Center for Independent Experts (CIE) Review of the June 15 2009 Recovery Plan for the Southern Oregon Northern California Coast (SONCC) Coho Salmon

Mike Bradford
Vancouver BC

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Executive Summary

The Southern Oregon Northern California Coast (SONCC) coho recovery plan provides guidance to managers charged with the recovery of this population complex. The plan provides a good overview of the issues and the regulatory framework, and general information on the biology and habitat needs of the species. A logical framework for subdividing the ESU into populations has been devised, and reasonable recovery goals, in terms of spawners, have been set. An extensive analysis of the habitat and land-use conditions in each watershed has been conducted using the CAP process, and recovery actions for freshwater habitat are identified based on the CAP results.

In my view, the recovery plan could be improved in the following ways:

1. Make greater use of quantitative information from the SONCC where available and elsewhere, where appropriate. Much of the plan is narrative in nature and sometimes, it is unclear whether the assertions being made are based on evidence or opinion. Detailed analyses are not always required but a few simple graphics such as time trends in abundance, catch, exploitation rates, ocean survival, or maps of abundance estimates would be helpful.
2. From point (1), a more thorough assessment of the relative roles of habitat conditions, marine survival rates and exploitation in contributing to the overall status of the ESU is needed. The current focus is on freshwater habitat, but it is unclear whether these populations are recoverable at all, given current and future trends in ocean conditions.
3. The recovery goals should have timelines, and an analysis of risk. If the recovery actions deemed to have the greatest impact on freshwater habitats take 50 years to become effective, then that needs to be identified. The risk analysis might consider the effects of downturns in ocean survival, the uncertainty surrounding the habitat restoration activities (which should be informed by experience elsewhere), and institutional or societal risks.
4. The current status of the ESU (in terms of salmon abundance) should form the template for recovery, rather than watersheds, which is the approach used in the plan. While it is ultimately desirable to have fish in every watershed, it would seem more effective to begin in basins where the remaining population is reasonably abundant and work from there in a staged manner. It would seem more beneficial to focus efforts on extant populations than in streams where the numerical abundance of coho is so low that recovery in unlikely unless there is a major shift in ocean survival. Similarly recovery actions should be staged, starting with those that will yield immediate results (such as water flow and temperature control) to those that are decadal in nature.
5. The recovery actions should span the complete range of threats and actions so that all of the required recovery actions are encoded in the plan. For example, harvest rate, and the way that harvest rate might change with abundance, should be included. Strategies for the control of non-native fish should be identified. Conservation hatchery programs (fry supplementation) can be useful tools to kickstart very small populations.

6. SONCC coho have been identified formally as a conservation concern for more than a decade yet it appears that the responsible agencies have yet to implement a monitoring program to follow trends in the abundance of adults and juveniles on a consistent basis. The development of a structured program to track changes in the status of the ESU, and the efficacy of recovery actions is urgently needed.

SONCC Review

Recovery planning for the SONCC coho salmon complex presents significant challenges. The virtual absence of standard salmon assessment data including abundances and estimates of survival rates and other life history parameters makes the identification of the causes of declines to be largely based on judgment or inferences from other regions. Further, the lack of baseline data will make the evaluation of recovery activities difficult.

Many, if not most, of the freshwater habitats in the region have suffered from the combination of highly erodible bedrock, high rainfall, and a long history of extensive land use (particularly forestry and placer mining). Water withdrawals in the interior regions have exacerbated flow and stream temperature issues. Other than the restoration of streamflow and connectivity (via physical works), most of the measures to restore watersheds are very long-term endeavors, as acknowledged in the report. There is a danger that the time frame of these actions may not meet the needs of the target species.

At the larger, regional, scale salmon abundances are driven by changes in ocean conditions that affect the smolt-adult survival rate. In many other regions the forecasted ocean survival rate is a key management tool, and programs are in place to monitor survival and develop predictive tools for it. This does not appear to be the case for the SONCC region. As a result, it is difficult in the material presented in the Plan to determine how large a role ocean survival has played in the current status of the population, and what might be expected in the future. Information from the Pacific Northwest can provide guidelines for the ocean survival rates that can permit recovery of populations from good, average or degraded freshwater habitats.

The recovery plan itself (as specified in the sections in Chapter 11) is really a freshwater habitat recovery plan. For the most part the actions identified and the recovery criteria are designed to restore streams back to the range of condition that is close to natural, or at least sufficient to support salmonid populations. Because many of the threats to stream habitats are the result of land-use activities, changes to those activities could have significant impacts on stakeholders within the watershed. Thus I think a stronger case should be made that the actions proposed will lead to the recovery of coho salmon.

To make the plan more specific to the recovery of SONCC coho salmon there should be a chapter on the current status of coho within the region. Rather than rely on biostandards to estimate potential historic populations, this chapter would use whatever information is available to evaluate which streams have none, some, or many coho salmon. There are sufficient data in the literature to relate observations on fry, smolts or adults to adult population size so that virtually any source of information could be brought to bear to evaluate current status. There are methods available to estimate the probability of a species being present based on capture probability that could be employed evaluate null results in the data.

Once the status of each stream’s spawning population has been determined (in relative or absolute terms), the data can be mapped to determine the spatial mosaic of existing populations. These data can also be used to validate the assumptions underlying the current CAP process and the recovery plan, that is, the current status and recoverability of populations are related to the present and future status of freshwater habitat. If this is true, there should be some sort of relation between the current status of the population and the overall CAP rating or a subset of indicators that are particularly important. Such an analysis would be extremely useful to support the CAP process.

The spatial organization of the stronger extant populations should be used as the template for recovery activities. Coho salmon usually have some sort of metapopulation dynamics, and it seems sensible to focus actions on rebuilding populations that have sufficient existing abundance so that the management actions will produce the greatest increase in spawners. Local increases in abundance are likely to result in fish expanding in range, either within the basin, or among basins. Under this framework recovery may focus on a few nodes within the SONCC that take advantage of existing abundance (and presumably reasonable intact habitats), and grow outward from there.

Because the current Plan is largely based on the recovery of freshwater habitats throughout the range, actions are proposed for all watersheds, and no overall spatial organization is proposed. There may be administrative reasons for this, but I do not think this is necessarily the best way to maximize the rate of recovery at the ESU level. It will be extremely difficult to rebuild a population using habitat-based measures when the existing population consists of only a few spawners, perhaps strays from other streams that show up sporadically depending on ocean conditions and streamflows during the migration period.

