An Evaluation of the

‘Biological Opinion for the Trinity River Division of the Central Valley Project’

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1. Executive Summary

This review was undertaken to evaluate if the draft Biological Opinion for the Trinity River Division of the Central Valley Project' (dBiOp):

- incorporates and utilizes the latest scientific information on climate change into the analysis of impacts from the project through the year 2030;
- incorporates and utilizes the latest scientific information on the effects of hatchery fish on listed fish;
- utilizes the concepts of viable salmonid populations and the population structure of listed coho salmon;
- considers the effects of the project on the habitat of listed coho salmon; and,
- represents the best scientific information available.

In general it can be said that dBiOp meets to all five conditions.

The document includes first time analyses and projections of the effect of climate change on air temperatures and precipitation within the Upper Trinity Basin and ultimately, information about future river temperatures and discharges to the Upper Trinity River through 2030. As well, nearly 30 literature citations are offered in support of the potential impacts of climate change on in-river and ocean production.

The report also extensively covers the potential (and likely) impact of hatchery coho on wild coho in all habitats of the Trinity Basin and possibly at sea. The authors support the argument that hatchery fish are a non-benefit to efforts to restore wild coho with over 40 relatively recent literature citations. Critical information on the possible loss of genetic diversity of wild fish as a result of hatchery practices was not available.

Abundance, productivity, spatial structure and diversity parameters, i.e. the components of a viable salmon populations and published works on the population structure of the SONCC coho salmon, were used to effectively evaluate the status of Trinity River coho salmon. It is these parameters on which the risks of the Project Action to the conservation of the species are based. Data for the VSP parameters are sparse and the analyses and conclusions have merit given that the SONCC coho salmon ESU is presently 'listed'.

The hydrologic and hatchery effects of the Project on the habitat of listed coho salmon are effectively considered at length in a detailed hierarchical analysis of juvenile rearing areas, juvenile and adult migration corridors and spawning areas within the Upper and Lower Trinity River and Lower Klamath River. The analyses are aided by the development and use of relationships between discharge and weighted useable areas for each of spawning, fry, juvenile and rearing areas within mainstem reaches at 'Project' mandated discharges.

In total there is little that is obvious within the dBiOp to suggest that the most recent and best available information e.g., VSP/ population structure, habitat availability, hatchery fish and climate has not been effectively applied within the report.

Recommendations relevant to a revision include:

- the investigation and inclusion of less conservative temperature forecasting models on the projected changes in river temperatures;
- the inclusion of additional information on the products and operation of the Trinity Hatchery;
- reminders where appropriate, that in data-poor situations involving 'listed' species, the instigation of the 'precautionary approach' will frequently trump uncertainty;
- the inclusion of more background information and data for the SONCC coast coho on IP km, numbers of fish for depensation thresholds, spawner densities and spawner thresholds from Williams *et al.* (2008), population unit boundaries (Williams *et al*. op cit);
- large scale maps of the areas in question (needed for general purpose through the document);
- summary text table (s) of results involving VSP parameters in Sections 6 and 10;
- summary table of the many results of analyses of the effects of the project on the habitat and fish; and,
- attention to editorial details.

Recommendations of a more far reaching nature include:

- the refinement of available models and application of local data to simultaneously investigate coho productivity in the Trinity River and ocean under various climate change scenarios;
- the development of models that evaluate the possibility of variable increases in the Central Valley's demand for additional water through 2030; and,
- the investigation of genetic introgression in the wild populations.

2. Background

The U.S. Bureau of Reclamation (BOR) proposed to operate the Trinity River Division of the Central Valley Project until 2030. The Project includes facilities to store, divert, and distribute water for irrigation, power generation and fish and wildlife mitigation and protection. The project blocks access to 109 miles of anadromous fish habitat on the Trinity River located upstream of the dam. The amount of water proposed to be diverted from the Trinity River to the Sacramento River equates to approximately 743,243 acre-feet, or 54% of average annual inflow to the Trinity River.

