An Independent Peer Review of the Draft Recovery Plan for Southern California Steelhead

Independent Peer Review for the Center for Independent Experts

By

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1. Executive Summary

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. A draft recovery plan has been prepared for the endangered Southern California Distinct Population Segment (DPS) of steelhead that 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.

The Center for Independent Experts (CIE) requested that I conduct an impartial and independent peer review of the draft Southern California Steelhead Recovery Plan (SCSRP) for the endangered Southern California Distinct Population Segment (DPS) of steelhead. The goals of the peer review were set forth in the Scope of Work Terms of Reference that ensure the principal elements of a recovery plan are included and to address the set of questions provided for reviewers, as described in the Introduction.

I reviewed and commented on the draft SCSRP and its associated appendices and background documents. My findings are grouped into four general sections. First, I listed a number of primarily editorial items that should be helpful for the authors to refine the document so that it is more accurate and reads better. The second section is a listing of findings and suggestions from my review of the draft plan, with particular reference to a) DPS considerations: populations, habitats and threats; b) extinction risk analysis and recovery criteria; c) evaluation of conservation measures; and d) research and monitoring recommendations. The third section is a summary of my findings, with reference to the five objectives of the recovery plan, and noting major recommendations. The fourth section presents the major conclusions of the review, noting additional recommendations.

Overall, the SCSRP is well-written and contains the necessary elements to support recovery of the southern California steelhead (SCS). I especially applaud the precautionary approaches to setting viable population levels pending development of additional information. If the recovery actions presented in the SCRP are successfully implemented, then, at least in some populations, there is an excellent chance that the viability targets and expression of all life history forms and strategies will also be restored.

Throughout the review, I provided a number of specific comments and suggestions for improvement of the SCSRP. Besides the numerous suggestions for improvement throughout the review, the most **significant recommendations** are:

1. Provide specific strategies for how the SCSRP will be implemented in cooperation with existing agencies and landowners, especially local governments which control the many land-use actions that impinge on steelhead habitat.

2. Prioritize review of and planning for emergency conservation hatcheries to begin saving biological gametes for future reintroduction and population rebuilding as habitat is further protected and restored in the future.
3. Revisit the proposed core population structure to ensure that sufficient Core 1 populations have been designated for each biogeographic population group (BPG), and that threats to Core 2 and 3 populations are sufficiently ameliorated so that SCS will be restored to previously occupied habitats.
4. Improve the connection between the SCSRP and background science by carefully and thoroughly citing all previous work, especially Boughton et al. (2005, 2006, 2007), wherever that work supports statements made in the SCSRP.
5. Previous work on estimating persistence and viability should be reviewed and discussed in the SCSRP to set the stage for the process selected for the SCS. For one example, see the methods used by the Lower Columbia Fish Recovery Board (LCFRB 2004).
6. The CAP workbook process, the basis for developing threats analysis and recovery actions, could be better elucidated if Appendix D contained an example set of workbook tables for one watershed. It would be helpful for the reader to see an example of how the process worked from beginning to end, from the Kier and Associates workbooks, to the threats tables, to the recovery action tables in the BPG chapters.
7. Several missing components of the SCSRP should be completed, particularly the sections on time and costs of the recovery actions, and Chapter 14, Adaptive Management.
8. A more detailed analysis of the SCS extinction risk should be included in the SCSRP, so that decision-makers will be apprised of the likelihood of extinction, depending on whether the restoration actions are implemented.

2. Introduction

2a. Background

The Southern California steelhead is a rainbow trout subspecies (*Oncorhynchus mykiss irideus*) (Behnke 2002). It has been extirpated from many of its former habitats and is now listed as Endangered under the U.S. Endangered Species Act. NOAA National Marine Fisheries Service is the lead federal agency designated to prevent steelhead from going extinct and to, in fact, develop a Recovery Plan designed to implement processes that will rebuild the populations sufficiently to eventually have this species removed from the endangered species list.

I was requested by the Center for Independent Experts (CIE) to conduct a review of the draft of the Southern California Steelhead Recovery Plan (SCSRP) (May 27, 2009 version). The scope of work focused 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):

"The ESA mandates application of all methods and procedures which are necessary to provide for the conservation and survival of listed species, to the extent that measures pursuant to the ESA will no longer be necessary. Therefore, the plan conveys:

- An assessment of the threats facing the species, including those identified when the species was listed and any new threats;
- A strategy to achieve recovery that is transparent and adaptable;
- The actions NMFS believes are critical to abating those threats and restoring habitat conditions and species' health; and
- Criteria to measure the achievement of recovery." (SCSRP 2009)

Furthermore, the SCSRP states: "To recover steelhead, the following objectives have been identified:

1. Prevent steelhead extinction by protecting existing populations and their habitats;
2. Maintain current distribution of steelhead and restore distribution to previously occupied areas that are essential for recovery.
3. Increase abundance of steelhead to viable population levels, including the expression of all life history forms and strategies.
4. Conserve existing genetic diversity and provide opportunities for interchange of genetic material between and within viable populations.
5. Maintain and restore suitable habitat conditions and characteristics for all life history stages so that viable populations can be sustained.
6. Conduct research and monitoring necessary to refine and demonstrate attainment of recovery criteria." (SCSRP 2009, p. 2).

2b. Terms of Reference

As specified in the Statement of Work (See Appendix 2), the Terms of Reference for this review are as follows:

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:

- 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.

2c. Description of Activities in the review

The primary activity undertaken was to carefully review the SCSRP (2009) and to address the Terms of Reference from Annex I in the Statement of Work, as described above. However, of the five BPG chapters in the SCSRP, due to time constraints, only Chapter 8 was reviewed carefully as an example of the other BPG chapters.

In addition, several of the background documents were also reviewed to varying degrees depending on their topic and relevance to the Terms of Reference. Other literature and web-

based information sources were also investigated as necessary to support the review. Lastly, this independent review of the SCSRP was written using all the above information.

3. Review of Information used in the Recovery Plan

The papers by Boughton et al. (2005, 2006, and 2007) were thoroughly reviewed as background for the SCSRP, and other references were scanned as necessary in support of the SCSRP review. Very few criticisms were found of the work in these papers. The few concerns found in regard to the background documents are included where relevant in the review comments on SCSRP.

I noted one discrepancy in a background report that may influence some conclusions in the SCSRP, but is not referenced specifically in the SCSRP. That is, in Boughton et al (2005, p. 11), there is a reference to uncertainty about the ability of steelhead to pass barriers: "opinion varies widely about the abilities of steelhead with respect to barriers/impediments". Steelhead are known to be among the best leapers of the salmonids (e.g., Scott and Dill 2008, Section 3.2). Their ability to pass a given barrier depends primarily on the flow rate, height of jump, and the depth and flow characteristics of the plunge pool.

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4. Review of the Findings made in the Recovery Plan

First, to assist the authors of the SCSRP, this section of the review contains editorial recommendations that may help to improve the readability of the Plan, each cited by page and line number.