Recovery goals and strategies usually have a numerical target, a time frame, and a probability of success (when a fully quantitative approach is taken). An example might be "taking actions that have an 80% chance of reaching 5,000 spawners within 5 generations". Based on this type of target, recover actions can be evaluated to determine their contribution to reaching this target. The probabilistic statement about recovery is the result of uncertainty about recovery actions, and unpredictability of future events. In the case of salmon, the latter can be due to trends in ocean survival that can effectively prevent recovery.

The current Plan is devoid of timelines and any assessment of risk of recovery. A recovery timeline may be informed by the current status of the population and the recent threats, as well as societal expectations. If a population is an extremely poor state, interim targets can be established along with a relatively short timeline to reduce the imminent risk to persistence. Such a target would be less than the current goal that is based on "full seeding", but probably more than the lower "depensation" values proposed in the current Plan. This type of recovery timeline would necessarily require recovery actions designed to achieve immediate results. Examples might be additions to stream flow, physical works to the stream or floodplain, reductions in exploitation and other harm, and conservation breeding programs. Longer term recovery actions such as property purchases, changes to forestry practices and riparian plantings may take decades before any significant changes will take place to salmon survival rates. The timelines associated with these types of activities needs to be explicitly recognized, as there is a risk that the populations could be in too poor a condition to recover by the time the habitat actions take effect.

There is also a need for some sort of risk analysis to accompany the recovery plan. As most of the plan is based on watershed restoration, it would be worth considering experience elsewhere with large-scale restorations to ask “what is the probability of such a program provided the increases in freshwater survival needed to affect the recovery of SONCC coho salmon?” I believe there are a few evaluations of programs of this sort in the Pacific Northwest and those results could be helpful for the risk assessment.

A fuller description and consideration of all available recovery actions would be useful in Chapters 4 or 6. Harvest rate restrictions should be indentified as a recovery action, and some guidance provided on how and when those restrictions might be relaxed if abundance was to increase. It may be important to identify that harvest restrictions will need to be in place throughout the rebuilding stages, and that there is not guarantee, even if abundance increases, that a sustainable harvest will be possible in the future.

Another recovery action that was not identified in the plan was the use of conservation breeding programs to kickstart diminished populations. Carefully designed breeding programs can minimize adverse genetic effects, although evaluations of these types of programs are just beginning. I believe this type of program is in use in other parts of the range for coho, and its role in the SONCC should be identified, one way or the other.

Conclusions and Recommendations

The conclusions and recommendations are as itemized in the Executive Summary at the beginning of this review report.

Responses to Questions contained in the Terms of Reference.

1. *Does the plan delineate those aspects of the species biology, life history and threats that are pertinent to its endangerment and recovery?*

Coho salmon are an extremely well-studied species, and the plan does provide reasonable overview of its biology in Chapter 3. The following text was taken from my CIE review of the central California coho recovery plan (and adapted slightly), as I think it is equally relevant to the SONCC Plan:

> Although the basic life cycle of the coho salmon is described in chapter 3 and is made use of in subsequent sections, in my view the large body of knowledge on coho salmon population dynamics could be used to greater advantage in recovery planning. In 2000, I made use of existing data for coho salmon in the Pacific Northwest to develop a simple 2-staged model based on the "hockey-stick" model of smolt production (Bradford et al. 2000) which has proven useful for coho salmon recovery planning (Bradford and Irvine 2000; Bradford and Wood 2004). Other, more detailed mechanistic models have also been developed.

On the freshwater side, coho salmon usually exhibit strong density-dependent mortality caused by physical habitat limitations. As long as there are sufficient spawners to fully seed the available habitats, smolt production is largely independent of spawner density, creating a flat smolt-spawner relation. Smolt production is usually limited by the availability of pool habitats, either for summer or winter rearing (Sharma and Hilborn 2001, Nickelson et al. 1992). Because stream morphology varies widely, there is considerable stream-to-stream variation in the carrying capacity. An empirical review produced estimates ranging from 500 to 4500 smolt/km, with most streams in the 1000-2000 smolts/km range (Bradford et al 1997). On top of the stream-specific variation, there is some year-to-year variation in smolt production within a stream; the CV is in the 25-30% range. While it is tempting to try to ascribe this variation to regional weather (floods, low flows etc.), a spatial analysis suggests that most of the variation in annual smolt yields is unique to each watershed, undoubtedly due to the interaction between regional weather and watershed-specific factors (Bradford 1999). To my knowledge there isn't a single environment variable that has successfully predicted annual variation in smolt yields across a range of streams.

Bradford et al. (2000) fit rectilinear broken-stick or "hockey-stick" models to coho salmon smolt-spawner data. This model has 2 parameters, the slope of the rising limb (α, as smolts/spawner), which is the rate of smolt production in the range of spawner abundances where the stream is not fully saturated, and K, the carrying capacity as smolts/km. While likely an oversimplification, this model does facilitate thinking about how the smolt-to-adult survival (S) and freshwater production interact, especially at low population levels.

The key outcome of using this model is that the recovery of small coho salmon populations is contingent on the interaction between the smolt-to-adult survival rate and α, the freshwater productivity at low abundance. Population growth will occur when the inequality $\alpha S(1-h)>1$ is true (h is the harvest rate, S is the smolt-adult survival rate). Stream carrying capacity (K) is not a consideration for the sustainability of small populations. Assuming the streams in Bradford et al. (2000) are representative of coho streams that are not in a degraded state, the available estimates for α suggest that at smolt-to-adult survival rates of under 3% (which includes all forms of fishing) will result in declines in half of the populations; at 2% marine and fishery survival most populations are predicted to decline.

The determinants of α have not been well studied, as most coho studies have focused on carrying capacity issues. Coho spawning success is usually good, with egg-fry survivals of 20% being measured; these are more than twice those recorded for pink, chum and sockeye salmon (Bradford 1995). Because coho spawning often scattered in headwater areas, it likely enables females to choose sites and are uncrowded and have good quality gravel. Most fry that are produced are swept immediately downstream after emergence; Bradford et al. (2000) found an average rate of migration of over 400 fry/female spawner leaving the natal stream in the spring months. This is significant as the total emergent fry per female is expected to be in the 3000 egg/female * 20% survival = 600 fry/female. This result indicates that spawning habitat is usually not limiting for coho salmon.

A clue to the cause of variation in α (the smolt productivity parameter) is provided by a negative relation between spring fry migrations and α (Bradford et al. 2000). That is, the most productive streams (high α) were those that had the lowest rates of outmigration of newly emergent fry. Bradford et al. (2000) hypothesized that those streams that were able to retain fry during the spring emergence/outmigration period were those that would produce the most smolts/spawner when abundances were low. Habitat complexity and the absence of spring flow extremes may be factors in retaining fry during this period.

