentally tested, and if it does not yield the desired or predicted results, an alternative strategy can be pursued (Walters and Holling 1990). Ideally, adaptive management sets a scientifically rigorous framework for this process to unfold and for making decisions as information and understanding accumulate.

<u>Recommendation 2.</u> The IMST recommends that the Oregon Plan Core Team assess the degree to which individual agency contributions to the Plan may be effective in meeting the Plan goals.

The Plan lists numerous current and proposed agency actions that are presumed to collectively support the goals of the Plan. However, there is no provision for determining the relative contributions of individual actions, nor the consequences to Coho ESU population status if proposed actions do not actually occur. This is especially true of actions that depend on factors beyond agencies' control, such as actions or inaction by private landowners, or the receipt or elimination of additional funding. In addition, there is no ability to determine how well agency actions will be integrated, and what their collective effects are likely to be. Ideally, an evaluation of potential agency contributions to Plan effectiveness would be carried out using predictive modeling and currently available data (Van Sickle et al. 2004; Stanfield et al. 2006). Finally, there is little evidence of close collaboration among agencies, such as shared survey sampling designs, common stressor and response indicators, open-access databases, or inter-agency

research and monitoring. This hinders assessing the relative effectiveness of various rehabilitation actions on habitat and Coho ESU populations (e.g. Gallo et al. 2005). Modeling and closer inter-agency collaboration would improve the State's ability to prioritize among actions, address possible consequences of insufficient accomplishments, and at the end of the monitoring cycle, ascertain which actions were or were not most supportive of Coho ESU conservation goals.

<u>Recommendation 3.</u> IMST recommends that ODFW employ multiple measurement time frames (e.g., 3, 6, 12, 24, & 48 years) and formally evaluate and model Coho ESU abundance trends across those times. Modeling should include both long-term increases and decreases in ocean productivity.

ODFW currently monitors Coho ESU life histories by basin and proposes a measurement timeframe of 12 years (approximately 4 generations) in the Plan. However, the long-period Pacific Decadal Oscillation and shorter period El Niño-Southern Oscillation occur at periodic, yet irregular intervals (Pearcy 1992; Ware and Thompson 1991). Such changes in ocean conditions greatly affect coho salmon abundance positively or negatively through nutrient, prey, and predator abundances (Peterson et al. 2006). Therefore, management actions (habitat rehabilitation, hatchery and commercial fishery harvest levels) may be masked by co-varying, long-term ocean conditions (Pearcy 1992; Lawson 1993; Spence et al. 1996; Peterson et al. 2006). Although annual monitoring is essential for early trend detection, trends will occur in multiple timeframes, and many of the most important trends occur on the scale of multiple decades.

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APPENDIX A

The Marine Bottleneck: As in the State's *Viability Criteria and Status Assessment of Oregon Coastal Coho*, it appears to the IMST that this Conservation Plan also assumes that a "low abundance paradigm" applies to Coho ESU population dynamics and that the Coho ESU can survive extended periods of adverse ocean conditions in the California Current similar to those observed between 1990 and 1997. The State of Oregon apparently reached these conclusions through the use of population dynamics models that include both freshwater and marine survivals. It is unclear to IMST whether mixed effects predictive models were used or not. Population models that include all life history stages will generally predict that and increase in the survival of one life stage can overcome reduced survival in another life stage. Also, the ODFW habitat model predicts that varying marine survivals result in use of varying amounts of freshwater habitats. The State of Oregon appears to have concluded from these results that improving and expanding Coho ESU freshwater habitats can improve freshwater survivals enough to overcome periods of low marine survivals. An opposing hypothesis is that conditions in the California Current (food supplies and predators) are limiting Coho ESU productivities during periods of low marine survivals and that increasing freshwater habitat quality and quantity cannot overcome the marine bottleneck. How the Coho ESU will actually respond to various combinations of these limiting factors creates uncertainty regarding the goal of doubling Coho ESU populations during an extended period of unfavorable marine conditions. This does not mean that the IMST believes that freshwater habitat is irrelevant. High productivity during moderate to good ocean years can provide important societal benefits and may provide a buffer against poor survival when ocean conditions are unfavorable. However, the success of freshwater recovery actions will be measured using fish numbers during periods of unfavorable ocean conditions. The inherent variability in the coho salmon life cycle (switching between spawning and recruitment dependency) may set the State up to fail on some of its goals.

