Review of the 27 May 2009 Southern California Steelhead Recovery Plan Draft

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EXECUTIVE SUMMARY

Although abundance and distribution data are exceptionally poor (often nonexistent), it seems apparent that populations of anadromous *Oncorhynchus mykiss* have suffered a catastrophic decline - from an estimated "historic abundance" of perhaps 32,000-46,000 adult spawners to less than 500 adults today - throughout the entire southern California recovery plan region. Only remnant populations appear to remain, and there is no solid notion of abundance of anadromous adults in almost all systems, although juveniles are known to be present in a large number of watersheds, sometimes at decent densities. As the anadromous *O. mykiss* found in southern California streams are winter run fish, it is especially difficult to determine their abundance when streams are at high flows and visibility conditions are poor. For these same reasons, abundance of winter run steelhead is poorly known is many parts of the Pacific Northwest, not just in southern California.

The southern California region is characterized by some of the highest concentrations of urban development and population density in the United States, is at the southern distribution limit of a species that ranges to at least central Alaska, and global climate change impacts may make the region less suitable (even drier summer months with greater amount and variation in winter rainfall) for support of anadromous *O. mykiss*. Thus, the southern California region is, *a priori*, a difficult region within which to maintain this species at viable levels. Indeed, I would argue that, within the range of this species, southern California is the most difficult region within which to maintain populations that will have long-term viability.

The southern California region is characterized by exceptionally low summer base flows, often with intermittent flows common, but with episodic winter storm events that provide access to spawning streams by winter run anadromous *O. mykiss*. In many watersheds, impassable dams have been constructed at distances not too far from the ocean. These dams and other barriers limit the upstream migration of anadromous *O. mykiss* and, in many cases, prevent access to the best quality habitat summer rearing habitat (cool water with perennial flows) which is often found in headwater streams on federal lands (see Habitat Envelope Report, Boughton and Goslin 2006).

The frequent existence of impassable barriers to upstream migration of *O. mykiss* has no doubt caused a serious loss of "connectedness" between now resident forms (above barriers) and anadromous forms (below barriers). Genetic evidence (see Clemento and Garza references)

suggests that, in almost all situations, above barrier resident *O. mykiss* are most closely related to the anadromous *O. mykiss* from the same watershed. Non-native hatchery-reared *O. mykiss* have been frequently stocked above barriers, but there is no genetic evidence of their having successfully spawned with native resident *O. mykiss* to any substantial degree. These genetic data suggest that, in many cases, removal of barriers to upstream migration should reunite resident and anadromous forms from the same populations, reestablishing more substantial "combined" populations that should eventually become primarily anadromous if conditions for anadromy are favorable.

The essential absence of time series of abundance for any *O. mykiss* populations in southern California made development of recovery criteria extremely difficult. It was impossible to develop "performance-based" recovery criteria based on empirically observed time series of abundance for specific populations. Instead, assumption-laden theoretical models had to be used to develop a recovery criterion that individual *O. mykiss* populations need returns of at least 4,150 adult spawners. As noted below, this recovery criterion is not strongly supported and seems unrealistically and perhaps unnecessarily high.

The draft Recovery Plan devotes extensive attention to "Threats Assessment" and to development of specific recovery actions that are purported necessary in individual watersheds within individual biogeographical population groups (BPGs). Assessment of threats may or may not be valid and recommended specific recovery actions may or may not be well considered. It is impossible for me, as a reviewer without extensive knowledge of southern California watersheds, to assess the credibility of these Threat Assessments and their associated recommended recovery actions. It does, however, seem well justified to conclude that recovery of *O. mykiss* in certain southern California streams would in many cases require removal of dams or installation of fish passage facilities.

Given the dire circumstances of *O. mykiss* in the southern California region, coupled with the fact that the region may relatively soon be climatically unsuitable to support *O. mykiss*, it is difficult to know where and how to begin a recovery process, and it is even more difficult to judge the degree to which recovery is a feasible objective. I found the draft Recovery Plan to be ambiguous and equivocal with respect to whether or not recovery planning should focus indiscriminately on recovery actions taken for all populations or whether recovery planning should instead focus on a restricted set of populations which have the highest probability for successful recovery and/or of

greatest biological significance. In this regard, the recovery plan guidelines seem somewhat at odds with supporting documents which seem consistently to imply that the focused approach would be more likely to succeed.

It was interesting to see "inadequate monitoring" included as a cause for the endangered status listing. I agree that the absence of long-term monitoring data hinders assessment of status and determination of recovery criteria or policies. Given the current reliance on the precautionary principle, absence of information (especially abundance data) leads to more conservative recovery criteria than might be needed if there were adequate information. I remain concerned, however, that there is little discussion of how future monitoring ought to be carried out. If concern lies with estimation of adult abundance of specific populations, then monitoring ought to be focused at the level of these specific populations, not at a larger "regional" scale which generally cannot deliver accurate abundance estimates at a population level.

Main conclusions and recommendations

- Grouping of southern California steelhead populations into a set of five discrete biogeographic population groups (BPGs) is useful for discussion purposes. *Absent information on exchange of individuals within and between these BPGs, and on clear genetic and/or life history differences between populations constituting BPGs, however, it is impossible to judge whether or not these groupings are useful or necessary with respect to recovery planning and viability of the southern California DPS.*
- Classifying populations within BPGs into "Core 1", "Core 2" and "Core 3" populations seems worthwhile, in principle, if Core 1 populations are most important for recovery and if recovery actions are to be directed primarily at Core 1 populations, at least in the initial stages of recovery activity. I could not find any clear justification or motivation in the Recovery Plan itself for how specific populations were placed into the three categories, however, and supporting documents did not use this classification system. Instead, the "Population Characterization" report (Boughton et al. 2006) distinguished between "Category 1" and "Category 2" populations on the basis of watershed flow patterns. *Clear and defensible rationale should be presented for classification of populations into the three "Core" categories.*