Under this framework the key to population recovery is to address the factors that will lead to the retention of fry in the spring and will enhance the survival of those fry through to the smolt stage. These factors have not been identified in the field, but may include the severity of spring flows, channel complexity, and habitat configuration (the organization of spawning and rearing habitats along the channel).

Detailed research studies in streams with small numbers of coho spawners are needed to determine whether SONCC streams with the current habitat conditions are producing smolts at rates observed in the Pacific Northwest. If these rates are much lower, then poor survival due to habitat conditions or predation may be a limiting factor for recovery. If estimates of α are not especially low, then estuary, ocean, or fishing factors may have a greater role. Such research may also lead to a more focused habitat program directed at improving α, rather than broad-based activities that might lead to an increase in K, but will have little impact on recovery.

The plan is nearly devoid of empirical, quantitative, information on the status of SONCC coho salmon or life history information. I had the opportunity to briefly look at the nice paper by Brakensiek and Hankin (2007) and suggest that this study provides a useful starting point for further analysis. In their study they use capture-recapture methods to estimate smolt survival rates for Prairie Creek coho salmon in 1999 and 2000. Although the data were not analyzed this way, it is possible to use their information to estimate the total smolt run past 2 fyke nets that were installed in the creek. My quick calculations suggest that about 3000 smolts passed the upper trap (6.3 km of stream) and about 6000 passed the lower trap (13 km of stream). The resulting production estimates are about 500 smolts/km of stream. This is at the low end of the range among the historical database (Bradford et al. 1997; most streams are in the 1000-2000 smolts/km) for streams that are fully seeded. However, I believe that this was a period of lower ocean survival and the stream may have been underseeded. If escapement information is available it would be possible to calculate the smolts/spawner ratio (this is α from the section above). Either way, there is available information to begin to compare the productivity of Prairie Creek to those systems from the Pacific Northwest that have been better characterized. Further, if adult returns and ageing data are available, a smolt-adult survival rate can be derived for the creek as well. Though I am not aware of full extent of data that is available for the SONCC region the preceding calculations suggest to me that more could be made of whatever information is available. Burns (1971) is another useful source of quantitative historical information.

Chapter 3 does tend to underplay the significant role of large-scale ocean conditions on the population dynamics of the ESU as a whole. Ocean mortality accounts for about half of the total egg-adult mortality (Bradford 1995). Whereas freshwater survival tends to be uncorrelated among streams (Bradford 1999, possibly excepting very large floods), variation in ocean survival is usually correlated at regional scales. As noted above and highlighted by Lawson (1993), ocean survival and freshwater productivity interact to impact population trends. However, many of the recent trends in spawner abundance can be attributed to changes in ocean survival rates rather than habitat conditions which have probably varied at much longer time scales. The recent upsurge in Oregon coastal coho populations is an excellent example of that.

The section on ocean conditions in Chapter 2 is also rather vague about recent trends in marine survival and its role in endangerment. It should be possible to provide concrete information from the OPI region as well as some indication of trends in the SONCC region based on hatchery returns (which are little affected by freshwater habitat conditions) or other data.

Though the Plan does provide a general overview of these factors, as noted earlier a much more quantitative focus could be taken that lead to a more focused approach to recovery. A key issue that is not addressed is the role of long-term changes in ocean survival rates (as well as fishing) on the current status of the ESU. At the moment the focus is almost completely on freshwater habitat. There is plenty of reason to be concerned about freshwater habitats, but I could not find evidence to refute the ocean condition hypothesis. Based on the relatively well-defined production parameters for coho-producing streams, a key question is whether marine survival rates are low enough to prevent recovery regardless of short- or long-term freshwater habitat rehabilitation. If that is the case, then the only alternative may be to use carefully designed hatchery supplementation to increase the smolts/spawner ratios sufficiently to ensure an increase in spawner abundance over time.

2. *Is the recovery plan grounded in a clearly articulated and biologically meaningful conceptual framework?*

Generally yes, although there is a general lack of quantitative information throughout the report that would serve to support the assertions made in the Plan.

The generalized threats in Chapters 2 and 4 are well-described, and the quantitative measures of freshwater habitat condition are a useful and important summary. While there are many technical details that can be debated, the establishment of numeric targets for spawners in each stream provides a consistent basis for evaluating recovery.

Perhaps the weakest section of the Plan is in the actual Recovery Strategy (including the stress abatement objectives). Because the preliminary material provides little guidance on the relative importance of the stresses, the approach taken appears to be to attempt to remediate all stresses related to freshwater habitats for most of the watershed(s). While these activities are laudable for the general goal of watershed health, the Plan provides little guidance on their impact on coho recovery. Questions that come to mind are:

- Given the variable (and often dubious) success rate of physical habitat restoration, how likely are these measures likely to increase the freshwater productivity of the habitat?
- Are current and future ocean conditions too poor to expect recovery even if freshwater habitats were in moderate or better condition?
- “Natural” watershed restoration processes are likely to take 50 years or more. Will there still be any coho left by the time habitats are significantly improved?
- Will the decreased snowpacks, rainfall and increased human demands for water forecast for the future overwhelm restoration activities?

A more biologically meaningful approach is to consider explicitly how restoration activities will results in recovery of the populations and the ESU. For example, I would have difficulty with the decision to expend considerable effort in a stream where coho are functionally extirpated, or those for which few individual have been observed as such a stream is probably being supported by “strays” from adjacent larger source pools. It might be more effective to focus on increasing the productivity of existing larger populations (at least in the short term). Similarly, those actions that cause an immediate increase in survival should have priority over those that might take decades to come into effect.

3. *Does the recovery plan provide a useful and meaningful "road map" to recovery and have a logical strategy to achieve recovery that is relevant to habitats, life stages, populations, diversity groups and the overall ESU?*

No. I interpret a "road map" to mean sequence or plan of actions to achieve the recovery goals. Recent experience with Oregon Coastal Coho shows that the recovery goals could potentially be simply met with a couple of generations of good marine survival irrespective of the habitat work. Similarly, a run of poor years could equally thwart recovery efforts. Thus the importance of uncertain future conditions on recovery needs to be noted- recovery is not certain. The plan does mention focus on the key habitats of the core populations but there could be some further analysis to determine which activities in what order are likely to be the most successful. At the moment, at an ESU scale there is little prioritization of basins or activities (I am sure there are many more priority 1 and 2 activities than resources at the moment). Many of the activities are only likely to result in significant changes to freshwater habitats after a number of decades, and the plan does not identify how recovery will occur over the short, medium and longer terms.