From about 1975 to 1998 the northeast Pacific Ocean was warming (Kaczynski 1998, National Marine Fisheries Service 1998, Peterson et al. 2006). Major current changes began in 1976 (Bernal and McGowan 1981; Chelton et al. 1982; McLain 1984; Pearcy 1992; Barry et al. 1995; Graham 1995; Roemmich and McGowan 1995). The California Current slowed and weakened, stratification grew stronger and shallower, upwelling decreased, and nutrients for phytoplankton in the mixed photic zone decreased. As the northeast Pacific warmed, there were invertebrate species shifts northward (e.g., Barry et al. 1995; Hooff and Peterson 2006). Phytoplankton and zooplankton production in the California Current decreased as the waters warmed (Peterson et al. 2006). Marine birds and mammals were seriously affected and many marine fish and invertebrate species shifted their distributions northward (McGowan et al. 1998). Norton and Mason (2005) reported that log transformed sardine landings were closely related to accumulated sea surface temperature anomalies at La Jolla, California ($R^2 = 0.90$). They concluded that 40 to 50% of the variance in 39 other fish and invertebrate landings could be explained by physical variables in the California Current, primarily sea surface temperatures. The variability of the abundance of 29 species was correlated with the variability of abundance of sardines. Climate-scale changes in the fish and invertebrate assemblages occurred from 1930 to 2000 (Norton and Mason 2005). Zooplankton production in the California Current declined over 70% from 1975 to 1995 with similar declines in larval fish biomass (McGowan et al. 1998). Roemmich and McGowan (1995) calculated up to 80% reduction in zooplankton biomass in this period. Per classical ecological

theory (Odum 1959), a 70% reduction in zooplankton results in a 70% decline in predators dependent upon them, such as juvenile coho salmon in the California Current. An 80% reduction would result in a food supply that could only support 20% of the prior predator biomass (such as coho salmon). And the preferred prey (large amphipods) of juvenile coho salmon declined 80% being replaced by smaller less preferred copepods (McGowan et al. 1998). The body size of coho salmon surviving this period reflected these food reductions. Average weight of troll-caught coho salmon was 8.2 pounds from 1970 to 1975 while average weight from 1976 to 1991 was only 6.2 pounds (dressed weight corrected to whole weight in September from Pacific Fisheries Management Council catch data records). Wells et al. (2006) showed that size variation of coho salmon stocks south of Alaska (Washington, Oregon, California) was synchronous and negatively correlated with warm ocean conditions and weak North Pacific high pressure during ocean residence.

The adverse marine conditions reduced coho salmon survivals. From 1965 to 1975, the average coho salmon marine survival was 6.7% (Nickelson, T. 1994 personal communication[2]). From 1976 to 1990 the average coho salmon marine survival was about 3.2% (Kaczynski 1998). Figure 3 of Amendment 13 and Welch et al. (2000) had the same basic estimates as all estimates came from OPIA hatchery release, catch and return data. From 1991 to 1997 the average survival was only about 1.2% (same sources). Applying classical food chain dynamics, a 70% reduction in the coho salmon food base should result in a marine survival of about 2% (from 6.7%). An 80% reduction should result in a marine survival of about 1.3%. The observed average marine survival from the 1991 to 1997 period was 1.2% (and was as low as 0.5%), which was close but less than predicted by the reduction in the food base alone. From 1999 to 2005, the average survival was about 2.6%, with a low of 0.5% in 2005 and a high of 4.5% in 2000 (Peterson et al. 2006). A change in the predators of juvenile coho salmon, such as a shift northward of Pacific mackerel that was also observed in this period, could easily account for the additional decline in coho salmon survival.

Applying the conservative calculation of the net reproductive rate (Birch 1948; Molles 2005) and using an average 3% freshwater survival as seen in 5 streams in western Oregon and Washington and 2,500 eggs per female the Oregon Coast average (1,250 female eggs; ODFW 1982), Kaczynski (1994) calculated that 2.7% smolt to adult marine survival was necessary to maintain the coho salmon population. This is a net reproductive rate of 1 (1 daughter replacing 1 female in the course of 1 generation; directly analogous to 2 recruits per spawner pair, a ratio of 1). Coho salmon survival was so poor in 1976, 1983, 1984, 1986, 1989, and 1991 to 1997 (smolt entry years) that populations probably declined naturally even without the added fishing mortalities that occurred. If the California Current gradually warms with global warming, conditions for marine survival may worsen in the future. California and Oregon coho salmon populations could contract as has been observed in other species.