The Trinity River is the largest tributary to the Klamath River, draining approximately 7,690 km^2 in California. The Klamath River system is the second largest river system in California draining approximately 26,000 km^2 in California, and 14,000 km^2 in Oregon. It once supported large anadromous populations of fall and spring run chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), steelhead (*O. mykiss*) as well as Pacific Lamprey *(Lamptera tridentata)*, and green sturgeon (*Acipenser medirostris*) that supported commercial and recreational fisheries, as well as the cultural, subsistence, and commercial needs of native tribes throughout the region.

In 1957 construction began on the Trinity River Division of Bureau of Reclamation's Central Valley Project (CVP), which transfers water from the Klamath Basin to the Sacramento Basin. The Division consists of a series of dams, lakes, power plants, a tunnel, and other related facilities. Lewiston Dam, part of the CVP, was constructed in 1963 near Lewiston, California and is now the upper limit of anadromous fish migration on the Trinity River. At times, 90% of the Trinity River flow was diverted to the Sacramento Basin, contributing to the decline of chinook salmon and coho salmon. These water withdrawals, which extracted a large portion of Trinity River water, caused severe degradation to fish habitat of the Trinity River. Trinity River Hatchery (TRH), located at the base of Lewiston Dam, was constructed to mitigate for the loss of 109 miles of anadromous fish habitat upstream of the dam. However, the hatchery does not mitigate for habitat altered or lost downstream of the dams. Trinity River Hatchery releases roughly 4.3 million Chinook salmon, 0.5 million coho salmon and 0.8 million steelhead annually.

Out of concern for declines in anadromous fish populations, Congress enacted the Trinity River Fish and Wildlife Restoration Act (P.L. 98-541) in 1984. This act directed the Secretary of the Interior to take actions necessary to restore the fisheries resources of the Trinity River Basin. The Central Valley Project Improvement Act (CVPIA) of 1992 (P.L. 102-575) legislated alterations in the operation of the CVP for the improvement of fish and wildlife habitat and resources.

In December 2000, Interior signed the Record of Decision (ROD) for the Trinity River Mainstem Fishery Restoration Environmental Impact Statement (EIS) and EIR. The ROD, based mainly on the Trinity River Flow Evaluation Study, was the culmination of years of investigations on the Trinity River. The ROD adopted the preferred alternative, a suite of actions that included a variable annual flow regime, mechanical channel rehabilitation, sediment management, watershed restoration, and adaptive management. The EIS/EIR was

challenged in Federal District Court. (Westlands Water District, et al. v. United States Dept. of the Interior, 275 F.Supp.2d 1157 (E.D. Cal, 2002)). Initially, the District Court limited increased flows to the Trinity River called for by the ROD until preparation of a supplemental environmental document was completed. On July 13, 2004, the Ninth Circuit reversed that part of the decision, ruling that Reclamation did not need to prepare a supplemental environmental document. (Westlands Water District, et al. v. United States Dept. of the Interior, 376 F.3d 853 (9th Cir. 2004)). Consequently, Reclamation has been and continues to implement the flows described in the Trinity ROD.

This is a controversial federal action with a recent litigious history. The project has large potential implications on the economy of California's Central Valley, coastal communities in California and Oregon, commercial and recreational fisheries in California and Oregon, and tribal and public trust resources. Additionally, the biological opinion will contain new and innovative analyses and assessment models to help quantify hatchery effects on listed coho salmon and the effects of the project on coho salmon habitat.

This draft Opinion by NMFS on the effects of the proposed action by Reclamation on SONCC coho salmon, the Southern DPS of green sturgeon and designated critical habitat, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.) will supersede the 2000 Biological Opinion on Trinity River Mainstem Fishery Restoration. This draft Opinion is based on both the re-initiation package provided by Reclamation, including the CVP/SWP operations BA (USDI Bureau of Reclamation 2008) received by NMFS on October 1, 2008 as well as scientific literature and reports.