4. *Does the plan use and incorporate the best available scientific, technical and commercial data and information?*

The Plan uses a reasonable amount of the literature to support its sections on the biology and habitat requirements. There are reviews of habitat restoration available that could provide some guidance on the efficacy of actions proposed. As noted, some empirical data should be added to the plan, as well as a stronger link to known aspects of coho population biology. The **References** section is incomplete.

5. *Does the plan meet the minimum standards described in section 4(f)(1)(b) of ESA by including site-specific management actions, objective measurable criteria and estimates of time and cost?*

No. A comprehensive list of site specific management actions and population and habitat objectives has also been provided. As far as I can tell, the cumulative costs or timelines for this work have not been determined.

6. *Does the plan incorporate general recovery tenants for coho salmon in the Klamath-Trinity River basin previously identified by the National Research Council in their final 2004 report?*

The NRC plan clearly identified stream flow and temperature as limiting factors for Klamath Coho and suggest that conditions could be rectified so that some of the important tributaries could become productive contributors. The recovery plan identified in Chapter 11 is consistent with their findings.

7. *Is the plan suitable for serving as an outreach tool to co-managers, stakeholders and other interested individuals or organizations and does it invite public participation in the recovery process?*

The extensive analysis of watershed condition contained in Chapter 11 provides considerable guidance to stakeholders within those watersheds. However, the lack of specific linkages between some of the land and water use activities and coho recovery may be an impediment to stakeholder engagement where sacrifices of personal or economic interests are at stake. The plan also does not speak to a number of potential stakeholders (harvesters, nearshore and marine groups).

8. *Are the products developed by the SONCC TRT from the SONCC Historical Population Structure and SONCC Population Viability Criteria reports described and applied appropriately within the recovery plan?*

Defining populations is a somewhat arbitrary task as spawners will interchange among tributaries in large basins and among coastal streams. These exchanges may be relatively small in number but nonetheless significant from a genetic perspective. The Plan uses a definition of population that depends on demographic independence and is largely based on watershed size. Populations defined at this scale may be sub-populations if genetic considerations are used (e.g., a definition of less than one migrant per generation). Thus it may not be appropriate use the demographic definition of populations when making N_e calculations. Similarly, genetic concerns probably shouldn't be invoked for the development of recovery guidelines using this definition of population.

It is somewhat surprising the depensation is used as a motivator for a lower benchmark (viability criteria as there remains no evidence for depensation in the freshwater component of the coho life cycle. There are examples from the Alsea watershed in Bradford et al. (2000) that shows good smolt production from very few spawners. I would think that a greater concern is demographic stochasticity, which is the greater significance of random events for very small populations. Examples of the negative consequences of demographic stochasticity include the probability of having no returns at all from a small smolt run, highly male-biased sex ratios, or a mismatch in run timing among those adults that do return. These factors tend to increase the variability in productivity (i.e., smolts/spawner) when populations are small, and could be disastrous if a number of negative events occur simultaneously. Importantly, these factors could also lead to very good production from few spawners if chance is on their side. Nonetheless, the values that were generated on the basis of depensation look reasonable as a benchmark for a high-risk level of abundance.

The minimum spawner levels identified for each basin are based on my meta-population analysis of Pacific Northwest stream and are the average level needed to fully saturate the stream with juveniles (to maximize smolt production). This is a reasonable starting point, and the resulting goals (Table 6.1-3) are large enough to minimize genetic risks and provide sufficient buffer against a multiyear downturn in ocean conditions. Sometimes, meeting these types of recovery goals gives fishery managers the impression that harvest levels can be increased to historic levels. Estimates of productivity (derived from ocean survival rates or recruits/spawner) are needed to determine the level of harvest these populations can sustain once recovered.

9. *Is the SONCC recovery plan clear regarding the differences between biological population viability and threats abatement recovery criteria?*

Unfortunately the Plan does not contain the phrase "Threats abatement recovery criteria". I interpret this question to mean the freshwater habitat suitability indicators located in Table 4.2-1 and the surrounding text. Text in Chapter 6 often suggests that the recovery criteria are a "medium stress", but it is not clear from the document from where these stress ratings arise. A version of Table 4.2-1 that indicates the stresses and what constitutes acceptable levels for recovery would be a useful addition. This new table's entries should exactly match the "stresses across targets" tables found in Chapter 11. Chapter 4 is a methods section and the information in this should inform the reader on how the tables and ratings in Chapter 11 were done. As in any technical report, the headings and sections in the methods should match the content and sequence in the "results" (i.e., Chapter 11). At the moment this is not the case.

There are other stressors that are not contained in these sections as the focus is largely on freshwater habitat. For example, marine and freshwater harvest (directed, incidental, bycatch from non-salmonid fisheries) guidelines should be established. It is also possible to establish the ocean survival conditions needed for recovery (see Bradford et al. 2000 for the Pacific Northwest). Specific guidelines for hatchery protocols can also be developed as criteria for recovery.

10. *Does the recovery plan provide an evaluation of threats discussed in terms of the five ESA listing factors identified under ESA section 4(a)(1) (e.g., the present or threatened destruction, modification, or curtailment of its habitat or range) at the time of listing?*

Yes, but as noted above, the plan does not include a sufficiently detailed population dynamics approach to identify which of the threats is a primary or secondary factor in the current status of ESU. A primary concern is the extent to which population trajectories and status are dominated by trend in ocean survival (including fishing) relative to freshwater habitat conditions. In the absence of indicator systems to estimate survival rates a useful starting point would be to determine if there is a relation between current status (for example, the density of juveniles or adults) and the freshwater habitat rating from chapter 11. It would also be useful to apply the CAP system to coho streams in the Pacific Northwest with healthy salmon populations (or one of the many Washington State index streams that have adult and smolt monitoring) determine if there is a threshold or band of values that are likely to be adequate to sustain coho populations. Nearly all the streams in the Puget Sound area are impacted to some extent yet are able to be relatively productive. Stream temperature (and flow) may be the differentiating factor in this comparison, though.

If there are streams in the SONCC region that have freshwater conditions that are not dissimilar in CAP rating to those in the Pacific Northwest, and if the coho populations in those streams are greatly diminished, then that highlights the role of non-freshwater factors on the ESU status. However, if coho are locally abundant in streams in good conditions in the SONCC region, then there is more basis to the assertion that freshwater conditions are a threat to recovery of the ESU. In addition to the empirically-based adult abundance reference points used in the current analysis, there are also smolt (smolts/km) and juvenile (fry/m2) density estimates from throughout the Pacific coast that can be used as reference points for assessing population performance.