- The proposed viability/recovery criteria appear to call for achievement of 4,150 adult spawners annually in all populations critical to reestablishing viability of anadromous *O. mykiss* in the southern California region. Neither the Recovery Plan nor the supporting documents provide clear statements concerning how many populations within BPGs need to achieve this individual criterion or regarding whether or not all BPGs need to achieve viability standards if the species is to have status changed from endangered to threatened or to be delisted. Indeed, the Viability report (Boughton et al. 2007) at page 17 states that "it is not clear if all groups are capable of supporting viable populations." This report speculates that the Santa Monica Mountains and Santa Catalina Gulf Coast BPGs may be ephemeral and periodically recolonized from neighboring watersheds/BPGs. *The Recovery Plan must make clear statements concerning the numbers and, ideally, identities of populations within BPGs that must be rebuilt to viability levels for recovery and must also more clearly address the issue of whether or not it is reasonable to expect or require that all BPGs be restored to viability before the endangered status of the southern California DPS can be reassessed.*
- The proposed viability/recovery standard of 4,150 adult spawners per population is very poorly identified (see Viability report, page 4): at 94% probability of 100 year viability the standard would be 2,000 adults and at 96% probability the standard would be more than 11,000 adults. The 4,150 adult spawner abundance level seems quite high to me and seems in part contradicted by the apparent long-term viability of small *O. mykiss* populations on the Big Sur Coast (South-Central CA recovery region). *The Recovery Plan needs to much more directly state that the 4,150 adult anadromous spawners viability criterion is an "interim" criterion that may likely be revised downward as better information becomes available for this O. mykiss DPS.*
- Given the apparent greater genetic similarity of *O. mykiss* above and below barriers within the same watershed than between watersheds, I believe that it is reasonable to assume that elimination of barriers to upstream migration will in many cases be the most effective strategy for achieving long-term viability. With respect to how to treat a "combined" population with respect to the viability criterion, I believe that anadromous adults could generally be separated from resident adults on the basis of their size, their scale growth patterns or possibly their redd sizes. *If the recovery criterion is expressed in terms of anadromous adults, then the abundance of resident fish in a combined population is not relevant with respect to ascertaining whether or not a recovery abundance criterion has been achieved.* I agree with the authors of supporting

documents that it would be problematic to predict the speed with which the anadromous form would reestablish itself among previously resident fish faced with new access to the ocean, but I feel fairly certain that a transition/reversion would take place to the degree that anadromy is a successful life history strategy in the barrier-free system.

- The Recovery Plan calls for life history diversity criteria to be met in all populations. To become viable, populations must all have anadromous, resident and lagoon-anadromous components. I am a "fan" of life history diversity but, for a number of reasons, I do not believe that it is appropriate to require that this life history diversity objective be achieved in all populations. First, I suspect that many watersheds in the southern California region (and certainly elsewhere) may not naturally have summer formation of lagoons, yet they nevertheless have apparently viable and sometimes very large populations of *O. mykiss*. Second, I see no reason why a resident life history is critical for viability if an anadromous population is suitably large and has relatively reliable ocean access in most years. *The Recovery Plan needs to present better justification for why all populations must exhibit all three life history type or should reconsider this requirement. Where reasonable and possible, this life history diversity requirement may have merit, but global application seems inappropriate.*
- Barrier removal (e.g., removal of dams of development of fish passage facilities) is recommended for many watersheds. In some watersheds, however, upstream reservoirs now have populations of introduced non-native species. These species might successfully colonize lower reaches of watersheds in which barriers were removed, thereby endangering rather than assisting recovery of anadromous *O. mykiss* currently found below barriers. *This issue requires substantially more attention and must be addressed on a watershed by watershed basis.*

INTRODUCTION

Background

The author was contracted by the Center for Independent Experts (CIE) to perform an unbiased independent review of the draft Southern California Steelhead Recovery Plan, per the Statement of Work reproduced at Appendix B, with report format dictated by Annex 2 of Appendix B. The author has extensive knowledge of anadromous salmonids, including steelhead, has served as a member of the Central California Coast Technical Recovery Team (charged with developing recovery criteria for threatened ESUs of coho and Chinook salmon and steelhead trout), and has

extensive knowledge of sampling theory, with special expertise in design of surveys for estimation of abundance of juvenile salmonids in small streams. The author has limited direct knowledge of habitat conditions in the heavily urbanized southern California coastal region, but has lived in California for 33 years and has traveled to the southern California coastal region on many occasions. The author has had no role in development of any of the materials provided to him for review although he is familiar with many of the individuals, particularly within NOAA NMFS, who participated in preparation of provided materials.

Terms of Reference

Terms of Reference for the independent review are described in detail in Annex 1 of Appendix B. Generally, the author was asked to provide an evaluation of (1) adequacy, appropriateness and application of data used in the draft Recovery Plan, and an evaluation of (2) proposed recommendations for site-specific management actions, and future research and monitoring.

Description of activities in the review

The author's review was undertaken as a solo effort, based entirely on evaluation of provided materials and without any NOAA NMFS oral presentations on the logic or validity of interpretations, analyses and/or recommendations presented in the Recovery Plan or developed in related documents. Materials examined in the author's review are listed in Appendix A. With four exceptions, all materials were read in their entirety. The four exceptions were: (1) Helmbrecht and Boughton (2005) (pages 1-16 only); (2) Southern California Steelhead Recovery Plan (extensive tables of Recovery Action Matrixes were not thoroughly reviewed); (3) Boughton et al. 2007 (material pertinent only to south-central recovery domain was sometimes only "skimmed" or ignored); and (4) Boughton and Goslin 2006 (material pertinent only to south-central recovery domain was sometimes only "skimmed" or ignored).

In reviewing documents, I highlighted issues or passages that seemed to raise issues of importance that should be discussed in a formal review. These instances were "flagged" to ensure that they would be noticed at the time of the author's preparation of his review. In addition, I kept a written list of "emerging issues of concern" that was intended to ensure that key concerns or issues (e.g., resident vs. anadromous forms of *O. mykiss*) would be highlighted in my formal review. To prepare my formal review, I first went through all reviewed documents, generating a

tabulation of issues, concerns and highlighted materials, identified by page and document. I used this tabulation, along with the written list of "emerging issues of concern", as the basis for development of my formal review.

Adequacy, Appropriateness and Application of Data Used in the Draft Recovery Plan

Findings and Recommendations made in the draft southern California steelhead Recovery Plan are based in part on a set of documents prepared by a Technical Recovery Team and its leader, David Boughton, NMFS, Santa Cruz, and by various reports concerning genetic relationships of southern California steelhead, produced by Carlos Garza's fish genetics group at the NMFS Santa Cruz Ecology Laboratory. Documents that I read, in addition to the recovery Plan itself, are listed in Appendix A and provide me the only direct basis to evaluate the adequacy, appropriateness and application of data used in the Recovery Planning process. An exceptionally large number of additional documents are referenced in the Recovery Plan and obviously also provided data important for recovery planning. I have no direct knowledge of these other documents except for those that he may have read previously for some reason other than this review. Below I provide a brief bulleted list of observations concerning data relied upon in development of the Recovery Plan, to the limited extent with which I am familiar with these data.