What Freshwater Survival Rates Might Be Necessary To Overcome Low Marine Survival Rates?
Ignoring the marine bottleneck and assuming that increasing freshwater survival can overcome poor marine survival rates, how much of an increase in freshwater survival would be required? This can be calculated by applying the net reproductive rate.

[2] Nickelson, Tom., Oregon Department of Fish and Wildlife. Personal communication to V. Kaczynski in 1994.

The net reproductibe rate is 1 when marine survival is 2.7%, freshwater survival is 3% and the mean number of female eggs per female is 1,250. Given a marine survival rate of 1.1% in the Plan and a doubling of escapement (net reproductive rate equals 2), what freshwater survival rate would be required? 1,250 female eggs per female are probably too high when productivity in the California Current is low as was observed from 1976 to 1998. coho salmon weights in September dropped from 8.2 to 6.2 pounds from 1970 to 1975 versus 1976 to 1991. This was roughly a 24% weight drop. Egg numbers in coho salmon are proportional to length and weight (Shapovalov and Taft 1954). Would female egg numbers drop 24% to 950? Let us use 1,000 female eggs per female, as this appears reasonable for this example (and can be refined if needed). So:

$$R = 2 = (0.011)\ (X)\ (1{,}000)$$

$$11(X) = 2$$

X = 0.18 or 18% freshwater survival would be needed in one generation (with more good freshwater habitats in the future) to meet a goal of 101,000 spawners.

Eighteen percent freshwater survival for coho salmon has never been seen to the knowledge of the IMST. Achieving an average 18% freshwater survival for coho salmon in any generation during a very low marine survival period is highly improbable. The goal of doubling the escapement abundance at extremely low (1.1%) smolt to adult survival does not appear feasible.

A similar analysis can be done for a 371,000-escapement goal at 4.4% average marine survival. The average escapement during such a period is estimated by dividing 371,000 by this average escapement-- this is the net reproductive rate to use in the example to derive the needed boost in freshwater survival. Using the actual escapements in Table 3 of Appendix 2 for low survival years, the average escapement is 140,000. Thus the net reproductive rate needed is 2.65. So:

$$R = 2.65 = (0.044)\ (X)\ (1{,}250)$$

$$55(X) = 2.65$$

X = 0.048 or 4.8% average survival would be needed in one generation with more good freshwater habitats to meet a future goal of 140,000 adult coho salmon.

4.8% egg to smolt survival is within the range reported in the literature (Sandercock 1991). Achieving this average for coho salmon during a low or moderate marine survival period is a very ambitious goal. Achieving the 371,000-escapement goal might be possible over time as the net reproductive rate should be about 1.8 (growing) assuming just 3% freshwater survival.

With the data available at this time, we cannot evaluate the freshwater survivals needed to meet the 10.3% and 15% marine survival escapements. Have these survival levels been seen since 1970? If these survival levels were estimated before 1970, then it would be appropriate for Appendix 2 to discuss the reliability of the estimates.

Table 3 in Appendix 2 exhibits great year-to-year variability in Coho ESU abundance and some decade-scale trends in observed returns (survivals). These are important observations. Year-to-year changes in the freshwater environments of the Coho ESU likely cannot explain the variability and trends. This variation is better explained by year-to-year changes in the California Current (Kaczynski 1998). This reinforces the hypothesis that the marine environment is controlling productivity of the Coho ESU in poor marine survival years. Appendix 2 should address whether any of the total escapements in Table 3 reflect the present productivity potential

of the freshwater habitat for the Coho ESU. It is doubtful that improved changes in the freshwater environment can significantly improve productivity of the Coho ESU in unfavorable ocean years. The lake populations are anomalous in their returns.

Clearly, the marine environment appears to be controlling Coho ESU productivity during low survival periods. This is not to say that the freshwater environment is unimportant. Without it, the Coho ESU cannot persist. During moderate to highly productive ocean years, high Coho ESU productivity can result and produce substantial coho salmon returns. Improvements in riparian areas and stream conditions can benefit water quality and other species. It is likely that riparian and freshwater habitat improvements, increased the Coho ESU freshwater survivals, and larger populations during moderate to good ocean survival periods might make the Coho ESU more resilient going into a poor ocean survival period (e.g., Nickelson and Lawson 1998).

APPENDIX B: Recommendation Background

The IMST creates several types of reports[3]. 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[4].

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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[3] 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.

[4] 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).