11. *Does the plan explicitly identify measurable threats and track, through objective measurable criteria, how each threat will be reduced or ameliorated, through specific management actions?*

The plan does an excellent job of detailing desired physical habitat conditions and the CAP system is useful to summarize available information and assessing the threats. The Plan would benefit from a concise summary of the how the ratings were attached to the threats in chapter 11. The material in Chapter 4 (Table 4.3-1) provides definitions for some of the “low” to “very high” for some of the categories found in the CAP tables in Chapter 11. However the rows in Table 4.3-1 are different than those in Chapter 11, and many of the entries for the ratings are left to “professional judgment”. I note that values are found in the document “Example NOAA CAP Threats Assess.doc” and suggest that Table 4.3-1 be reconfigured so that it is exactly parallel to the CAP tables in the watershed sections of Chapter 11.

Chapter 11 also provides an account of habitat restoration measures that are thought needed to address the habitat stresses. These prescriptions are necessarily general in many cases, and there is not sufficient information to determine how much of an action is needed to achieve a threat reduction.

12. *Is the modified Nature Conservancy’s Conservation Action Planning (CAP) Threats Assessment protocol/methodology employed for assessing anadromous salmonid threats effective?*

    a. *Does the plan contain a fair assessment of current population and habitat conditions, and the identification of the biological stresses to coho salmon life stages and sources of stresses (i.e., threats)?*
    b. *Is the threats assessment methodology developed objective and transparent for this species and have all realistic threats been identified?*
    c. *Are other limiting factors considered for each threat (e.g., its’ scope, severity, frequency, magnitude, etc.) as suggested in the Recovery Guidance?*
    d. *Do the scoring and rankings in the matrices link logically to your understanding of the species and the systems they live in?*
    e. *Are the habitat types as defined in the matrices sufficient?*
    f. *Are the linkages between habitat types and life stages correct and complete?*
    g. *Does the protocol for threats assessment have a high likelihood of correctly identifying the dominant stressors for each population?*

h. *Does the threats assessment adequately focus and discuss the biological stresses to coho salmon as a result of the physical processes that have been affected (i.e., threats)? Are there others that should be considered?*
i. *Are the metrics developed and utilized to describe physical conditions of coho habitats adequate for the species, repeatable and measureable as described in the Recovery Planning Guidance?*

This block of questions duplicates the intent of many of the other questions and my responses won't be repeated here. My overall view is that the CAP process is very suitable for examining watershed level habitat conditions and possible recovery actions, but it does not include all threats to the population, nor is linked tightly to coho recovery. The approach might be more suited to a multi-species recovery plan, but that was not the context of the document under review.

13. *Does the recovery plan adequately address potential uncertainties related to threats assessment?*

No. Currently all of the threat categories are treated with certainty, although each category is broad such that uncertainty about the ranking is probably not resulting in a stream being miss-classified. Also lacking is a formal assessment of the likelihood that ameliorating the threat will lead to recovery of coho populations (at what time scale).

14. *Are the color coded CAP Threats Assessment summary pages which display population/watershed stresses and stressors useful for conveying to the public, agencies, stakeholders, what is needed to restore coho salmon and their critical habitats and why?*

I image that the colorful pages are indeed useful for evaluating the overall status of the watershed, and the page-level average color ("the heat") is likely a good indicator of watershed condition. I attempted a similar thing some time ago (Bradford and Irvine 2000, CJFAS), using a 0-2 point scale and 12 categories of impact. When I summed the points (range 0-24), I found that the overall watershed assessment was indeed correlated with the decline in the number of coho spawners in that stream. In that analysis the large-scale decline was due to a combination of overfishing and ocean conditions, but the stream-by-stream variation in decline was a function of habitat conditions in the natal streams.

It is important to try and ensure that the width of the low-med-high categories results in a consistent impact on coho productivity so that the threats (and the impacts to stakeholders) are evenly treated. The second, and perhaps more difficult, factor is to identify which of the threats is most significant for coho recovery. At the moment each of the 9-11 threats are given equal "bandwidth" in the summary pages, but I am sure that in many cases there are 2 or 3 that should dominate the overall rating (and should be focused on for recovery). For the purposes of comparing and ranking watersheds for overall impact this may not be a big issue, but it may be important for recovery planning.

Questions Regarding the Conservation Assessment Process

15. Does the plan adequately assess the effectiveness of conservation actions to date including, if the action was in place before listing and the reasons why the efforts were considered insufficient?

No, not in an identifiable way. The Plan does describe some of the large-scale conservation activities underway, but not their effectiveness. Certainly the changes to fishing mortality are identified. However, I did not review each stream's account in Chapter 11 to extract information from individual watersheds. As in many areas there does not seem to be enough monitoring information to evaluate the impacts of management actions or changes to population status.

16. Is it clear what threats are being addressed through conservation efforts and what threats remain unaddressed?

This question is unclear as the plan does not list current "conservation efforts" but rather indicates future potential activities. From the plan there appears to be little attention paid to hatcheries or other conservation breeding programs, harvest, ocean factors or institutional or social limits to recovery.

Questions Regarding the Recovery Strategy

17. If the species (ESU) met all the biological and physical threats abatement recovery criteria, is it plausible that this species would likely persist for the foreseeable future?

The use of the term "persist" is inconsistent with the structure of the strategy and is undefined. I will assume that intent of the question is to evaluate if populations will reach the recovery goal. I note that "*foreseeable future"* is also undefined, but it does highlight the need to include explicit recovery timelines in the plan.

In chapter 6, recovery criteria for the 7 stresses are described, but it was not clear in the documentation what a "medium stress" consists of for each of the measures. Unfortunately the stresses listed in chapter 4 are different from those listed in chapter 6 and in the CAP tables. It would be helpful to align the material in chapters 4, 6, and 11 so that the reader is clear how the ratings were conducted. Without that it is not possible to determine if the "medium" rating provides adequate conditions for coho in freshwater although I assume that it is, as the thoroughness of the analysis would suggest the criteria are appropriate. If the threats to freshwater habitat were abated to the criteria proposed, it seems likely that freshwater conditions should be adequate for persistence. The empirical benchmark for persistence will be smolt production within the range of streams found in Bradford et al. 2000, or preferably, within the range found in reasonably functional SONCC streams, based on locally collected data. However, ultimately, the fate of the ESU may rest on changes in ocean conditions that are likely to affect the whole ESU in a similar manner. Changes in ocean conditions may occur at a faster scale than some of the freshwater habitat restorations measures which may ultimately hinder recovery. The same can be said for changes in water supply and temperature in freshwater resulting from climate change.