- **Abundance Data.** The information basis relied upon for development of the fundamental recovery objectives and recovery criteria that are found in this Recovery Plan is exceptionally limited. Among other things, there are virtually no quantitative abundance data with which to reliably characterize historic or present status or to use for establishing "performance-based" viability criteria (see Boughton et al. 2007).
- **Range Contraction.** A comparison of historical accounts (many anecdotal) of apparent steelhead distribution in southern California with apparent current distribution, based on Boughton's recent juvenile surveys conducted in presumptive anadromous waters, seems adequate to support a conclusion that there has been substantial contraction in the distribution of steelhead in the southern California region. Methods used to determine presence/absence were not statistically rigorous, but Boughton et al. did an adequate job of suggesting that results from surveys (at "favorable looking locations") did a decent job of detecting presence (at least when fish are present in decent numbers). I was, however, unable to evaluate the contention that abundance has declined from something like 32,000-46,000 to the current total of less than 500 anadromous adults (Busby 1996

reference, not reviewed). The absence of quantitative abundance data is startling and is a serious shortcoming of the Recovery Plan, though not attributable to any actions taken by Recovery Plan members! Indeed, Section 2.3, Species Abundance, takes up just a single paragraph at p. 18.

- **Key Population Issues: Resident-Anadromous and Genetic Exchange.** In addition to absence of abundance data, there are two very central issues for which there are inadequate data or inadequate understanding: (1) population dynamics and genetic relationships between resident and anadromous *O. mykiss* in the same watershed, including the degree to which "crossing-over" takes place between the two life history types; and (2) Rates of genetic exchange among populations/watersheds. The first issue is of substantial relevance to prediction of the potential response of a combined resident and anadromous population following barrier removal (recommended for many watersheds). The second issue is critical for determination of "independent populations" and to establishing the number of populations over which the viability criterion of 4,150 spawning anadromous adults applies. It should be noted, however, that these issues may be of critical importance for development of Recovery Plans for steelhead elsewhere in their range and the understanding of these issues is generally poor throughout the range of this species.
- **Intrinsic Potential.** Following efforts by TRT's in other locations, Boughton and Goslin (2006) used the "Envelope Method" to characterize relative habitat quality on the basis of extant known distribution (not abundance) of resident and anadromous *O. mykiss*. Over-summer habitat was viewed as the limiting habitat in this exercise. It is not clear, however, that this approach can be relied upon to portray potential areas for anadromous *O. mykiss* recovery because in many instances the highest quality areas of streams appear to be headwater reaches which may or may not be accessible to anadromous *O. mykiss f*ollowing recovery actions. Elsewhere in their range, resident *O. mykiss* are often present in the headwater reaches of watersheds within which *O. mykiss* spawn. Without a "spawning corridor" assessment/analysis, the extent to which these habitat envelopes reveal locations of promise for anadromous *O. mykiss* is unclear, although they no doubt provide good guidance concerning areas that can support resident *O. mykiss*.
- **Dispersal Models.** I was disappointed with the dispersal models developed for application to southern California steelhead. First, the homogenous dispersal model (Variant 1, "Dispersal Pool", in the Population Report) makes no sense to me at all and results are very much at odds with other models. I believe that findings from the

"dispersal pool" analysis should be discounted. The other two dispersal models (nearest neighbor and river flows) are much more reasonable, but a better model would include (a) distance from adjacent streams, and (b) reliability of flows at adjacent streams. (See Bjorkstedt's work for the Central CA Coast TRT's analysis of possible coastal Chinook migration flow across populations.) This issue is of importance only to the extent that recovery plan actions are based on the rankings of "independence" of populations that come out of this kind of analysis (e.g., Figure 32 in Boughton et al. (2006).

Review of Key Findings made in the Recovery Plan

DPS considerations: Populations, Habitats and Threats

Designations of Populations and Biogeographical Population Groups (BPGs) in the Recovery Plan seem to faithfully following the suggestions made in supporting documents (primarily NOAA Technical Memoranda). The review of habitat features of streams in the southern California region seems adequate though it could place greater emphasis on the "migration corridor" issue mentioned previously. If much of the best summer rearing habitat is in upstream reaches on federal lands, such habitat is not of substantial value unless there are passable migratory corridors. This seems a key issue in southern California streams, certainly with respect to the degree that barrier elimination might enhance abundance of populations.

The Recovery Plan's identification and ranking of various threats to populations seem reasonable to me, but I am not familiar with the "CAP Workbook" procedures nor am I highly qualified to judge the merits of such habitat threats assessments. I believe that such assessments must, in general, be first made at a local scale by individuals familiar with specific watersheds and then synthesized at a higher level, in this case, of BPGs. Evaluating the merits of such threats assessments seems well beyond the scope of this review.

Recovery Objectives, Extinction Risk Analysis and Recovery Criteria

Recovery Objectives. For several reasons, I find substantial fault with the recovery objectives, particularly the second objective, as stated on page 44 of the Recovery Plan. First, I do not believe that the second recovery objectives clearly emerge from the supporting documents that I reviewed. Second, I believe that recovery objective 2 ("Maintain current distribution of steelhead and restore distribution to previously occupied areas") is both unrealistic and unjustified. As a

scientist, I refuse to believe that the long-term viability of a species, or a DPS of a species, requires that the full historic distribution and abundance of a species (or DPS) needs to be restored. If that is the case, we are doomed to lose most species. Instead, the interesting scientific issues are "How much of a species distribution and abundance needs to be maintained and where?". This issue is central to recovery planning, but the draft Recovery Plan instead appears to present an ambiguous proposal to improve conditions and populations "everywhere" (more on this below).

Extinction Risk and Recovery Criteria. Biological Recovery Criteria presented in Table 5-1 of the Recovery Plan seem very much to reproduce the essence of Table 1 from the "Viability Report" of Boughton et al. 2007. As noted previously, the population-specific adult spawner viability criterion of 4,150 fish is unreliable and was arrived at on the basis of hypothetical/theoretical calculations rather than on performance-based analysis. Also, I reexamined Appendix A in Boughton et al (2007) and confirmed my suspicion that these theoretical calculations were for a single age population without age structure. I am unfortunately not an expert in viability analysis, but the age-structuredness of a steelhead population should allow it to persist through several very poor years because adults from a single brood may mature over several return years and may also spawn repeatedly. I don't think that the simple Foley/Lande models capture that important aspect of population dynamics.