Terms of Reference (App.1, Annex 2)

- Does the draft biological opinion incorporate and utilize the latest scientific information on climate change into the analysis of impacts from the project through the year 2030?
- Does the draft biological opinion incorporate and utilize the latest scientific information on the effects of hatchery fish on listed fish?
- Does the draft biological opinion utilize the concepts of viable salmonid populations and the population structure of listed coho salmon?
- Does the draft biological opinion consider the effects of the project on the habitat of listed coho salmon?
- Does the biological opinion represent the best scientific information available?

Description of Review Activities

Access to the Biological Opinion for the Trinity River Division of the Central Valley Project', Appendix and 2 supporting documents was granted via an NMFS ftp site Aug 24; the review was initiated on August 28 (per agreement with M. Shivlani) and completed on Sept 11. All four posted documents (Appendix 1) and two later sought from NMFS were perused in the first week as were several references retrieved from the internet or available from recent reviews of NMFS recovery plans for California salmonids. Special attention was given the review document and Terms of Reference at the start of the second week with the development of notes for and the drafting of the responses following.

3. Summary of Findings (ToRs and responses)

ToR 1. Does the draft biological opinion incorporate and utilize the latest scientific information on climate change into the analysis of impacts from the project through the year 2030?

Climate change is highlighted in five Sections of the draft Biological Opinion (dBiOp). Firstly, within the Section 'Analytical Approach', secondly under 'Factors Affecting SONCC coho salmon/ Status of the Species, thirdly within Factors Affecting Critical Habitat/ Status of Critical Habitat, fourthly within 'Factors Affecting SONCC Coho Salmon and their Habitat' (through 2030)/ Environmental Baseline and finally, strategically placed through 'Effects of the Action'. There is a heavy reliance on the models developed by USDI Bureau of Reclamation (2008) for the Central Valley.

Core to the analyses were the effects of changing green house gas emissions, increasing atmospheric temperatures, and in the SONCC Coho Salmon ESU, resultant changes in precipitation as both rain and snow, snow pack, stream discharges/ hydrology, water for storage, and resultant discharges and water temperatures that will affect the biology/ behavior of coho and its' critical habitat. Climate change will as well potentially alter the frequency or intensity of extreme weather events such as severe storms, winds, droughts, and frosts in unpredictable ways. Similarly, the frequency and/or magnitude of some important processes such as wildfires, flooding, invasive species and disease and pest outbreaks is likely to alter as the climate changes.

Unique to this assessment and perhaps among the first divergences for California assessments is the utilization of climate change projections for the upper Trinity Basin in the examination of the effects of the Proposed Action (Section 7) on Trinity River temperature and flow (and its impact on critical habitat of coho). Scenarios chosen from those presented by USDI Bureau of Reclamation (2008) (Drier, More Warming) and (Wetter, More Warming) were based on an "A2" high emission pathways model which in itself may under estimate the actual emission in the future (Section 6.3.10). This approach is a pleasant departure from the more normal narratives that flag the effect of climate change but fail to integrate it into an assessment. The advancement is bound to raise the bar in the development of models to project and integrate, e.g., increased frequency of extreme weather events and annually variable reservoir drawdowns, esp. drought cycles or climate impacted ocean models for the projection of productivity into assessments of other "Proposed Actions". I would note however that there is a need within the early text of this Section to insure identification of 'temperatures' as either air or river. There is as well room for i) elaboration of the transition from air to river temperatures additional to "Based on the analysis, water temperature will increase at comparable rates to air temperature (Figure 6 7)", ii) the derivation of climate impacted precipitation and flows, and iii) greater clarity on who developed the models and in which ones NMFS substituted the more localized data.

Fire risks will continue to increase in the future as conditions become drier and hotter. Higher temperatures, reduced snow pack, and earlier spring snowmelt all contribute to the frequency, intensity, and extent of fires. Interestingly, the considerations by Lindley *et al.* (2007) of the potential effects of increased wildfires on listed salmonids or citations within that document

including the effects of wildfires on fishes and macroinvertebrates (Rinne 1996; not read) or catastrophic wildfire and number of populations as factors influencing risk of extinction for Gila trout (Brown *et al*. 2001; not read), were not considered. Even more interesting is that 'Climate change and wildfire in California' (Westerling, and Bryant 2008; not read) is included in the dBiOp Reference Section but not cited in the text.