18. *Are the Population Profiles contained within the plan adequate in summarizing the technical information assimilated for each historic coho salmon population and in conveying what is needed to recover/reduce the threats affecting the population?*

The Profiles do an excellent job of evaluating the status of the watershed and the threats to aquatic habitats in each watershed. Although I did not review all of the Profiles, I did note a lack of quantitative information on coho salmon that could help inform recovery activities. For example, there have been a number of studies on Prairie Creek and Redwood Creek from which estimates of juvenile and adult abundance have been made. These can be used to speak to status and trends in a more specific manner than the narratives provided.

19. *Do the recovery strategy and recovery criteria adequately consider large-scale environmental perturbations such as climate change and ocean variability?*

In general, no; the plan needs a more in-depth analysis of the historical data to help partition the effects of ocean, harvest and freshwater habitat on the current status of the stock. Trends in ocean survival can be inferred from hatchery returns, information from the OPI region or analysis of recruits per spawner across a suite of populations (to average out the effects of freshwater). Harvest or harvest rate time series should be constructed and provided.

Probably as a result of climate change there are a number of Pacific salmon species complexes that are faced with ocean survival conditions that barely permit them to persist. These are cases for which freshwater habitat is still productive, but the poor marine survival puts them frequently below replacement. My previous analysis of coho salmon (Bradford et al 2000) suggests that populations will fall below replacement when the ocean survival rate (including the effects of fishing) fall below about 3%. Because populations (streams) will vary in productivity, our analysis showed that at a 3% ocean survival about half of the populations in the meta-analysis are predicted to decline. If freshwater productivity (indexed as the number of smolts produced/spawner) is lower than average because of habitat conditions, then the critical marine survival rate for persistence will correspondingly increase.

An attempt should be made to address the question: How much of the current status of coho salmon in the SONCC region is the result of persistent low ocean survival rates (and corresponding overharvest) in the past 40 years? From this, it may be possible to evaluate the role of future ocean conditions in assisting or thwarting recovery efforts that are focused on restoring freshwater habitats.

20. *Are the links between human activities, effects on habitat, effects on individual fish, and expected responses of populations clearly described?*

The generalized links between the major human activities and their effects on stream habitats are well described. Similarly, reference conditions for those habitats to be productive are established. This is an important strength of the recovery plan.

Stronger links can be drawn between habitat effects when the freshwater biology of coho salmon is considered explicitly. For example, in small streams newly emerged coho fry are produced in considerable excess to availability of rearing habitats. If we use the 40 spawners/km benchmark, the corresponding 20 females will produce about 12,000 fry (3000 eggs * 0.2 egg-fry survival [Bradford 1995]). Of these, at least half are immediately lost, and the abundance of the remaining fish declines over the year to produce 1000-1500 smolts. These results mean that spawning habitat quality may not as critical for smolt production compared to features that enhance the survival of juveniles prior to smoltification.

My point here is that the very specific goal of recovering coho populations using fresh water habitat manipulations should be directed at increasing the smolt/spawner ratio and there may be directed recovery actions to achieve this goal instead of more generalized stream restoration activities. A careful consideration of the literature and consultation with those involved in the evaluation of large-scale recovery programs in freshwater may assist in directing recovery activities.

21. *Does the recovery plan contain a logical framework for prioritizing recovery efforts at multiple spatial scales? Such as:*
    a. *For each of these populations, have the primary stressors been identified?*
    b. *Given the prioritized stressors, do the recovery actions have a high likelihood of achieving measurable results?*
    c. *Is there a logical link between stressors, populations and prioritized recovery actions such that they will have the highest likelihood for success?*

I primarily reviewed the Redwood Creek chapter to respond to this question. I found that the available information was not extensively used and there were inconsistencies within the recovery plan. First, I recall there is a reasonable time series of spawner abundances for Prairie Creek that should be presented. The Plans asserts "*As previously discussed, a portion of the Redwood Creek coho salmon population rears for two years in freshwater, providing a valuable life history diversity strategy for this population. The estuary and lower river provide critical rearing habitat for this important diversity strategy, as this reach has greater thermal complexity and relatively cooler water temperatures than the middle portion of mainstem Redwood Creek*". This statement is used as a rationale for the high priority for estuary restoration activities.

It is my understanding that 2-year old smolts were found in Prairie Creek- this is probably an outcome of the cold and shady conditions in the creek in the summer months

(Bell and Duffy 2007 provides information on slow growth rates that supports this). For coho salmon smolt age is flexible as will vary with growth rate. Once leaving Prairie Creek these smolts likely move quickly to the ocean. Chapter 3 is vague about the use of estuary habitats noting (p. 3-4) “Yearling SONCC smolts may *linger* and utilize tidal marshes…as they migrate through the estuary to the ocean”. No further evidence of the use of the lower river and estuary by age-2 is provided. I don’t see support for the statement that the estuary and lower river provides “critical rearing habitat”.

Based on the work of Brakensiek and Hankin (2007), an outmigration of about 6000 smolts was derived for 2001. The question that needs to be addressed is whether the current estuary conditions are sufficient to allow this number of smolts to move through to the ocean, and if expansion of estuary habitats as proposed in the recovery strategy will increase survival. At the moment this assertion is unsupported, and perhaps unlikely.

I am not sure whether this type of mismatch between empirical findings and the proposed recovery activities occurs frequently across the Population Profiles, but it does highlight the need to take an empirically (or evidence) based approach to recovery planning. This begins by using the species known population dynamics as the basis for evaluating recovery actions.

As a summary response to this question I would suggest that stronger and explicit linkages should be developed between the recovery actions and coho life history and that the rate of recovery of habitat should be indicated in each case. If the linkages are not known (i.e., unsupported by evidence) or are unpredictable, then that should be identified.

22. Do the proposed recovery actions link logically to the threats identified in the CAP Threats Assessment?

   a. Do proposed recovery actions target the primary stresses/stressors for each population?
   b. Are recovery actions prioritized in a manner consistent with identified threats?

The proposed recovery actions for freshwater habitat are coupled to the threats that are listed in the CAP work tables. However, because the threats are not necessarily tightly coupled to the factors needed to recover coho salmon, the justification for some of the recovery actions is sometimes tenuous. For some of the smaller creeks an extensive suite of restoration activities is listed for watersheds where there is little evidence that coho salmon currently exist (or exist in an abundance sufficient to facilitate recovery). Not only should recovery actions within watersheds be prioritized with respect to their contribution to increasing coho abundance, watersheds themselves should also be prioritized for recovery.

Question Regarding Monitoring and Adaptive Management

23. Does the plan have a well-defined methodology for adaptive management to evaluate whether recovery measures are producing the intended effects and, if not, for informing mid-course corrections in the recovery plan and its implementation?