1. P. 10, line 17-18, the term alevin is incorrectly applied "…with a layer of gravel, where the embryos (alevins) incubate within the gravel." Alevin is a salmonid larvae that has hatched but has not absorbed its yolk sac. Pre-hatch, fertilized eggs are also embryos incubating in the gravel. This would more correctly read "…embryos and alevins incubate…".

2. Perhaps the citation on Table 2-1 should be changed. Table 2-1 (pp. 14-15) cites Boughton et al. (2006), but no similar information in the table is noted in that reference. On the other hand, Table 2-1 seems to come almost directly from Appendix B in Boughton et al. (2005).

3. The rankings illustrated by Appendix B are unclear. A definition of the ranking would be very helpful. What is ranked? Is it viability, or strictly amount of habitat? The caption says rankings are based on the amount of habitat available, but it does not say what is actually ranked.

4. The definition of effective population size in the footnote 1 at the bottom of page 19 is too general. The correct definition is more like: "The minimum number of breeding individuals in an idealized population that would not have a genetic tendency to drift toward extinction due to random genetic drift or inbreeding."

5. It was noted that, in a search for San Dieguito, the stream was variably referred to as San Dieguito Creek and San Dieguito River.

6. In Table D-2 the explanation "fewer number of indicators used in the latter analyses" is confusing. Does latter refer to the analysis performed later (i.e., Hunt and associates), or to the analysis showing up in the right column, reading left to right? Some rewording of this would be helpful – just say "in the Kier analysis".

7. The latter part of the following statement is erroneous: "There are no steelhead hatcheries operating in or supplying hatchery reared *O. mykiss* to the Southern California Steelhead DPS.". (SCSRP 2009, p. 32, lines 24-25). It should read "There are no steelhead hatcheries operating in or supplying hatchery reared steelhead to the Southern California Steelhead DPS".

8. In the reference list (SCSRP 2009, P. 299), the citations for National Marine Fisheries Service. 2007e and 2007g appear to be redundant.

9. Section 5.3.1.1 (SCSRP, p. 47, lines 8-22) should cite Boughton et al. (2007), especially regarding the methods for derivation of the 4,150 mean population size for viability.

10. The references for Holmes 2001, Lindley 2003, and Dennis et al. (2006) noted on p. 47 (SCSRP 2009) do not appear in the Literature Cited list.

11. The decision tree described on p. 48 (SCSRP 2009), lines 1-3, and referenced in Boughton et al. (2007) should be incorporated into the SCSRP as an important figure for understanding the proposed population-level recovery criteria.

12. Statements about the effects of ocean conditions, under the section on "Criterion P-2 – Ocean conditions", (SCSRP 2009, p. 48, lines 12-20), while agreed to be true, should have citations to supporting research literature.

13. On page 54 (SCSRP 2009), line 29, there is a reference to Table 4-4, but that table does not appear to be included in the SCSRP.

14. The phrase "Priority 1 actions are aimed to prevent the DPS as a whole,…." (SCSRP 2009, p. 51, lines 18-19), needs to be reworded.

15. It seems like "Priority 2 actions are the….." (SCSRP, p.51, line 22) should be "Priority 3 actions are the…..".

16. The discussion of studies that have demonstrated high growth rates in some seasonal lagoons, and possibly other freshwater habitats which provide suitable over‐summering habitat, (SCSRP 2009, p. 59, lines 27-30) should have references for the studies.

17. The key word “barriers” may be lacking in the following statement: “This component encompasses such restoration activities as removing passage to prime upstream spawning and rearing habitats” (SCSRP 2009, p. 63, lines 8-9).

18. On page 77 (SCSRP 2009), line 20, there is a discrepancy between the number of tributaries assessed (8) and the number of tributaries that are listed across the top of Table 8-2 (9).

19. Should the reference to “ESU” in the following statement be modified to “DPS” to conform with the remainder of the SCSRP (2009, p. 231, lines 19-20): “The viability criteria address two levels of organization, population and the Evolutionarily Significant Unit (ESU).”?

20. The tables in Chapter 13 are numbered differently than in the preceding chapters.

21. Since nothing is permanent, the term “permanent” in lines 14-17, p. 234 might more appropriately be replaced with “long-term”.

22. The citations to Ward et al. (1989) (line 22, p. 237) and Ward (2000) (line 26, p. 237) are not listed in the references section.

4a. DPS considerations: Populations, Habitats and Threats

The remainder of the review is focused on the SCSRP content in light of the Terms of Reference.

Definition of the DPS and its Populations and Habitats

I do not agree that the DPS should only include habitats downstream of artificial barriers (SCSRP 2009. p. 3) because in some cases those habitats and populations upstream of artificial barriers may be critical for recovery. For example, Deiner et al. (2007) found that *O. mykiss* above artificial barriers were not different from those below the barriers, Docker and Heath (2004) found no genetic differentiation between sympatric resident and anadromous *O. mykiss*, Girman and Garza (2006, as cited in SCSRP 2009) determined that above-barrier *O. mykiss* were more closely associated with their below-barrier populations than to populations from other watersheds, and Pearsons et al. (2007) found many instances of interbreeding between resident and steelhead trout. Furthermore, “rainbow trout” which have completed their life‐history cycle entirely in freshwater sometimes produce progeny which become anadromous and emigrate to the ocean and return as adults to spawn in freshwater (SCSRP 2009, p.10). This evidence leads one to conclude that rainbow trout upstream of dams can serve as a remnant source of steelhead genetics for future reproduction in downstream populations, as was suggested by Nielsen (2002) for Alameda Creek steelhead. This is similar to the source-sink phenomenon described in Boughton et al. (2006), where a struggling population can be supported by a nearby population. It is positive to note that the

recovery planning area is designated to include stream reaches upstream of artificial barriers (SCSRP 2009, p. 4, line 24). Further on in the SCSRP (p.13), the authors cite 77 cases where rainbow trout can be found upstream of barriers, downstream of which steelhead have been extirpated. These populations can potentially serve as the source for future steelhead rebuilding in the downstream reaches. Therefore, the habitats upstream of barriers should be included in the DPS.

I question parts of the discussion about Critical Habitat designation on page 4, lines 4-9 (SCSRP 2009). What is the basis for the statement on Critical Habitat that, for the southern California steelhead, it "excludes some occupied habitat based on economic considerations and all military lands with occupied habitat." What are the economic considerations and why are some Critical Habitats exempted under those conditions? Why are potential critical habitats on military lands excluded? It seems that, since military lands are often relatively undeveloped, they provide a good opportunity to preserve Critical Habitats to support recovery. Under ESA, all federal agencies are required to protect critical habitat and prevent "take". Furthermore, why are Critical Habitats designated only on the basis of current occupation? There may be some useful unoccupied habitats to which the DPS could expand occupation if rebuilding is successful. Although these three issues (economic exemptions, military lands, and only occupied habitats) may have been addressed outside the scope of the Recovery Plan, they are relevant to this review under the guidance that the following criteria under Section 4(f)(1)(b) of ESA is not met: "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".