The Recovery Plan, at pages 242-243, provides text (from the Boughton et al. 2007 Viability Report) that further undermines the credibility of the proposed 4,150 viability criterion: "It was unclear, due to questions of exchange patterns, whether the criteria should be applied to : anadromous fish in a particular basin, or the sum of anadromous fish across several basins, or the sum of anadromous and freshwater-resident fish in a particular basin, or the sum of anadromous and freshwater-resident fish across several basins."

Although the value of 4,150 anadromous adult spawners is used in Table 1 of the Viability Report, it does not explicitly appear in Table 5-1 of the Recovery Plan and I was left asking myself - "Well, IS there any run size criterion or not?". I also believe that the run size criterion that applies, whatever it's value, should be viewed as an "average" abundance across good and bad years of ocean conditions for survival. If 4,150 is instead viewed as an average that must be met during periods of poor ocean conditions, then the average run size over both good and bad years would probably be at least twice this value which I just cannot imagine would be correct.

Also, I remain concerned about the use of a "spawner density" criterion and expressed similar reservations on the TRT on which I served myself. The spatial distribution of anadromous fish spawning is highly aggregated in most watersheds. It is the density of fish in the local aggregations that matters, not some density value averaged over an entire system.

Other issues of concern regarding the Recovery Plan Criteria concern the numbers of populations that must become viable within each BPG (see Recovery Threshold 1, Table 5-1 of the Recovery Plan). Table 1 of the Viability Report refers to Table 6 of the Viability report. Table 6 of the Viability report appears to be an analysis based on wildfire frequency and intensity. I could not find any other treatment, in any of the supporting documents, that referred to a specific number of populations that would be required for viability within any given BPG. I cannot see why the number of populations required for viability should be based exclusively on an analysis of fire frequency and intensity, but perhaps I misread the Viability report. Also, I reiterate my belief that there is inadequate justification for a requirement that viable populations exhibit all three life history types (resident, fluvial-anadromous, lagoon-anadromous).

Finally, it is a minor point, but I noted that the Recovery Plan states that DPS recovery goals include harvest; I was not convinced that the Viability Report analyses accounted explicitly or implicitly for harvest. This same ambiguity was evident on the TRT on which I served. The issue of harvest does not seem to be adequately considered in the Endangered Species Act.

Evaluation of Conservation Measures. As noted previously, this reviewer does not feel competent to judge the merits or logic of proposed site-specific recovery actions for individual watersheds. I am willing to accept that the most effective recovery actions would in some cases require removal of dams and/or development of fish passage facilities, but I am unwilling to accept the general recommendation that streams need to be managed for "normal" stream flow regimes. In many cases that would be impossible because dams are often constructed explicitly to modify or capture (store water from) these natural flow regimes and, in any event, I am not convinced that this is either necessary or beneficial. In some cases, "unnatural" altered flow regimes may enhance conditions for spawning or rearing or corridor migration. Overall, I believe that much more attention should be given to the topic of "migration corridors".

I am far more concerned about the ambiguity that I found in the recommendations for the various detailed recovery measures proposed in the Recovery Plan. Are these all to be undertaken for

Core 1, 2 and 3 populations? Or are only the most critical recovery actions for Core 1 populations proposed for immediate action? Is it reasonable to expect that all BPGs can be restored to viability, or are some (as noted earlier) ephemeral and not individually viable over the long term? I very much like the suggestion that Core 1 populations should form the nucleus of targeted recovery actions (i.e., invest first where the investment is most likely to succeed), but I could not determine the basis for establishing Core 1, 2 and 3 populations (noted previously) and at least my copy of the Recovery Plan does not appear to have a critical table (Table 4-4, referenced at page 54 of the Recovery Plan) which, according to the text in the first paragraph under section 6.1 (CORE POPULATIONS) lists key watersheds which must form the foundation for recovery of Southern California steelhead. (Are these the same as the Core 1 populations listed in Table 6-1?). I confess to having given up in frustration on this absolutely critical issue of "when and where" to put recovery efforts. Finally, the following text of the Recovery Plan at page 55 says that Core 2 populations also form part of the recovery strategy and that Core 3 populations may also "eventually" be needed to achieve viability. So where does this all leave us? How can there be a specific number of populations required to achieve viability in each BPG (see Table 6 of the Viability Report?), but then "all populations" may eventually be needed to achieve viability. I would not want to be on the receiving end of this moving target and cannot imagine that it is an acceptable approach. Instead, a phased recovery action/reevaluation process seems in order:

- Take most critical recovery actions in Core 1 populations/watersheds.
- Evaluate/monitor performance of steelhead populations in these key populations/watersheds following recovery actions.
- Compare population performances with pre-specified viability criteria and previously identified numbers of populations required for BPG viability.
- Reassess recovery criteria for possible modification in light of monitoring data and revaluate T&E status/designation.
- Propose additional recovery actions if necessary.

Call the above process "adaptive management" if you wish.

Research and Monitoring Recommendations

Over the long-term, the most obvious key monitoring need is to somehow obtain accurate estimates or indexes of adult anadromous spawner abundances in those populations that seem most critical for recovery. This will require population-level survey designs that ensure that sampling levels will be adequate for abundance estimation for individual populations. Large-scale regional or coastal monitoring programs that are currently being considered for anadromous fish elsewhere in California will not deliver the goods at the level of individual populations. The effectiveness of redd counts as an index of spawning escapement is uncertain (including the problem of distinguishing resident from anadromous redds) and application/comparison across streams is confounded by differences in observation probabilities that depend on visibility, etc.. Application of DIDSON technologies may therefore be promising for many streams given the low numbers of returning fish and the fact that there are no "confusing" species among returns. (Elsewhere, DIDSON technologies have had difficulty separating returns of pink and sockeye salmon.).

My other notes/concerns about recommended research and monitoring are as follows:

- IF dams restore access to streams, how would the anadromous adults be separated from resident adult? Scale analysis? Redd size? This is a critical monitoring issue for any systems in which barriers to upstream migration are eliminated or reduced.

- I must point out the text at p. 234, bottom, of the Recovery Plan: - resident *O. mykiss* are not at risk, so "focus of recovery is to recover and secure the anadromous form." Why is this logic not pertinent to sea run cutthroat trout which have NOT been listed despite substantial declines in their abundance and attempts to have this anadromous form listed?