No, this section appears incomplete. The lack of any monitoring of stocks is a major deficiency in the ESU. There is an immediate need to establish index streams where adult and juvenile abundances can be monitored. I would suggest that a relatively pristine system be chosen to allow for monitoring of the impact of effects other than freshwater habitat restoration. An impacted stream should also be chosen that would be the site of intensive restoration activities. Monitoring salmon populations to evaluate responses to habitat alterations is extremely challenging and will require considerable effort and commitment (See Bradford et al. 2005 for an example). There is a danger with this Plan that both monitoring and recovery actions will be spread too thinly across the ESU to be effective. It would be unfortunate to be in a situation 20 years from now to not have a understanding what impacts the recovery Plan has had to the populations and their habitats.

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Appendix 1: Statement of Work and Terms of Reference for the Peer Review

Statement of Work for Dr. Michael Bradford

External Independent Peer Review by the Center for Independent Experts

Southern Oregon/Northern California Coast Coho Salmon Draft Recovery Plan

Scope of Work and CIE Process: NOAA's National Marine Fisheries Service's (NMFS) Office of Science and Technology manages a contract through the Center for Independent Experts (CIE) to conduct impartial and independent peer reviews of NMFS scientific projects. This Statement of Work (SoW) described herein was established by the NMFS Contracting Officer's Technical Representative (COTR) based on the peer review requirements submitted by NMFS Project Contact. CIE reviewers will be selected by the CIE Coordination Team and Steering Committee to conduct the external peer review of NMFS science with project specific Terms of Reference (ToRs). Each CIE reviewer shall produce a CIE independent peer review report with specific format and content requirements (**Annex 1**). This SoW describes the work tasks and deliverables for conducting the CIE peer review of the following NMFS project.

Project Description: The Endangered Species Act (ESA) requires NMFS to develop and implement recovery plans for the conservation of threatened and endangered species. The Southern Oregon/Northern California Coast (SONCC) Coho Salmon Evolutionarily Significant Unit (ESU) includes all naturally spawning coho salmon from the Elk River near Cape Blanco in southern Oregon south through the Mattole River near Punta Gorda in Northern California. This ESU contains three large river basins, including the Rogue River in Oregon and the Klamath-Trinity and Eel Rivers in California that extend inland considerable distances. The draft recovery plan serves as a guideline for achieving recovery goals by describing the steps that must be taken to improve the status of the species and their habitats. Although the recovery plan itself is not a regulatory document, its primary purpose is to provide a conservation "road map" for Federal and state agencies, local and Tribal governments, non-governmental entities, private businesses, and stakeholders. Development of this recovery plan is a challenge as the geographical range of the species crosses the Oregon/California border. In addition, the recovery plan will adapt portions of the "Recovery Strategy for California's Coho Salmon, recently listed under California's ESA (CESA) in 2005" and conservation, recovery efforts and strategies developed for southern Oregon coho salmon populations under the State of Oregon's Native Fish Conservation Policy.

The NMFS Recovery Plan for the SONCC Coho is expected to generate substantial interest from outside parties because it: (1) will contain recommendations involving water supplies for a variety of industrial, commercial, agricultural and urban users and municipalities; (2) will prioritize targeted restoration and recovery actions for coho salmon populations and watersheds throughout southern Oregon and northern California; (3) could influence local and regional environmental planning efforts and decisions involving land development patterns; and (4) may advise federal, state, tribal, local and regional governments on actions necessary to reduce the threats causing biological stresses to coho salmon populations and their critical habitats. The draft recovery plan will include a large geographic area in Southern Oregon and Northern California and has the potential for wide-ranging implications. The threats assessment process used in the draft plan represents a new approach for anadromous salmonid ESA protected species and has been completed by NOAA Fisheries in full cooperation and coordination with state, federal, local, and regional governments and agencies. Stakeholder interest will be high and likely lead to inquiries from elected representatives at the state and Federal levels. The Terms of Reference (ToRs) of the CIE peer review are specified in **Annex 2**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete all work tasks of the peer review described herein. CIE reviewers shall have the expertise, background, and experience to complete an independent peer review in accordance with the SoW and ToRs herein. The CIE reviewers shall have expertise with strong credentials in salmon management, salmon conservation biology, salmon restoration practices, salmon/water management, and salmon conservation under the Endangered Species Act.

Location of Peer Review: The CIE reviewers shall conduct the external peer review of the report as a desk review, in which no travel is required.

Statement of Tasks: Each CIE reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

<u>Prior to the Peer Review</u>: Upon completion of the CIE reviewer selection by the CIE Steering Committee, CIE shall provide the CIE reviewer information (name, affiliation, and contact details) to the COTR, which will be sent to the NMFS Project Contact no later the date specified in the Schedule of Milestones. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents and reports to be peer reviewed. Changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

<u>Background Documents</u>: At the commencement of the peer review, the NMFS Project Contact will send by electronic mail, or make available at an FTP site, the CIE reviewers all necessary background information and the report for the peer review. If the documents need to be mailed to the reviewer, the NMFS Project Contact will consult with the CIE on where to send the documents.

A tentative list of background documents and the report is provided in Annex 3, and an updated list will be provided up to two weeks before the peer review. Any delays in submission of review documents for the CIE peer review will result in delays with the CIE peer review process, including a SoW modification to the schedule of milestones and deliverables. Furthermore, the CIE reviewers are responsible only for the documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein.

Desk Peer Review: Each CIE reviewers shall conduct the independent peer review in accordance with the SoW and ToRs. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.**

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review report according to the format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review;
2) Conduct an independent peer review in accordance with the SoW and ToRs (Annex 2);
3) No later than 29 June 2009, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent via email to Manoj Shivlani, CIE Lead Coordinator shivlanim@bellsouth.net, and CIE Regional Coordinator, David Die ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in Annex 2;
4) CIE reviewers shall address changes as required by the CIE review in accordance with the schedule of milestones and deliverables.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

1 June 2009	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
15 June 2009	NMFS Project Contact sends the CIE Reviewers the report and background documents for the peer review no later than this date.
15-29 June 2009	Each reviewer conducts a desk (requiring no travel) peer review
29 June 2009	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator

12 July 2009	CIE submits CIE independent peer review reports to the COTR
26 July 2009	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: Requests to modify this SoW must be made through the Contracting Officer's Technical Representative (COTR) who submits the modification for approval to the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the CIE within 10 working days after receipt of all required information of the decision on substitutions. The COTR can approve changes to the milestone dates, list of pre-review documents, and Terms of Reference (ToR) of the SoW as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToRs and deliverable schedule are not adversely impacted. The SoW and ToRs cannot be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (the CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards: (1) each CIE report shall have the format and content in accordance with Annex 1, (2) each CIE report shall address each ToR as specified in Annex 2, and (3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon notification of acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the approved CIE reports to the NMFS Project Contact and regional Center Director.