The conclusion that steelhead are no longer present because a stream was dry in 2002 is somewhat questionable (SCSRP 2009, Table 2-1). The table footnote states that '"Dry" indicates the stream had no discharge in anadromous reaches during the summer of 2002." If the stream were flowing in other years, would there be potential for steelhead presence? The high degree of life-history plasticity described by Boughton et al. (2006) makes it reasonable to think that steelhead in this southernmost part of their range have adapted to the varying effects of wet and dry years. Perhaps in dry years, there is no migration through, or presence in, the anadromous reaches whereas in wet years, fish from upstream, adults able to access the stream from the ocean, or strays from neighboring streams can fill available habitat. Relying on only one year of observation (2002), and not considering these other potential sources of steelhead, may be missing the true picture of presence/absence.

In Table 2-1 of the SCSRP, there are six streams for which the classification is "negative observation" which, according to the footnote means "juveniles were not observed during a spot-check of best-occurring summer habitat in 2002". Although the methods for those spot checks are not described in the SCSRP, they are described in Boughton et al. (2005). In that report, the spot checks were described as performed by snorkeling the best-occurring habitat to observe steelhead (Boughton et al. 2005, p. 6). The methods included accounting for the likelihoods of not observing fish that were actually present and included comparison to a less rigorous method. The best-occurring habitat method appears to be sound. However, the possibility still remains that steelhead actually do occur in streams with negative observations, or that they occur in other years (most surveys were done in one year only).

From the survey of presence/absence it was reported that 17 of the historically occupied basins were considered vacant due to the presence of impassible barriers to all known spawning habitat (SCSRP 2009, p. 13, lines 25-26). However, as noted above, the presence or absence of resident *O. mykiss* in the watersheds upstream of those barriers, especially if they are anthropogenic barriers, is relevant to the potential recovery of steelhead. Ideally, this information on the densities of resident rainbow trout could be obtained and incorporated into the SCSRP.

It is also important to note that Section 2.2 of the SCSRP (p. 13) does not specify whether the target of snorkeling surveys are adults or juveniles, or both. Because the occurrence of adults is seasonally ephemeral, it is important that such surveys be targeted to both juveniles and adults. (The fact that the surveys targeted juveniles is clear in Boughton et al (2005), but should also be stated in the SCSRP.)

There seem to be some inconsistencies in the lists of streams to be included in the BPGs. For example, Table 2-1 lists six streams with "negative observations": Jalama Creek, Canada San Onofre, Canada del Refugio, Canada del Capitan, Big Sycamore Canyon, and Santa Margarita River. Yet, in the listing of streams in Table D-1, i.e., those subjected to the CAP workbook process, Jalama Creek is included, but not Canada San Onofre, Canada del Refugio, Canada del Capitan. Also, those streams are not included in the analysis of the recovery actions in the BPG chapters. What is the basis for dropping these three out of the CAP process, while other similar streams are included in the process? Even though the presence/absence survey was negative for these watersheds, they should still be considered in the workbook process in case steelhead can be restored to them, especially since the second recovery objective includes "….and restore distribution to previously occupied areas." (SCSRP 2009, p.44, lines 24-25).

Similarly, at least one stream (the San Diego River) is included in the CAP workbook process (Table D-1) but does not show up on the list of DPS habitat (Table 2-1).

The CAP Workbook Process

The CAP workbook process, cited as the basis for developing threats analysis and recovery actions (SCSRP, p. 28, lines 35-36 and described in Appendix D), could be better elucidated if Appendix D contained an example workbook for one watershed. As it stands, the reader needs to refer to separate documents to see the results (see SCSRP, p. 275, lines 35-44), but it would be helpful to be able to see an example of how the process worked (or not). A link to the Kier and NMFS (2008) document and the watershed workbook tables would be valuable for all reviewers and readers of the SCSRP.

The threats assessment may be missing a valuable opportunity to rank specific threats for recovery action by not utilizing the full information obtained about threats as indicated in the following statement: "Functionally; however, we assumed that there are essentially two states for an indicator as it relates to the target: 1) "poor-fair", in which the indicator exceeds or minimally meets the requirements for species survival and the population is in danger of

extirpation, and 2) “good - very good”, where habitat conditions are favorable for species persistence.” (SCSRP 2009, p. 274). Why force the process to only allow a binomial choice when, first of all it was measured in four categories, not two, and secondly the use of information in the four categories gives a better result on a gradient of outcomes that, when combined with results from all factors, actually gives a more realistic picture of the likelihood of survival or extirpation? This combining of information is essentially discarding good information. Furthermore, depending on where the biological, life-cycle bottlenecks are for each life history stage, the indicators may be more or less important, i.e., they should be weighted for their relative importance.

The use of landscape-scale metrics to assess the relative habitat quality, while an efficient approach that captures much of the negative influence on salmonid populations, is not always the best surrogate for all potential impacts, as implied in this excerpt: “These landscape - scale metrics were used in this threat assessment to overcome logistical and analytical problems inherent in local scale metrics of *O. mykiss* habitat quality (*e.g.*, water temperature), that exhibit extreme spatial and temporal variation, which can lead to misinterpretations.” (SCSRP, p. 274, lines 18-21). If the focus of the analysis is water temperature, it is, in fact, the extremes that are important. Therefore, gauging water temperature in a number of locations (relatively easy to accomplish) would have been the preferred method to obtain empirical data on the effects of temperature on steelhead.

Overall, the CAP workbook process, as described in Appendix D, lacks sufficient detail to assess its ability to fully identify threats and the resultant recovery actions. While the basic explanation sounds reasonable, it is not sufficiently thorough to for this reviewer to evaluate whether the process was rigorous enough to completely elucidate threats and then support proposed recovery actions. For just one example, the abbreviated list of Key Ecological Attributes (KEAs), e.g., degraded hydrologic function, increased turbidity, presence of non - native predators, increased substrate embeddedness (SCSRP 2009, p. 274, lines 36-38), is missing a number of other factors that have negative impacts on SCS. There is no way to tell whether other critical factors, such as blocked access, degraded riparian areas, competitors, unstable hillsides, paved impervious surfaces, disease, and pollution are being accounted for in the CAP watershed workbooks.

As one example, it was surprising to see little reference to the effects of increased flood intensity and frequency due to increased impervious surfaces accounted for, either in the CAP workbook methods, or in the main SCSRP text about threats to recovery. In comparison, these factors were rated as very important in the draft Central California Recovery Plan and, in fact, one of the key metrics used in that CAP workbook process was the amount of impervious surface in watersheds, as estimated from the National Landcover Database for 23 central California watersheds (NMFS 2008).