- p. 235. I agree that population dynamics of mixed resident/anadromous population is of enormous interest, especially with respect to life history advantages of anadromy (large size, greater fecundity, but possibly reduced and more variable survival) vs. residence (smaller size, more stable environment, less risk), but fecundity increases very gradually in salmonids as a consequence of increased egg size with increased fish size. This complicates interpretation of increases in fecundity in addition to making the benefit, in terms of fecundity, less obvious for salmonids (which increase generally as about the square of length) as compared to teleosts with fixed egg size (for which fecundity increases as cube of length).

- p.240. Regarding intermittent creeks, Everest's key studies of Rogue River steelhead showed that intermittent streams were very important for spawning.

- p. 244. Mangel and Satterthwaite (2008) was not listed in the References but seems relevant.

- p. 246. Exchange rates across populations are unknown but are extremely important with respect to assessing independence of populations as well as establishing whether recovery criteria should apply across single populations, or across several populations with substantial exchange among them (e.g., Big Sur coast, south-central CA region)

- p. 249. I agree that, especially for the southern California region, it is important to "identify those watersheds that are most likely to be suitable for steelhead in the future climate."

- p. 255, Section13.3.5. The proposed use of otoliths and genetics to estimate spawning population size is not at all clear and no references are provided.

- p. 255, 13.4. This section (learning from recovery efforts) seemed very weak and confusing and should be rethought.

- p. 261 The E.O. Wilson quote at top of page is "dorky" and might be replaced.

Summary of findings made by the CIE peer reviewer

In this section I provide brief responses to the specific questions listed in the Terms of Reference, Appendix 1:

1. In general, does the Plan include and cite the best scientific and commercial information available on the species and its habitats, including threats to the species and to its habitat including large-scale perturbations such as climate change and ocean conditions?

I do not fault the plan on this basis. I do not believe that any stone has been left unturned.

2. Where available, are opposing scientific studies or theories acknowledged and discussed?

The Recovery Plan and supporting documents make no pretensions that critical issues (e.g., contribution of resident *O. mykiss* to anadromous *O. mykiss* populations; exchange among populations; viability population abundance criteria) are well understood and they do the best they can to address these issues.

3. Are the scientific conclusions sound and derived logically from the results?

I remain concerned that the population abundance viability criterion (4,150 anadromous adults) is on such shaky ground and I think it would be worth reevaluating this criterion from a theoretical perspective, ideally using a model that somehow captured the age-structuredness of *O. mykiss* populations. I also think that improvements could be made in the theoretical models used to approach migration among populations, and I am uncertain that that the habitat envelope maps, based on summer rearing habitat, provide an adequate proxy for "habitat quality" given the obvious importance of migratory corridor access to headwater areas in many of the southern California watersheds.

I am also concerned that I did not find clear or compelling logic for the Recovery Plan's categories of Core 1, Core 2 and Core 3 populations. These did not clearly emerge from the supporting documents, which mentioned the desirability of specifying "core populations" but, so far as I could tell, did not explicitly list them and, in any event, did not have a three-tiered categorization of populations.

I remain concerned that the Biological Population Groupings (BPGs) may not provide a sound basis for assessment of overall DPS viability. These groupings are convenient and useful for discussions, but no genetic or life history data was presented that convinced me that they have any particular stature as a "critical component of life history or genetic variation". Therefore, it is not clear to me that recovery would require that all of these BPGs need to become "viable". Indeed, I would argue that, realistically, this may be impossible for some BPGs. Somehow I have a hard time imagining viable steelhead in Los Angeles County.

I did not otherwise find any seriously illogical conclusions and the folks that worked on the TRT, etc., who are extremely talented.

1. Does the Plan meet the minimum standards for recovery plans outlined in the NMFS Interim Recovery Guidance and mandates described in section 4(f)(1)(b) of ESA to include site-specific management actions, objective measurable criteria (criteria that links to listing factors) and estimates of time and cost?

I do not feel well qualified to pass judgment on this essentially legal rather than scientific matter, but I make the following observations: (1) The Recovery Plan provides an abundance of site-specific management actions, but lacks clarity with respect to whether or not "secondary"

management actions ought to be taken at the same time that "primary" management actions are taken (those judged most critical and focused on "Core 1" populations); (2) The Recovery Plan, as currently drafted, does not provide unambiguous criteria that might be used for a delisting process. Among other things, the population level recovery criterion (4,150) is weakly supported and it is unclear at what level of population aggregation it might best apply; it is unclear whether the listed number of populations per BPG presented in the Recovery Plan is a firm number that was intended for such use by those individuals who drafted the Viability Report; and it is unclear whether recovery of southern California steelhead would require recovery to viability of every one of the BPGs or only those judged not "ephemeral" (periodically re-populations through external migrations). (3) My version (27 May 2009) of the draft Recovery Plan did not yet seem to have estimates of time and cost for recovery actions, but I am not qualified to judge the merits of any stated values for time and cost of recovery actions, so I did not carefully examine this issue.

2. Is there a clear presentation of the species' extinction risk, the threats facing the species and the necessary actions to remove or reduce those threats such that recovery goals can be achieved?

In a very general way, I think that the Recovery Plan and the supporting documents do a fine job of presenting extinction risk, threats and necessary actions to remove or reduce threats so that recovery goals ***might*** be achieved. But I think it would too much to ask that the Recovery Plan provide recipes for recovery that will ***ensure*** recovery. There are far too many uncertainties (which have been previously discussed in my review).

3. Does the recovery strategy and overall recovery plan provide clear guidance for the public, restorationists, managers, regulators and others to act in a relevant manner over the next several decades to promulgate recovery of salmon and steelhead.

No. As noted before, it is here that I seriously fault the draft Recovery Plan. First, the Recovery Plan does not adequately justify assignment of individual populations to Core 1, Core 2 and Core 3 categories. Second, although the Recovery Plan highlights certain recovery actions as being most critical for recovery and it suggests that recovery actions targeted on Core 1 populations should have highest priority, it also seems to imply that is valuable or even necessary to carry out

recovery actions on all fronts and that even Core 3 populations may "eventually" be needed to be restored to viability.

I believe that the ambiguity with respect to recommended (required?) recovery actions results from the Recovery Team's reluctance to "discourage" restorationists from engaging in recovery actions that are at best benign and unlikely to achieve much, although they may generate substantial good will and good vibes. Some simple revisions to the Recovery Plan could, I think, provide a restoration action framework with much greater clarity: (a) Take most critical actions directed toward Core 1 populations; (b) Begin establishing long-term population monitoring programs in these Core 1 populations; (c) Reevaluate situation after, say, 20 (30?) years.