Climate change will as well effect the estuarial and ocean habitats and the life and production of salmon therein. The dBiOp considers several articles regarding sea-level rise as it will affect the Trinity River estuary. It as well, considers such topics as e.g., 'multidecadal change in the Pacific Ocean' (Chavez *et al.* 2003; not read), 'critical size and period hypothesis to explain natural regulation of salmon abundance and the linkage to climate change' (Beamish and Mahnken. 2001; not read) and 'climate-driven trends in contemporary ocean productivity' (Behrenfeld *et al*. 2006; not read) but largely refrains from proposing the possible impacts on the Trinity River through 2030.

The dBiOp incorporates and utilizes nearly 30 citations relevant to the analysis of impacts of climate change from the project through the year 2030. Another six or so could be classified as secondary to the task as they are not principally about climate change but rather, provide trends based on current observations of declines in abundance/production under past and present environmental conditions. Ten of the text citations are either not referenced or have been mis-dated (Appendix 3). Many of the articles, like the field itself are recent, i.e., in the last 5-6 years. Having been privy during the last 12 months to two Recovery strategies for California salmonids in which climate change was dealt with only very lightly, I was pleasantly surprised with the depth of considerations by the authors of this document.

It is somewhat surprising that either Reclamation or NMFS has not adapted the 'stochastic, density-dependent life-cycle model with independent environmental effects in juvenile and ocean stages for populations of spring/summer Chinook" (Crozier *et al*. 2008; not read) for use in the Trinity deliberations. The development of an ocean temperature or productivity model through 2030 would inform for example, on the effects of the 'Proposed Action' to mitigate for coho production lost to dams and reservoirs and potential variability due to ocean climate. In the interim it is suggested that there would be value to embellishing the overview of variable ocean conditions even if simply 'borrowing' more from p11-84 onwards from USDI Bureau of Reclamation (2008) and more clearly relating impact scenarios on Trinity River salmon in terms of potential for changed ocean productivity and adult returns.

On p. 6-67 it is noted that

"If predictions are correct that the Trinity will become warmer and have less snow pack, the ability of the Project to store flow and cold water may ameliorate some of the impacts from climate change to coho salmon in the Trinity River basin. *It may also reduce Reclamation's ability to meet the temperature objectives set forth in SWRCB order WR 90-5*. Overall, flexibility and adaptive management will be needed to maintain flows and temperature requirements for coho salmon. Another compounding factor to consider when developing a climate change baseline is the effects occurring in the Central Valley and the impacts that will have on storage and Trinity River flows. If precipitation decreases or summer droughts occur in the Central Valley, as has occurred recently and as is predicted under some scenarios, **the action agency may not be able to meet flow or temperature goals on the Trinity River.**"

The question regarding increasing incidence of droughts in the Central Valley and the inability of the Action agency to meet flow or temperature goals on the Trinity River Flows may be worthy of elaboration within Section 7.1, "Trinity and Lewiston Reservoirs"/ "Effects of Actions", especially p. 7-85. This suggestion stems from the recent evidence of the increasing frequency of droughts and the albeit blunt prognosis of Stokely (2007) that "current and proposed water delivery schedules by BOR, CDWR and other agencies include plans to deliver unprecedented amounts of water during wet, normal and dry years, such that large reservoirs will likely be drained to mud puddles during the next multi-year drought". Such a prognosis is suggestive of effects that are potentially more serious than a few degrees of temperature change.