It is difficult to track the explanation given in Appendix D (SCSRP 2009, p. 275, lines 12-24) for the workbook process and how that was used in the chapters for each BPG (Chapters 8-12). Appendix D refers to three levels of CAP workbook tables: a first “Summary of Threats” table; a second table (“Stress Matrix”) that shows the rank of each stress on each life - history stage; and a third table entitled, “Overall Viability Summary”, that ranks the

viability of each life‐history stage and KEA category. Appendix D goes on to describe the third table as having a composite rank of the current habitat indicators from the "Viability" table of the workbook, as well as an overall "Project Biodiversity Health Rank". However, the only four tables in each BPG chapter are the Physical and land-use characteristics, the Threat source rankings in each watershed, the Critical recovery actions for Core 1 populations, and the recovery action matrix for each watershed. There is no apparent description or discussion how the threats, stresses and viability results from the CAP workbook tables translate into the tables seen in the BPG chapters. It would be preferable if the Workbook process described in Appendix D was easy to follow into the findings and action recommendations.

Threats from Hatchery Programs

The potential threat from hatchery stocking of non-anadromous rainbow trout and other, non-game, species may be underestimated in the SCSRP. For example, in two separate SCSRP references there are indications that hatchery programs and/or non-native species stocking may be negatively affecting SCS, but the effects seem to be minimized or overlooked in the SCSRP. First are the statements from p. 26, lines 39-43: "However, there is an extensive stocking program of hatchery cultured and reared non-anadromous *O. mykiss* which supports a put‐and‐take fishery. These stockings are now generally conducted in non‐anadromous waters (though other non‐native game species such as smallmouth bass and bullhead catfish are stocked into anadromous waters by a variety of public and private entities)." The second statements are found on p. 32, lines 24-36: "However, there is an extensive stocking program of hatchery cultured and reared, non‐anadromous *O. mykiss* that supports a put‐and‐take fishery. These stockings are now generally conducted in non‐anadromous waters. Other non‐native game species, such as smallmouth bass and bullhead catfish, are often stocked into anadromous waters by a variety of public and private entities."

These statements raise three general, but important, concerns. First, the use of the term "generally" indicates there are some exceptions wherein non-anadromous rainbow trout are still being stocked into waters of the SCS DPS. The specifics of these stockings should be elucidated in the SCS or at least referenced to other documents.

Second, the put-and-take stocking of non-anadromous rainbow trout into waters upstream of barriers, but within the watersheds of the DPS, raises concerns about the fitness of any remaining resident rainbow trout. If these resident rainbow trout are to serve as a potential source of future steelhead, as described above, and in the SCSRP, then they must be free of introgression from the hatchery fish, which are often less well-adapted than wild fish and which, when spawning with wild fish, can sometimes reduce the fitness of the progeny (e.g., Araki et al. 2007). Although Clemento et al. (2008) found little introgression of hatchery reared genetic signal into upstream wild O. mykiss, continued or increased stocking can increase the likelihood of this occurring.

Third, and perhaps more importantly, the stocking of predators and competitors, as referred to on p. 24, lines 28-31 and p. 26, lines 42-44, should also be more fully specified in the

SCSRP. Government-sponsored programs resulting in direct mortality of steelhead provide an excellent opportunity to make changes that can benefit SCS recovery. For example, a search for the word "bass" only revealed five "hits" in the SCSRP, and the only reference to bass as possible predators in a specific BPG summary was in the Monte Arido Highlands. Bass are certainly also predators in the impoundments of the other BPGs as well. In general, the effects of predators and competitors, both native and non-native, should be more fully developed in the SCSRP.

Another topic related to the stocking of hatchery fish is the long-time practice of stocking non-native, hatchery-reared steelhead into the streams of California, as described at the top of p. 34 SCSRP (2009). Although this has apparently been halted, the long-term effects of intermingling hatchery with wild steelhead may still be having a negative influence on the survival rate of the remaining steelhead, as described by Araki et al. (2007). The CDFG Salmon and Steelhead Stock Management Policy directs CDFG to evaluate the stocks of each salmon and steelhead stream and classify it according to its probable genetic source and degree of integrity (McEwan and Jackson 1996, as cited in SCSRP 2009, P. 34, lines 7-9). Has this been done? If so, the results, or a summary thereof, should be included, or referred to, in the SCSRP.

Other Threats Assessment Topics

In Section 3.0 of the Factors Leading to Federal Listing, under section 3.2, about overutilization, while there is no directed commercial fishery for steelhead, it is likely that some steelhead are incidentally caught in directed salmon or other fisheries. When the numbers of individuals in a given DPS are extremely low, as they are in some of this DPS' populations, the loss of any fish to human-induced mortality could be significant. This factor needs to be more fully explored.

In the Section on Inadequacy of Existing Regulatory Mechanisms (Section 3.4) one other important element could be added to the list of non-federal regulatory mechanisms (section 3.4.2, bottom p. 25) that affect the recovery of steelhead. That, is, the lack of a local recovery planning effort. For example, local, state, and tribal governments and organizations joined forces to create the Puget Sound Salmon Recovery Plan for Chinook salmon, chum salmon, and bull trout (see http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Puget-Sound/PS-Recovery-Plan.cfm). This plan was adopted by NOAA Fisheries as its final salmon recovery plan in 2007.

In the review discussion under the subheading of Seal Level Rise on pages 37-38 (SCSRP 2009), no allowance is made for the potential improvements in sand barrier access due to the higher sea levels, which might contribute at least a small benefit to steelhead via improved likelihood of ingress and egress through these barriers.

In the section on Climate-Induced California Current Ecosystem Issues, pages 39-42 (SCSRP 2009), perhaps a sixth factor should be added: ocean acidification. Ocean acidification was alluded to in a previous section, and has the potential to severely affect biological production of prey and predator species. The effects on steelhead are unknown but should at least be speculated.

4b. Extinction Risk Analysis and Recovery Criteria

A specific risk analysis for the SCS DPS is not explicitly described in the SCSRP, probably mainly because there is so little data on the present run sizes. Chapters 3 and 4 serve generally as a basis for the risk analysis, giving an overview of the factors leading to listing and the threats to recovery. However, a summary of the best available demographic information with an analysis of the likely trajectory, with and without recovery actions, would seem more fitting as an "Extinction Risk Analysis". The work in Boughton et al. (2005) apparently is more closely aligned with the idea of an "Extinction Risk Analysis" but that work is not referenced directly as such in the SCSRP (although it probably should be).

In regard to addressing Recovery Criteria, the SCSRP depends on "the viability as recovery criteria until such time as sufficient scientific information is available to refine the criteria for assessing population and DPS viability." (SCSRP 2009, p. 45, lines 35-37). The SCSRP more directly addresses the recovery criteria than it does the extinction risk analysis, by specifying recovery thresholds at the population level for mean annual run size, population numbers under poor ocean conditions, spawner densities, and the anadromous fraction of the population. Further recovery criteria at the DPS level include biogeographic diversity and life history diversity. Details of these recovery criteria are iterated in Chapter 5 of the SCSRP.

The remaining comments in this section are devoted to specific details about extinction risk and/or recovery criteria in the SCSRP.