4. Review the research and monitoring recommendations made in the Report and make any additional recommendations, if warranted.
These have been previously reviewed above.

Conclusions and Recommendations (based on the Terms of Reference in Annex I)

The following Conclusions and Recommendations are taken from the Executive Summary.

- Grouping of southern California steelhead populations into a set of five discrete biogeographic population groups (BPGs) is useful for discussion purposes. *Absent information on exchange of individuals within and between these BPGs, and on clear genetic and/or life history differences between populations constituting BPGs, however, it is impossible to judge whether or not these groupings are useful or necessary with respect to recovery planning and viability of the southern California DPS.*
- Classifying populations within BPGs into "Core 1", "Core 2" and "Core 3" populations seems worthwhile, in principle, if Core 1 populations are most important for recovery and if recovery actions are to be directed primarily at Core 1 populations, at least in the initial stages of recovery activity. I could not find any clear justification or motivation in the Recovery Plan itself for how specific populations were placed into the three categories, however, and supporting documents did not use this classification system. Instead, the "Population Characterization" report (Boughton et al. 2006) distinguished between "Category 1" and "Category 2" populations on the basis of watershed flow patterns. *Clear*

and defensible rationale should be presented for classification of populations into the three "Core" categories.

- The proposed viability/recovery criteria appear to call for achievement of 4,150 adult spawners annually in all populations critical to reestablishing viability of anadromous *O. mykiss* in the southern California region. Neither the Recovery Plan nor the supporting documents provide clear statements concerning how many populations within BPGs need to achieve this individual criterion or regarding whether or not all BPGs need to achieve viability standards if the species is to have status changed from endangered to threatened or to be delisted. Indeed, the Viability report (Boughton et al. 2007) at page 17 states that "it is not clear if all groups are capable of supporting viable populations." This report speculates that the Santa Monica Mountains and Santa Catalina Gulf Coast BPGs may be ephemeral and periodically recolonized from neighboring watersheds/BPGs. *The Recovery Plan must make clear statements concerning the numbers and, ideally, identities of populations within BPGs that must be rebuilt to viability levels for recovery and must also more clearly address the issue of whether or not it is reasonable to expect or require that all BPGs be restored to viability before the endangered status of the southern California DPS can be reassessed.*
- The proposed viability/recovery standard of 4,150 adult spawners per population is very poorly identified (see Viability report, page 4): at 94% probability of 100 year viability the standard would be 2,000 adults and at 96% probability the standard would be more than 11,000 adults. The 4,150 adult spawner abundance level seems quite high to me and seems in part contradicted by the apparent long-term viability of small *O. mykiss* populations on the Big Sur Coast (South-Central CA recovery region). *The Recovery Plan needs to much more directly state that the 4,150 adult anadromous spawners viability criterion is an "interim" criterion that may likely be revised downward as better information becomes available for this O. mykiss DPS.*
- Given the apparent greater genetic similarity of *O. mykiss* above and below barriers within the same watershed than between watersheds, I believe that it is reasonable to assume that elimination of barriers to upstream migration will in many cases be the most effective strategy for achieving long-term viability. With respect to how to treat a "combined" population with respect to the viability criterion, I believe that anadromous adults could generally be separated from resident adults on the basis of their size, their scale growth patterns or possibly their redd sizes. *If the recovery criterion is expressed in terms of anadromous adults, then the abundance of resident fish in a combined*

population is not relevant with respect to ascertaining whether or not a recovery abundance criterion has been achieved. I agree with the authors of supporting documents that it would be problematic to predict the speed with which the anadromous form would reestablish itself among previously resident fish faced with new access to the ocean, but I feel fairly certain that a transition/reversion would take place to the degree that anadromy is a successful life history strategy in the barrier-free system.

- The Recovery Plan calls for life history diversity criteria to be met in all populations. To become viable, populations must all have anadromous, resident and lagoon-anadromous components. I am a "fan" of life history diversity but, for a number of reasons, I do not believe that it is appropriate to require that this life history diversity objective be achieved in all populations. First, I suspect that many watersheds in the southern California region (and certainly elsewhere) may not naturally have summer formation of lagoons, yet they nevertheless have apparently viable and sometimes very large populations of *O. mykiss*. Second, I see no reason why a resident life history is critical for viability if an anadromous population is suitably large and has relatively reliable ocean access in most years. *The Recovery Plan needs to present better justification for why all populations must exhibit all three life history type or should reconsider this requirement. Where reasonable and possible, this life history diversity requirement may have merit, but global application seems inappropriate.*
- Barrier removal (e.g., removal of dams of development of fish passage facilities) is recommended for many watersheds. In some watersheds, however, upstream reservoirs now have populations of introduced non-native species. These species might successfully colonize lower reaches of watersheds in which barriers were removed, thereby endangering rather than assisting recovery of anadromous *O. mykiss* currently found below barriers. *This issue requires substantially more attention and must be addressed on a watershed by watershed basis.*

Appendix A. Background Material

NMFS. 2009. Southern California Steelhead Recovery Plan. May 27, 2009 draft. 305 pp.

Boughton, D.A., P.B. Adams, E. Anderson, C. Fusaro, E. Kelley, L. Lentsch, J. Nielsen, K. Perry, H. Regan, J. Smith, S. Swift, L. Thompson, F. Watson. 2007. Viability Criteria for steelhead of the south-central and southern California coast. NOAA-TM-NMFS-SWFSC-407. 33 pp.

Boughton, D. and M. Goslin. 2006. Potential steelhead over-summering habitat in the south-central/southern California coast recovery domain: maps based on the envelope method. NOAA-TM-NMFS-SWFSC-391. 36 pp.

Boughton, D.A., H. Fish, K. Pipal, J. Goin, F. Watson, J. Casagrande, J. Casagrande, M. Stoecker. 2005. Contraction of the southern limit for anadromous *Onchorhynchus mykiss*. NOAA-TM-NMFS-SWFSC-380. 21 pp.

Clemento, A.J., E.C. Anderson, D. Boughton, D. Girman, and J.C. Garza. 2008. Population genetic structure and ancestry of *Onchorhynchus mykiss* populations above and below dams in south-central California. Conservation Genetics XX:xxxx-xxx (in press?)

Garza, J.C. and A. Clemento. 2007. Population genetic structure of *Onchorhynchus mykiss* in the Santa Ynez River, California. Final report for project partially funded by the Cachuma Conservation Release Board. 29 pp + tables, figures.