Mote *et al.* (2005; cited but not referenced within the dBiOp) indicates in a treatise of declining snow pack in Western North America that "losses to snow pack will continue and even accelerate with faster losses in milder climates like the Cascades' and "will have profound consequences for water use in a region already contending with the clash between rising demands and increasing allocations of water for endangered species". Lackey (2009) is his article "Challenges to Sustaining Diadromous Fishes through 2100: Lessons Learned from Western North America" reminds us under the heading "Individuals Select from Among Desirable Alternatives" (as he does in more dated articles) that there was a near complete silence from the public, elected officials, environmental groups etc when during ongoing electrical blackouts in 2001, the Bonneville Power Administration declared a power emergency and abandoned previously agreed upon interagency salmon restoration commitments to generate electricity at maximum capacity using water reserved to help salmon migrate later in the year.

Thus, there is a need to develop and convey some greater risk models that take into account increased water demand with e.g., ever increased frequency of dry years such that there are single or multiple incidents in which there is a total inability of Reclamation to meet any objectives for the Trinity River.

In conclusion, the dBiOp incorporates and utilizes a significant quantity of the latest literature on climate change and effectively incorporates projection of climate induced river temperatures and discharge into the effects analysis through the year 2030. It is suggested that i) the insights from the application of an even less conservative temperature forecasting model for the projected changes in river temperatures resultant of climate change be sought for inclusion in the "effects" section and ii) that the possible effects of climate change on the ocean be related more in terms of potential qualitative changes (scenarios) in ocean productivity through 2030.

<u>References</u>

Lackey, R.T. 2009. Challenges to Sustaining Diadromous Fishes through 2100: Lessons Learned from Western North America. Symp. Amer. Fish. Soc. 69: 6099-617.

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Sacramento-San Joaquin Basin. San Francisco Estuary and Watershed Science 5: Article 4. 20p.

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Stokely, T. 2007. Trinity Lake Cold Water Pool: Historical Analysis and Future Outlook. Available at http://www.trrp.net/science/symposium07/7_water_temp.htm#ts

USDI Bureau of Reclamation. 2008. Biological Assessment on the Continued Long-term Operations of the Central Valley Project and the State Water Project. U.S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region, Sacramento, California, 1,089p.

ToR 2. Does the draft biological opinion incorporate and utilize the latest scientific information on the effects of hatchery fish on listed fish?

The draft biological opinion (dBiOp) incorporates and utilizes approximately 45 citations relevant to the potential effects of hatchery fish on listed coho. At least three quarters of the citations were published within the last decade and variously inform on the potential for changes in wild population structure, behaviour, reduction in fitness and survival, displacement, reduced growth, redd superimposition, genetic interaction on the spawning ground, ecological interactions, predation outbreeding depression, disease etc. Repeated reference to the 'Columbia River Hatchery Reform System-Wide Report' (HSRG 2009; not read) is suggestive of the relative currency of the scientific information used within the report. Unfortunately several text citations are excluded from the dBiOp's 'References' (Appendix 3).

Few citations had their origins within the SONCC Coho salmon ESU but all were relevant and informative of the potential negative effects of hatchery fish on wild fish. Exceptions i.e., the benefits of hatchery fish, include a limited number of generations of hatchery fish originating from within live gene banks (O'Reilly and Doyle 2007; Fraser 2007) or from natural spawning populations comprised of less than 5% hatchery origin fish (Williams *et al*. 2008; HSRG 2009; not read). These positive actions were not among the suite of actions proposed in the USDI's "Biological Assessment on the Continued Long-Term Operations of the Central Valley Project and the State Water Project" (USDI Bureau of Reclamation 2008) and therefore apparently external to discussion within the dBiOp.

The effects of hatchery fish on wild fish were to a large degree introduced in a generally concise fashion in Section 4.5.2 (Artificial Propagation/ Status of the Species). The reference to McGinnity *et al*. (2003), with respect to the result of straying, can be 'progeny with lower survival'. This brought to mind the potentially broader coverage of effects in "Stocking and Ranching" by both Cross and McGinnity (Cross *et al*. 2007) in "The Atlantic Salmon Genetics, Conservation and Management".