Extinction Risks

The statement that "NMFS concluded that the information available on these impacts to steelhead did not suggest that the DPS was in danger of extinction, or likely to become so in the foreseeable future, because of disease or predation." (SCSRP 2009, p. 24, line 38-39) is questionable. While NMFS may have come to such a conclusion, the facts are that, although disease and predation may not be leading potential threats to extinction, several factors in this category do have negative impact on the DPS and, together with factors in the other categories, have a high potential of synergistically resulting in extinction. Once a population is at extremely low abundance, as is the case for the SCS populations, disease or predation can have serious implications for continued existence. Since the SCS are at the southern extent of their range (Boughton et al. 2005), they would be expected to be more susceptible to temperature–related disease (e.g., Belchik et al. 2004, Stocking and Bartholomew, unknown date).

In regard to predators, little is known about marine predators on steelhead, although sea lions are known predators (see http://wdfw.wa.gov/wlm/sealions/questions.htm). Some invasive species, such a smallmouth bass, are known freshwater predators of juvenile salmonids (e.g., Fritts and Pearsons 2006), as well as kingfishers and herons (Scott and Dill 2008). As these predators increase in abundance, they have the potential to push SCS populations toward extinction.

The effects of fishing and/or poaching may not be adequately addressed in the SCSRP. It is stated that: "Only Listing Factor B, Over‐utilization, does not have a specific threat

abatement criteria identified as changes in fishing regulations have already ameliorated the threat posed to the species from angling." (SCSRP 2009, p. 52, lines 12-13). This is contradicted by the statement "Angling for both adults and juveniles in those portions of coastal rivers and streams accessible to anadromous runs from the ocean (*with the notable exceptions of Sisquoc, Manzana, and Davy Brown Creeks in Santa Barbara County, and upper portions of Sespe Creek in Ventura County***)** has been eliminated through modification of the CDFG's angling regulations following the listing of the DPS as endangered in 1997. (SCSRP 2009, p. 24, lines 10-14). Why are there the above-noted exceptions? Some of the same streams that are listed as exceptions are also listed as bastions of remaining steelhead and their habitats. How was it decided that there should be exceptions to fishing regulations in those streams? Does this constitute "take" under ESA? There is no way to protect juvenile or adult steelhead from possible hooking while angling for resident rainbow or other species.

Furthermore, there is no mention of the negative effects of poaching and/or harassment of adult migrants or spawners by children and dogs. Although poaching and harassment is difficult to assess, it can generally be correlated to density of urbanization and/or recreational use. In some ways, poaching and harassment is a threat that can be ameliorated, especially through educational programs and increased enforcement.

Recovery Criteria

In Table 5-1, (SCSRP 2009, P. 45), it is unclear why one of the criteria is "Viable populations separated from one another by at least 68 km or as widely dispersed as possible". What is the basis for the 68 km separation? Furthermore, this does not appear to be explained in the text on p. 50, lines 9-23, where the criteria for D.2.1, .2, and .3 are explained. I found the explanation in Boughton et al. (2007), but this needs to be clearly referenced in the SCSRP (2009).

The first element of the population-level recovery criteria, as described in section 5.3.1.1, (SCSRP, p. 47, lines 8-22), raises concerns because the annual number of target spawners per population (4,150), while recognized as precautionary, is quite unrealistic for many of the smaller watersheds, even under the very best of conditions. A review of the basis for that number in Boughton et al. (2007) reveals an admirable attempt to deal with the difficult question of identifying the population viability level in the face of almost no empirical data to estimate the "viable" population, as detailed in their Appendix A. Although the viability target of 4,150 may be unrealistically high for smaller watersheds, it is prudent to set the target high while additional data is sought over the ensuing years that can then be used in the decision tree process described by Boughton et al. (2007).

The link between the conclusions in Boughton et al. (2007) and the SCSRP needs to be strengthened. For example, there are references in the SCSRP (2009) to "performance based criteria" (e.g., p. 47, lines 27-28, and p. 48, line 39) that, without at least a citation to Boughton et al. (2007), do not mean much in the context presented. The concepts of prescriptive and performance-based criteria should be briefly described in the opening of Section 5.3.1, or at least the terms should be defined more explicitly.

It is unclear how or why the following statements are made: “As performance‐based run‐size criteria are developed for populations within this DPS, the methods and data used to develop those values may change the ocean conditions criterion or even preclude the need for such a specific criterion. As discussed above, the magnitude and duration of poor ocean survival on the extinction risk of the population is a key factor to consider when developing the run‐size criterion.” (SCSRP 2009, p. 48, lines 39-43). The strategy for monitoring ocean survival described on p. 48, lines 27-37, should take precedence, because all other approaches for determining the effects of ocean survival will depend on monitoring both adult and smolt numbers to calculate respective freshwater and marine survival – there is no other method that is more effective.

It is noted that in Table 5-1 (SCSRP 2009, p. 46), there is a stark difference between the minimum number of viable populations listed for the Conception Coast (3) and the total number of member populations listed for Conception Coast (27) in Appendix C of SCSRP. Although not extensively explained in the text on p. 50 lines 8-18, it is surmised from Boughton et al (2007) that this extremely low number of populations in the Conception Coast BPG is derived from the analysis on drought and fire resistance (e.g., Boughton et al, 2007, Table 6). If the decision to only include three populations in the Conception Coast BPG is based on the 68-km distance criteria, then it violates the viability criteria described in Boughton et al. (2007, Table 1, footnote 5), which states: “Minimum distance between the boundaries of the pair of watersheds harboring each two populations of interest. If meeting the criteria is geographically impossible within a biogeographic group, then the viable populations should be as widely dispersed spatially as possible.” The bottom line is that the SCSRP needs additional explanation regarding why only three populations are included in the Conception Coast BPG.

Threats Abatement Criteria

Some of the threats abatement criteria explanation (Section 5.4, SCSRP 2009) is vague and somewhat difficult to follow. For example, the following text “with an additional descriptor: A) if the action addresses the first listing factor regarding the destruction or curtailment of the species’ habitat, or B) if the action addresses one of the other four listing factors.” (SCSRP 2009, p. 51, lines 15-17) should be cross-referenced with p. 22, lines 19-24. Otherwise, the reader may not track the process because they might not remember what the “five listing factors” are.

Another example is found in the sentence: “Where the recovery action addresses both types of listing factors, the descriptor is based on the principal listing factor addressed.” (SCSRP 2009, p.51, lines 17-18). The term “descriptor” has never been previously defined or referred to, so has no meaning in the sentence. This makes it difficult to follow the threat abatement process.

In regard to the threat abatement rankings of the recovery actions, described in SCSRP (2009, bottom P. 51, top p. 52), it is unclear how steelhead biology is directly incorporated into the ranking -- it seems like life history survival bottlenecks should be accounted for in the rankings. To use the example cited in the referenced pages, Table 5-2 shows groundwater

extraction rated at the 2B threat level. However, what if groundwater extraction for a given watershed was sufficiently severe, at least in some locations, to eliminate summer rearing in some years? Should not the abatement target level be "low" in cases where, due steelhead biology, one dewatering event eliminates all possibility of survival? On the other hand, in the Roads threat category, abating the threat to medium will not likely directly kill juveniles, but more likely will contribute to sublethal stresses.