Girman, D. and J.C. Garza. 2006. Population structure and ancestry of *O. mykiss* populations in South-Central California based on genetic analysis of microsatellite data. Final report for California Dept of Fish and Game Project P0350021 and Pacific States Marine Fisheries Commission Contract AWIP-S-1. 31 pp. + tables, figures.

Appendix B. Statement of Work

Statement of Work for Dr. David Hankin

External Independent Peer Review by the Center for Independent Experts
Southern California Steelhead Draft Recovery Plan

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract to provide external expertise through the Center for Independent Experts (CIE) to conduct impartial and independent peer reviews of NMFS scientific projects and to participate in resource assessments involving NMFS. The Statement of Work (SoW) described herein was established by the NMFS Contracting Officer's Technical Representative (COTR) and CIE based on the resource assessment requirements submitted by NMFS Project Contact. CIE appointees are selected by the CIE Coordination Team and Steering Committee to conduct the peer review of NMFS science and to participate in resources assessments with project specific Terms of Reference (ToRs). The CIE appointee shall produce a CIE independent report of the appointee's involvement with specific format and content requirements (**Annex 1**). This SoW describes the CIE appointee's work tasks and deliverables related to the following NMFS resource assessment project.

Further information on the CIE peer review process can be obtained at the CIE website via: http://www.ciereviews.com.

Project Background: The Endangered Species Act (ESA) requires NOAA's National Marine Fisheries Service (NMFS) to develop and implement recovery plans for the conservation of threatened and endangered species. The endangered Southern California Distinct Population Segment (DPS) of steelhead occur in an area extending from the Santa Maria River south to the Tijuana River at the US-Mexico border. The geographic area of this DPS contains a series of large river basins that extend inland considerable distances and short coastal systems within urbanized areas that are densely populated. The draft recovery plan serves as a guideline for achieving recovery goals by describing the watersheds and recovery actions 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 governments, non-governmental entities, private businesses, and stakeholders.

The NMFS Recovery Plan for the southern California steelhead is expected to generate substantial interest from outside parties because it: (1) will contain recommendations involving water supplies for a variety of municipalities and agricultural users in an area of low annual rainfall; (2) will prioritize watersheds for targeted restoration actions; (3) could influence local and regional planning efforts and decisions involving land-development patterns; and (4) advise state agencies and local governments on actions necessary to further improve land-use and water-management practices to protect the listed species and its freshwater habitats. The draft recovery plan will include a large geographic area in southern California and has the potential for wide-ranging implications in the public and private sectors. Stakeholder interest will be high due to the potential impact to millions of southern Californians and is expected to lead to inquiries from elected representatives at the local, state and Federal levels.

Requirements for CIE Reviewers: CIE shall provide three CIE reviewers to conduct a desk peer review (i.e., without travel requirement) of NMFS Draft Southern California Coast Steelhead

Recovery Plan to ensure that its contents can be factually supported and that the methodology and conclusions are scientifically valid. The area under consideration will be the lands and waterways in southern California. The desk review shall be conducted in accordance with the ToRs, SoW tasks, and schedule of milestones and deliverables as described herein. The location of the peer review does not need to occur on site. Draft documents can be mailed to reviewers.

Each reviewer's duties shall not exceed a maximum of ten work days. Each reviewer shall analyze the relevant Technical Memoranda developed by NMFS Technical Review Team (TRT) for the South-Central/Southern California Coast Steelhead Recovery Planning Domain as well as the draft Southern California Coast Steelhead Recovery Plan and develop a detailed report in response to the ToR (to be appended as Annex 1). The reviewers shall conduct their analyses and writing duties from their primary locations. Each written report is to be based on the individual reviewer's findings. See Annex II for details on the report outline.

NMFS requests the review be conducted by reviewers with strong credentials in west coast steelhead management activities under the Endangered Species Act.

CIE reviewers shall have expertise in steelhead management, conservation biology, steelhead restoration practices, steelhead/water management, and steelhead conservation under the ESA. Additionally, because of the many unique physical/hydrological aspects of habitat at the southern extent of the species range and the special adaptations of the species to this habitat, it is important that peer reviewers have familiarity with southern California steelhead biology and conservation issues.

The CIE reviewers shall have the requested expertise necessary to complete an impartial peer review and produce the deliverables in accordance with the SoW and ToR as stated herein (refer to the ToR in Annex 1).

Statement of Tasks for CIE Reviewers: The CIE reviewers shall be required to complete the following four tasks: Task 1 - conduct necessary preparations prior to the peer review; Task 2 - conduct the peer review; Task 3 – prepare independent CIE peer review draft reports in accordance with the ToR and milestone dates as specified in the Schedule section; and, Task 4 – Revise draft reports to produce final reports in accordance with the ToR and milestone dates as specified in the Schedule section. Each task is described more fully below.

Task 1 - Necessary Preparation Prior to the Peer Review: The CIE shall provide the CIE reviewers contact information (name, affiliation, address, email, and phone) to the Office of Science and Technology COTR no later than the date as specified in the SoW, and this information will be forwarded to the Project Contact.

Approximately two weeks before the peer review, the Project Contact will send the CIE reviewers the necessary documents for the peer review, including supplementary documents for background information. The CIE reviewers shall read the background documents for the actual peer review.

This list of background documents may be updated up to two weeks before the peer review. Any delays in submission of background documents for the CIE peer review will result in delays with the CIE peer review process. Furthermore, the CIE reviewers are responsible for only the background documents that are delivered to them in accordance to the SoW scheduled deadlines specified herein.

Task 2 - Conduct the Peer Review: The reviewers shall conduct their analyses and writing duties from their primary locations as a "desk" review. Each written report is to be based on the individual reviewer's findings and no consensus report shall be accepted.

The primary role of the CIE reviewer is to conduct an impartial peer review in accordance to the Terms of Reference (ToR) herein, to ensure the best available science is utilized for the National Marine Fisheries Service (NMFS) management decisions (refer to the ToR in Annex 1).

The ToR for the CIE peer review is attached to the SoW as Annex 1. Up to two weeks before the peer review, the ToR may be updated with minor modifications as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToR are not adversely impacted. Please see Annex 1 attached.

Task 3 - Prepare Independent CIE Peer Review Draft Reports: The primary deliverable of the SoW is each CIE reviewer shall complete and submit an independent CIE peer review report in accordance with the ToR, and this report shall be formatted as specified in the attached Annex 2.

Task 4 - Revise Draft Reports to Produce Final Reports: Following a review of their reports by the CIE technical team, reviewers will revise their draft reports, and produce written final reports. Reviewers will submit their final reports to the CIE.