Key Personnel:

William Michaels, Contracting Officer's Technical Representative (COTR)
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-713-2363 ext 136

Manoj Shivlani, CIE Lead Coordinator

Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Greg Bryant, NMFS Project Contact
NMFS Southern Oregon/Northern California Coast Domain Recovery Coordinator
1655 Heindon Road, Arcata, CA 95521-4573
Greg,bryant@noaa.gov Phone: 707-825-5162

Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Review Activities, Summary of Findings for each ToR, and Conclusions and Recommendations in accordance with the ToRs.

3. The reviewer report shall include as separate appendices as follows:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work

Annex 2: Terms of Reference for the Peer Review

Southern Oregon/Northern California Coast Coho Draft Recovery Plan

A review of the draft Southern Oregon/Northern California Coast (SONCC) Coho Salmon ESU Recovery Plan is being requested. Reviews and comments are to focus upon: (1) The use of the best available scientific, technical and commercial data and information; (2) Interpretation and application of the National Marine Fisheries Services' Southwest Fisheries Science Center SONCC Technical Recovery Team's (TRT's) supporting technical recovery planning reports and (3) Determination on whether processes developed for and methods employed provide adequate linkages between the SONCC TRT population and ESU recovery criteria, coho salmon life stage specific biological stresses inferred from physical habitat-based threats assessment, and the recovery actions and strategies developed to reduce or abate those population threats. Reviewers are not expected to evaluate or comment upon the TRT documents or the Threats Assessment template. The CIE reviewer's peer review shall address each of the following questions.

Fundamental Questions for the CIE Reviewers

1. Does the recovery plan delineate those aspects of the species biology, life history, and threats that are pertinent to its endangerment and recovery?

2. Is the recovery plan grounded in a clearly articulated and biologically meaningful conceptual framework?

3. Does the recovery plan provide a useful and meaningful "road map" to recovery and have a logical strategy to achieve recovery that is relevant to habitats, life stages, populations, diversity groups and the overall ESU?

4. Does the plan use and incorporate the best available scientific, technical and commercial data and information?

5. Does the plan meet the minimum standards described in section 4(f)(1)(b) of ESA by including site-specific management actions, objective measurable criteria and estimates of time and cost?

6. Does the plan incorporate general recovery tenants for coho salmon in the Klamath-Trinity River basin previously identified by the National Research Council in their final 2004 report?

7. Is the plan suitable for serving as an outreach tool to co-managers, stakeholders and other interested individuals or organizations and does it invite public participation in the recovery process?

Questions Regarding Use and Application of the SONCC Technical Recovery Team Reports

8. Are the products developed by the SONCC TRT from the SONCC Historical Population Structure and SONCC Population Viability Criteria reports described and applied appropriately within the recovery plan?

9. Is the SONCC recovery plan clear regarding the differences between biological population viability and threats abatement recovery criteria?

Questions Regarding Factors for Decline and New Threats Assessment Methodology

10. Does the recovery plan provide an evaluation of threats discussed in terms of the five ESA listing factors identified under ESA section 4(a)(1) (e.g., the present or threatened destruction, modification, or curtailment of its habitat or range) at the time of listing?

11. Does the plan explicitly identify measurable threats and track, through objective measurable criteria, how each threat will be reduced or ameliorated, through specific management actions?

12. Is the modified Nature Conservancy's Conservation Action Planning (CAP) Threats Assessment protocol/methodology employed for assessing anadromous salmonid threats effective?

    j. Does the plan contain a fair assessment of current population and habitat conditions, and the identification of the biological stresses to coho salmon life stages and sources of stresses (i.e., threats)?
    k. Is the threats assessment methodology developed objective and transparent for this species and have all realistic threats been identified?
    l. Are other limiting factors considered for each threat (e.g., its' scope, severity, frequency, magnitude, etc.) as suggested in the Recovery Guidance?
    m. Do the scoring and rankings in the matrices link logically to your understanding of the species and the systems they live in?
    n. Are the habitat types as defined in the matrices sufficient?
    o. Are the linkages between habitat types and life stages correct and complete?

p. Does the protocol for threats assessment have a high likelihood of correctly identifying the dominant stressors for each population?
q. Does the threats assessment adequately focus and discuss the biological stresses to coho salmon as a result of the physical processes that have been affected (i.e., threats)? Are there others that should be considered?
r. Are the metrics developed and utilized to describe physical conditions of coho habitats adequate for the species, repeatable and measureable as described in the Recovery Planning Guidance?

13. Does the recovery plan adequately address potential uncertainties related to threats assessment?

14. Are the color coded CAP Threats Assessment summary pages which display population/watershed stresses and stressors useful for conveying to the public, agencies, stakeholders, what is needed to restore coho salmon and their critical habitats and why?

Questions Regarding the Conservation Assessment Process

15. Does the plan adequately assess the effectiveness of conservation actions to date including, if the action was in place before listing and the reasons why the efforts were considered insufficient?

16. Is it clear what threats are being addressed through conservation efforts and what threats remain unaddressed?

Questions Regarding the Recovery Strategy

17. If the species (ESU) met all the biological and physical threats abatement recovery criteria, is it plausible that this species would likely persist for the foreseeable future?

18. Are the Population Profiles contained within the plan adequate in summarizing the technical information assimilated for each historic coho salmon population and in conveying what is needed to recover/reduce the threats affecting the population?

19. Do the recovery strategy and recovery criteria adequately consider large-scale environmental perturbations such as climate change and ocean variability?

20. Are the links between human activities, effects on habitat, effects on individual fish, and expected responses of populations clearly described?

21. Does the recovery plan contain a logical framework for prioritizing recovery efforts at multiple spatial scales? Such as:
    d. For each of these populations, have the primary stressors been identified?
    e. Given the prioritized stressors, do the recovery actions have a high likelihood of achieving measurable results?
    f. Is there a logical link between stressors, populations and prioritized recovery actions such that they will have the highest likelihood for success?

22. Do the proposed recovery actions link logically to the threats identified in the CAP Threats Assessment?

    c. Do proposed recovery actions target the primary stresses/stressors for each population?
    d. Are recovery actions prioritized in a manner consistent with identified threats?

Question Regarding Monitoring and Adaptive Management

23. Does the plan have a well-defined methodology for adaptive management to evaluate whether recovery measures are producing the intended effects and, if not, for informing mid-course corrections in the recovery plan and its implementation?

Appendix 2: Documents Reviewed

NMFS 2009. Recovery Plan for the Evolutionary Significant Unit of Southern Oregon Nothern California Coast Coho Salmon. June 15, 2009 version.

and:

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