The Role of Core Populations

It is unclear how the supplemental "criteria that are specific to particular conditions NMFS believes are critical to meet the recovery goal for the species." (SCSRP 2009, bottom half p. 52) are incorporated into the basic abatement criteria listed beforehand on page 51. The text simply lists the supplemental criteria but does not explain how these additional criteria are integrated with other criteria when recommending specific recovery actions in subsequent watershed-specific chapters. Additional explanation of the integration will be helpful.

It is difficult to reconcile the difference between the minimum number of viable populations listed in Table 5-1 (SCSRP 2009, p. 51) and the number of Core 1 populations shown in Table 6-1 (p. 56-57). Table 6-1 shows one Core 1 population for the Santa Monica Mountains BPG, one Core 1 population for the Mojave Rim BPG, and two Core 1 populations for the Santa Catalina Coast BPG, but Table 5-1 shows three, three, and eight minimum viable populations respectively for each of the BPGs. How can the number of minimum viable populations be attained if an insufficient number of populations within a BPG are rated as Core 1 populations?

Since the number of populations designated as Core 1 are insufficient to meet the recovery criteria shown in Table 5-1, some number of Core 2 populations should be designated as critical for attainment of full population- and DPS-level recovery (see Table 5-1). As it stands, the text at the bottom p. 54 and the top of 55 is unclear about the critical need of, and the number of, viable Core 2 populations. Additional language to this effect will be helpful to reduce the vagueness about the importance of Core 2 populations to recovery.

Another important distinction regarding Core 3 populations will also be helpful. The statement "Finally, the complete attainment of DPS‐level biological recovery criteria may also require recovery or stabilization of populations listed as Core 3." (SCSRP 2009, p. 55, lines 10-12) should read "will" instead of "may". This is because the Core 3 populations serve as the insurance policy for the recovery of the Core 1 and 2 populations. That is, they serve as back-up for the inevitable lack of recovery of some of the Core 1 and 2 populations by providing spawner numbers and genetic resources to stray into, or to have gametes transferred from, to Core 1 or 2 populations. To support this notion, one recommendation is to reword the last sentence on p. 55 to read "In the interim, the population‐level recovery criteria are proposed to apply to every core 1, 2, and 3 population." (It is noted that the bottom paragraph on p. 57 addresses this issue on the role of Core 3 populations as important to recovery but only in a general way. Specific, directive language is needed to ensure action on Core 3 populations.)

The same comments apply to the summaries of critical recovery actions for each BPG (Table 8-3 and similar tables for the other BPGs). The caption specifies these actions should be undertaken for Core 1 populations, but should probably be focused on all core populations, at all three levels. After all, the prescriptions are summarized for all the core streams in the foregoing tables in each section. The same comment applies to the text on p. 83, lines 7-8 and other similar text in the other BPG chapters.

It is noted that the threats tables (e.g., Table 8-4 and all similar tables) are incomplete and therefore somewhat difficult to fully evaluate.

4c. Evaluation of Conservation Measures

The perspective of dam modification for the purpose of avoiding extinction under ESA should be reversed from the way it is presently stated in Section 6.2, on page 59, lines 1-5 where it says "If dam modification (including removal or breaching) is determined to be technically or economically infeasible, alternative approaches for providing sustainable volitional passage of steelhead must be implemented. The selected alternative must be expected to provide ecological benefits that are similar to expected benefits from dam removal or breaching." As it reads, decisions depend on technical and economical feasibility of removal. Rather, the focus should be on successful steelhead passage. More appropriate language would be "If passage of adults and juveniles, and associated migration survival rates, cannot mimic natural background conditions with the dams in place, and modified with appropriate passage facilities, then the dams or diversions should be removed or breached".

Why is the statement on implementing other recovery actions (SCSRP, p. 59, lines 39-41), limited to Core 1 populations only? It is important that those same activities be implemented on Core 2 and 3 populations as well. The same can be asked about Table 6-2. Why are those actions limited to Core 1 populations only?

The recommendations in Table 6-2 regarding passage at dams should also include downstream migration as well as adult upstream migration. The language on p. 64, lines 7-9 should also include mention of the effects of dams and impoundments on downstream movement and mortality. Additionally, Table 8-3, and similar tables for all subsequent BPGs should account for remediating downstream passage where appropriate. There are numerous cases where, regardless of adult passage conditions, juveniles suffer unacceptable mortalities or delays at impoundments or dams of the approximate size as found in the SCS region (e.g., Wunderlich et al. 1994). Additionally, there is no apparent mention in the SCSRP of the losses of juveniles being diverted into water diversions as cited, for example, by Kjelson and Brandes (1989).

The description in Section 6.3 of population monitoring research required (SCSRP 2009, p. 62, lines 4-6) should include specificity of smolt enumeration. As it stands, the language only refers to adult enumeration. Furthermore, the list of research topics in lines 13-28, p. 62, should also include adult and smolt enumeration.

It is also important to include initiation of a research thrust on the potential role of conservation hatcheries in rebuilding the SCS in the list or research topics in lines 13-28, p. 62.

Recovery actions will not be sufficiently comprehensive without effective involvement from all levels of government. Therefore it is recommended that the DPS-wide recovery actions include specificity about including the various governments that do affect policies impinging on the success or failure of recovery. So, for example, suggest rewording the sentence from p. 64, line 37 to read: "(1) development of new and effective implementation of current laws, policies, and regulations within local, state, federal, and tribal governments".

The notion of funding for restoration should include seeking new funding sources, initiatives, etc. to support recovery, not just prioritizing existing funding, as stated on p. 64, lines 16-17.

Water in California is a zero-sum game, so alternative water sources are challenging to find and only create problems elsewhere. Therefore, for example, in Table 7-1, under the topic of "Relocate livestock grazing and water sources", suggest adding the phrase "…..or provide buy-outs to ranchers for their water rights and/or access" to the end of the last sentence in the Description box.

Scientists are increasingly becoming aware of the deleterious effects of pharmaceuticals and personal care products on aquatic life. For example, there is mounting, extensive evidence that sewage effluent can affect reproductive endocrine function in fish and contribute to alteration in reproductive development (e.g., Sumpter and Johnson 2005). Therefore, it is recommended that the language in the Description box, under Urban Effluents in Table 7-1, p. 72, be amended to include consideration of these presently untreated effluent constituents.

In the threats tables (e.g., Table 8-4 and all similar tables), the recovery action specified for non-native species in many cases is primarily to monitor them. The recommended recovery action should include "and to control the effects of non-native species on steelhead wherever necessary".