Schedule of Milestones and Deliverables: The CIE review and milestones shall be conducted in accordance with the dates below.

21 May 2009	CIE shall provide the COTR with the CIE reviewer contact information, which will then be sent to the Project Contact
28 May 2009	Project Contact will send CIE Reviewers the background documents
28 May – 11 June 2009	Each reviewer shall conduct an independent peer review
25 June 2009	CIE shall submit draft CIE peer review reports to the COTRs
6 July 2009	The COTRs will distribute the final CIE reports to the Project Contact

Acceptance of Deliverables: Each CIE reviewer shall complete and submit an independent CIE peer review report in accordance with the ToR, which shall be formatted as specified in Annex 2. The report shall be sent to Manoj Shivlani, CIE lead coordinator, via shivlanim@bellsouth.net and to Dr. David Die, CIE regional coordinator, via ddie@rsmas.miami. Upon review and acceptance of the CIE reports by the CIE, the CIE shall send via e-mail the CIE reports to the COTR (William Michaels William.Michaels@noaa.gov) at the NMFS Office of Science and Technology by the date in the Schedule of Milestones and Deliverables. The COTRs will review the CIE reports to ensure compliance with the SoW and ToR herein, and have the responsibility of approval and acceptance of the deliverables. Upon notification of acceptance, CIE shall send via e-mail the final CIE report in *.PDF format to the COTRs. The COTRs at the Office of Science and Technology have the responsibility for the distribution of the final CIE reports to the Project Contacts.

Request for Changes: Requests for changes shall be submitted to the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the Contractor within 10 working days after receipt of all required information of the decision on substitutions. The contract will be modified to reflect any approved changes. The Terms of Reference (ToR) and list of pre-review documents herein may be updated without contract modification as long as the role and ability of the CIE reviewers to complete the SoW deliverable in accordance with the ToR are not adversely impacted.

Key Personnel:

William Michaels, Contracting Officer's Technical Representative (COTR):
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ANNEX 1

Terms of Reference

CIE Peer Review of California's Southern California Coast Steelhead Draft Recovery Plan

The scope of work should focus on the principal elements required in a recovery plan. These principal elements have been defined in section 4(f)(1) of the federal Endangered Species Act (ESA) and sections 1.1 and 1.2 of the National Marine Fisheries Service Interim Recovery Planning Guidance (NMFS 2006)

Section 4(f)(1)(b) of ESA states that "each plan must include, to the maximum extent practicable,

- a description of such site-specific management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species;
- objective, measurable criteria which, when met, would result in a determination…that the species be removed from the list; and,
- estimates of the time required and the cost to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal."

From section 1.1 of NMFS (2006), a recovery plan should:

- "Delineate those aspects of the species' biology, life history, and threats that are pertinent to its endangerment and recovery;
- Outline and justify a strategy to achieve recovery;
- Identify the actions necessary to achieve recovery of the species; and
- Identify goals and criteria by which to measure the species' achievement of recovery."

Background Materials Required
There are five NMFS Science Center Technical Memoranda that form the biological framework for the recovery plan. These memoranda and other supporting information are critical to the review of the Draft NCCC Recovery Plan and include:

- Technical Recovery Team Reports:
- Historical Structure
- Viability Criteria
- Contraction of the southern range limit for anadromous Oncorhynchus mykiss
- Recent efforts to monitor anadromous Oncorhynchus species in the California coastal region: a compilation of metadata
- Potential steelhead over-summering habitat in the South-Central/Southern California Coast Recovery Domain: maps based on the envelope method

In addition, other important references include

- 2006 (2007 Updates) NMFS Interim Recovery Planning Guidance
- Endangered Species Act (http://www.nmfs.noaa.gov/pr/pdfs/laws/esa.pdf)
- Derek Girman and J. C. Garza. (2006) Population structure and ancestry of O. mykiss populations in South-Central California based on genetic analysis of microsatellite data. 33pp.
- Garza, J. C., and A. C. Clemento. (2008) Population genetic structure of */Oncorhynchus mykiss/* in the Santa Ynez River, California. 55pp.

CIE Peer Reviewer Questions:

Evaluate the adequacy, appropriateness and application of data used in the Plan.
1. In general, does the Plan include and cite the best scientific and commercial information available on the species and its habitats, including threats to the species and to its habitat including large-scale perturbations such as climate change and ocean conditions?
2. Where available, are opposing scientific studies or theories acknowledged and discussed?
3. Are the scientific conclusions sound and derived logically from the results?

Evaluate the recommendations made in the Plan.
1. Does the Plan meet the minimum standards for recovery plans outlined in the NMFS Interim Recovery Guidance and mandates described in section 4(f)(1)(b) of ESA to include site-specific management actions, objective measurable criteria (criteria that links to listing factors) and estimates of time and cost?
2. Is there a clear presentation of the species' extinction risk, the threats facing the species and the necessary actions to remove or reduce those threats such that recovery goals can be achieved?
3. Does the recovery strategy and overall recovery plan provide clear guidance for the public, restorationists, managers, regulators and others to act in a relevant manner over the next several decades to promulgate recovery of salmon and steelhead.
4. Review the research and monitoring recommendations made in the Report and make any additional recommendations, if warranted.

ANNEX 2

Format and Contents of CIE Independent Reports

The report should follow the outline given below. It should be prefaced with an Executive Summary that is a concise synopsis of goals for the peer review, findings, conclusions, and recommendations. The main body of the report should provide an introduction that includes a background on the purpose of the review, the terms of reference and a description of the activities the reviewer took while conducting the review. Next, the report should include a summary of findings made in the peer review followed by a section of conclusions and recommendations based on the terms of reference. Lastly the report should include appendices of information used in the review (see outline for more details).

1. Executive Summary
a. Impetus and goals for the review
b. Main conclusions and recommendations
c. Interpretation of the findings with respect to conclusions and management advice

2. Introduction
a. Background
b. Terms of Reference
c. Description of activities in the review

3. Review of Information used in the Recovery Plan (as outlined in the table of contents in the Recovery Plan)

4. Review of the Findings made in the Recovery Plan
a. DPS considerations: Populations, Habitats and Threats
b. Extinction Risk Analysis and Recovery Criteria
c. Evaluation of Conservation Measures
d. Research and Monitoring Recommendations

5. Summary of findings made by the CIE peer reviewer

6. Conclusions and Recommendations (based on the Terms of Reference in Annex I)

7. Appendices
a. Bibliography of all material provided
b. Statement of Work
c. Other