4d. Research and Monitoring Recommendations

The SCSRP describes the research and monitoring in four sections: The first section reviews the viability criteria from Boughton *et al.,* (2007), the second section gives an overview of relevant research questions, which can be grouped into three distinct areas: learning how to enhance anadromy in existing *O. mykiss* populations; clarifying key uncertainties about population structure; and planning for climate change; the third section describes a framework for monitoring populations; and the fourth section describes a conceptual framework for integrating monitoring with ongoing management of the species. (SCSRP, pp. 230-231). Overall, the research and monitoring chapter is excellent. Only a few additional comments follow.

In regard to research on the reliability of migratory corridors, mortality at sea, and juvenile competition, as mentioned in lines 19-21, p. 235, and then discussed further on the several following pages, one suggestion is, in the short run prior to obtaining monitoring data, to create heuristic models of the likely population trajectories under various migration and

mortality scenarios. The factors of migration success and at-sea mortality are, from a modeling perspective, essentially the same thing: loss of adults before spawning. However, they can be treated separately in the models to test for the separate effects. The suggested heuristic, deterministic models can be used to evaluate the relative impacts of seasonal and interannual losses caused by mortality at sea, blocked migratory access, losses due to floods, losses due to competition and/or predation on juveniles, and other factors. As additional monitoring data is gathered, the models can be refined to more accurately portray reality. Some examples of this kind of modeling are Knudsen et al. (2003) and Hamazaki (In press – presently available as a galley at http://www.fisheries.org/proofs/pse/pse.html).

Regarding the discussion of research on the role of estuarine nurseries and mainstem rearing habitats, it is likely important to include consideration of the anthropogenic impacts to these habitats. Various sources of pollution flowing into and through these systems, especially at first run-off, can have rapid deleterious effects and interact with other sources of stress to result in lethal or sublethal effects. For example, see Casillas et al. (1996).

Another approach that may help to address the issue of resident/anadromy phenotypic crossovers, as posed on pp 244-245, would be to use monitoring data. Comparisons of relative abundance of resident *O. mykiss* with observed abundance of steelhead would give clues about the importance of the residents as a source for anadromy. The basic question is: Do watersheds with greater densities (numbers per area of habitat) of resident rainbows also have greater densities of steelhead in the lower watersheds. This hypothesis would need to be controlled for other factors, such as the degree of seasonal/annual access of steelhead, presence of dams, or extent of urban development, for example, in the watershed.

In Section 13.3, another possible enumeration method is the use of a fish collection or counting facility such as a fence or weir, used extensively in Alaska, wherein all or most of the upstream migrants are counted. A floating panel weir is especially useful in streams subject to flash floods. Weirs can also be used to enhance the effectiveness of acoustic telemetry by concentrating the migrants into a smaller opening as they pass upstream. Mark and recapture methods can also be used in conjunction with weirs where flash floods may temporarily incapacitate the weir.

In addition to the research and monitoring described in Chapter 13, and discussed above, the following items should also be considered:

1) Consistent and ongoing monitoring of adult escapements and smolt emigration at semi-permanent weirs or other enumeration facilities, on as many streams as possible, are the backbone of an assessment program. Reliable adult escapement and smolt numbers allow calculation of survival rates for both the marine and freshwater components of the life cycle. Non-lethal scale samples taken from these enumeration projects may also support age structure which will reveal life history details, and perhaps crossover rates.

2) The most important SCS population to monitor is the Santa Ynez population (Boughton et al. 2007, Figure 4), because it is the only population for which there is already data.

3) An important question to explore is: where do SCS adults go in the ocean, and what do they do if their home stream is blocked? Are they subject to high mortality in the ocean, especially off California if blocked from stream access? (Tagging and/or scale analysis could be used to study these patterns of migration and related survival rates.)

4) Obtain adult carcasses wherever possible to retrieve otoliths for further age analysis and otolith microchemistry studies.

5) The effects of freshwater and estuarine predators and competitors, both native and non-native, should be more thoroughly researched, including the effects of stocking non-native predators, such as bass and bullhead.

6) Further marine questions are: What are the predators on steelhead in the ocean? What are the preferred oceanic foods of California steelhead? How will potential changes in the CCE affect their growth and survival (see discussion on pages 39-42 SCSRP (2009)? How many steelhead are being caught incidentally in salmonid or other fisheries.

5. Summary of findings made by the CIE peer reviewer

By way of summary, I will address the question: how well did the Plan meet its own recovery objectives (SCSRP 2009, p.44)? I have also inserted major recommendations where appropriate in this summary.

1. Prevent steelhead extinction by protecting existing populations and their habitats;

The SCSRP does a good job of laying out the biological, scientific, and strategic background for protecting existing populations and their habitats, with the exceptions noted above. However, in my opinion, insufficient attention was paid to specific strategies for how the Plan will be implemented in cooperation with existing agencies and landowners, especially local governments which control so many of the land-use actions that impinge on steelhead habitat.

> ***Recommendation***: Provide specific strategies for how the SCSRP will be implemented in cooperation with existing agencies and landowners, especially local governments which control so many of the land-use actions that impinge on steelhead habitat.

At the extremely low population numbers currently exhibited by these populations, especially in the more southerly areas heavily impacted by urban development, it may be critical to establish emergency conservation hatchery programs immediately to begin saving biological gametes for future reintroduction and population rebuilding as habitat is further protected and restored in the future.

> ***Recommendation:*** Prioritize review of and planning for emergency conservation hatchery to begin saving biological gametes for future

reintroduction and population rebuilding as habitat is further protected and restored in the future.

2. Maintain current distribution of steelhead and restore distribution to previously occupied areas.

The population and DPS-level strategy presented in the SCSRP is likely to ensure current survival of the SCS and hopefully restore the SCS to viability, but only if NOAA Fisheries, working with all concerned agencies and other interests are successful at implementing the Plan as presented. The restoration of SCS to all previously occupied areas may require revisiting the proposed approach to Core populations for two reasons, as noted in my review above. One, too few Core populations have been identified for several of the BPGs. Two, the disparate level of recovery actions between Core 1, 2, and 3 populations, especially Core 3, may result in too few populations being restored to many of the previously occupied habitats. These Core 3 populations are important to the overall recovery because they are the "Back-up" populations if recovery fails in some of the Core 1 and 2 populations. The recommendation for conservation hatcheries applies to this objective as well.

Recommendation: Revisit the proposed core population structure to ensure that sufficient Core 1 populations have been designated for each BPG, and that threats to Core 2 and 3 populations are sufficiently ameliorated so that SCS will be restored to previously occupied habitats.

3. Increase abundance of steelhead to viable population levels, including the expression of all life history forms and strategies.

If all of the major recovery actions in the SCSRP can be implemented, there is a good chance that steelhead can be restored to viable population levels. However, the outcome for each population will likely depend on the interplay of 1) its current population status and habitat health, 2) the extent of urbanization and other human uses of its watershed, 3) the willingness of the public and policy leaders to take the difficult and expensive actions necessary to rebuild populations in a given watershed, and 4) the degree to which current climate, and potential climate change, affects the population. Therefore, while individual populations have a good chance of achieving viability, especially in the north, DPS-wide viability is less likely because these four challenges are already more pronounced in the middle and southern end of the DPS. The huge question is whether the press of the human population and all its accompanying needs for land, agriculture, water, transportation, and recreation will "win" over choices that will protect and restore the SCS.

If the recovery actions presented in the SCRP are successfully implemented then, at least in some populations, there is an excellent chance that the expression of all life history forms and strategies will also be restored.

4. Conserve existing genetic diversity and provide opportunities for interchange of genetic material between and within viable populations.

If the recovery actions presented in the SCRP are successfully implemented then this objective will be met. However, the dire condition of the populations and their habitats begs the question of whether the implementation will be successful, especially in the more southerly, urbanized watersheds. The suggestion above for emergency conservation hatcheries applies to this objective as well. However, there are also risks of conservation hatcheries arising from the various effects of inbreeding and hatchery conformation, as described by Flagg and Nash (1999).

5. Maintain and restore suitable habitat conditions and characteristics to support all life history stages of viable populations.

If the recovery actions presented in the SCRP are successfully implemented then this objective will be met. The greatest challenges, however, include whether the proposed actions can or will be implemented. In particular the removal, breaching, or laddering of major dams is essential to restoration. Another very challenging habitat issue relates to the mainstem reaches of the SCS rivers. These streams flow through heavily urbanized and/or agricultural areas. The combination of seasonal drying combined with the effects flash run-off, and its constituent pollutants, render these areas extremely inhospitable for steelhead. Whether these habitats can be restored to a more natural state is a major challenge.

6. Conduct research and monitoring necessary to refine and demonstrate attainment of recovery criteria.

The research and monitoring proposed in the SCSRP will contribute greatly to the restoration of SCS, especially implementation of routine monitoring of adult escapements and smolt migration. I have added some comments and suggestions to the proposed research which will hopefully be helpful. The biggest question is whether the proposed research will be funded.

6. Conclusions and Recommendations

Overall, the SCSRP is well-written and contains the necessary elements to support recovery of the SCS. I especially applaud the precautionary approaches to setting viable population levels pending development of additional information. I have provided a number of specific comments and suggestions for improvement of the SCSRP, as presented above. The details of those recommendations will not be repeated here. As a way to present my overall conclusions and recommendations, I will address each of the reviewers' questions posed in the Terms of Reference.

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?

The SCSRP is based on excellent science as presented in the provided background materials (Boughton et al. 2005, 2006, 2007 and others). Much of the recent previous

scientific information has been conducted by NOAA Fisheries personnel and others as cited in those documents. Most other previous science conducted to date on SCS has been reviewed and included either in the background documents or the SCSRP itself. However, the SCSRP lacks citations to the Boughton et al. (2005, 2006, 2007) and other work in many places.

The SCSRP adequately addresses climate change and ocean conditions, given the dearth of information on either of these broad and developing topics, and the speculative nature of the future effects of climate change on terrestrial, freshwater, and marine habitats.

> ***Recommendation*:** Improve the connection between the SCSRP and background science by carefully and thoroughly citing all previous work, especially Boughton et al. (2005, 2006, 2007), wherever that work supports statements made in the SCSRP.

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

So little previous research, monitoring, or documentation has been conducted on SCS, that there are apparently no opposing scientific theories regarding the SCS.

The only opposing view that may have been missed is the possibility of a different approach for assessing and estimating viability. While I generally support the approach taken by the authors (Boughton et al. 2007), other methods could have been used, or at least discussed, such as those used by LCFRB (2004, Chapter 5 – see http://www.lcfrb.gen.wa.us/December%20Final%20%20Plans/Approved%20Recovery%20Plan/Regional%20Plan/RP%20Vol%20I%20Ch%205%20Recovery%20Goals.pdf).

> ***Recommendation***: Previous work on estimating persistence and viability should be reviewed and discussed in the SCSRP to set the stage for the process selected for the SCS. For one example, see the methods used by the Lower Columbia Fish Recovery Board (LCFRB 2004).

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

The work in the background documents is thorough and based on scientifically sound methods. All parts of the SCSRP that are based on Boughton et al. (2005, 2006, 2007) are sound and follow from their results (except that they need to be more completely cited, as noted above).

One area where the SCSRP did not follow from the results was that the CAP workbook process results were not sufficiently explained. Although the process was reasonably explained in Appendix D, there were no examples provided, or citations to the basic watershed tables, so that the reader could follow from the preliminary tables

to the final action tables in the BPG chapters. There is a lack of connection between the description in Appendix D and the final Action tables in the BPG chapters.

> ***Recommendation***: The CAP workbook process, the basis for developing threats analysis and recovery actions could be better elucidated if Appendix D contained an example workbook set of workbook tables for one watershed. It would be helpful for the reader to see an example of how the process worked from beginning to end, from the Kier and Associates workbooks, to the threats tables, to the recovery action tables in the BPG chapters.

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?

The SCSRP has sufficient, well-described, site-specific management actions that, when implemented, will lead to population viability and eventual delisting. The objective and measurable criteria, i.e., viability targets, which can be revised as additional information is gathered, are clearly spelled out. The restoration actions required to achieve the recovery viability targets, both at the DPS and population levels, are also listed.

However, the SCSRP is incomplete in several respects. First, the SCSRP did not fully estimate persistence with and without management actions, as described further below. Second, parts of the Action Plan are missing. For example, the threats tables (e.g., Table 8-4 and all similar tables) are incomplete, therefore somewhat difficult to evaluate. They lack the information on time and costs of actions, as required under section 4(f)(1)(b) of ESA. Also, Chapter 14 is completely missing.

> ***Recommendation***: The missing components of the SCSRP should be completed, particularly the sections on time and costs of the recovery actions, and Chapter 14, Adaptive Management.

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?

The threats facing the species and the necessary actions to remove or reduce those threats are clearly described in the SCSRP such that, if the actions are implemented, the extinction risk will be greatly reduced.

However, the SCSRP needs additional work on the likelihood of persistence both without and with action. As it stands, the "Extinction Risk Analysis" in the current report is only vaguely identifiable as such. The likelihood (e.g. probability) that this DPS will go extinct, with or without recovery actions, remains unexplored. A good

example of evaluating the likelihood of persistence is demonstrated by LCFRB (2004, Chapter 5).

> ***Recommendation***: A more detailed analysis of the SCS extinction risk should be included in the SCSRP, so that decision-makers will be apprised of the likelihood of extinction, depending on whether the restoration actions are implemented.

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.

Yes, with the exceptions noted throughout this review.

4. Review the research and monitoring recommendations made in the Report and make any additional recommendations, if warranted.

The research and monitoring recommendations made in the SCSRP were excellent. I have added some additional recommendations under that topic above.

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Appendix 2. Statement of Work

Statement of Work for Dr. Eric Knudsen

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.iexperts.gogax.com/index.html.

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:

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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