Effects of hatchery fish on wild fish is as well covered within "Current Risk of Extinction" (Section 6.1.2/ Species Baseline/ Environmental Baseline) where the potential effects of hatchery salmonids on wild salmonids are superimposed on coho in each of the Upper and

Lower Trinity, South Fork and Lower Klamath population units. Here they are effectively assessed under the VSP parameter headings of 'Spatial Structure and Diversity', Population Size', 'Productivity' with wrap ups of each in terms of 'Viability'. The wrap-up completes the linkage to concepts of viable salmon populations as laid out in 'Status'.

Some insight to the Trinity River Hatchery is provided in Section 6.3.12 (Hatcheries/ Factors Affecting SONCC Coho Salmon and their Habitat/ Environmental Baseline), as well as with consideration of genetic and ecological impacts. Therein the authors amplify with data, the serious impact on wild salmon of hatchery returns and spawners that have been swamping the relatively small 'wild' population in the mainstem spawning areas immediately below the Lewiston facility. The question of genetic introgression of the "Upper Trinity", and likely 'Lower Trinity' wild population units resultant of hatchery inundation, has yet to be investigated and could well inform directly on the past effects of the hatchery program.

As complete as Sections 4.5.2, 6.1.2, and 6.3.12 were, the authors saved approximately one-third of their total hatchery relevant citations for exclusive inclusion in the analysis within the "Effects of the Action" (Section 7), "Interrelated and Interdependent Effects" (Section 8), "Cumulative Effects" (Section 9), and "Integration and Synthesis" (Section 10). Points made included: ecological interactions with hatchery fish (McMichael *et al.* 1999; not read); aggressiveness of hatchery fish (McMichael and Pearsons 2001; not read); density dependent mechanisms where carrying capacity of spawning grounds has been exceeded (Kostow 2009; not read); fewer recruits from hatchery than wild spawners (Buhle *et al*. 2009; not read); reduction in the natural success of wild stocks resultant of hatchery straying (Araki 2009; not read); large hatchery releases attract predators (Mather 1998; not read); low survival of hatchery releases (Beeman *et al.* 2009; not read); size related mortality in smolts (Miyakoshi *et al.* 2001; not read and Jokikokko *et al.* 2006; not read); and releases of hatchery fish possibly exacerbating the effect of reductions in ocean productivity on naturally produced salmonids through density-dependent mechanisms (Beamish *et al*. 2004; not read). Some citations are mis-dated or missing from the 'References' (see Appendix 3).

Effects analyses of hatchery fish on the habitat of wild salmon and on wild salmon themselves are made possible by the use of relationships between discharge and weighted useable areas for mainstem Trinity River wild coho spawning, fry and juvenile rearing areas at discharges of the Proposed Action. Useful summary analyses are not provided but are suggested within ToR 4.

Insights to products and operation of the Trinity River Hatchery are sparse and could provide insight relevant to the dBiOp. For example, information on the length at release (10cm?), method of release and exposure to accelerated rearing might have resolved this reviewer's question of whether or not the March 15 release of coho 'yearlings' are actually yearlings, presmolts or 'smolts' as they are subsequently labelled (the term 'yearling' is not usually applied to smolts). Incorrect classification of these fish has the potential to change their use of a 'corridor' to that of 'summer juvenile rearing habitat'.

Information on disease issues and treatments in the hatchery might also have provided further insights to the 'effects' of the hatchery. For example, are fish, especially coho, vaccinated prior to release?, are there regular prophylactic treatments of all fish within the unit? Is the effluent

from the hatchery treated (there is no mention of the potential for diseases, nutrients and BOD to interfere with survival of eggs and juveniles immediately below the facility)? All salmonids within the unit are said to be released to the Trinity (there is mention of redd superimposition but little about the actually numbers of carcasses [other than coho] that must inundate the area below Lewiston). What is the water source(s) for the facility (will it be potentially impacted by drought/ water shortages as climate changes and demands for water increase in the Central Valley)? Are predators (avian in particular) an issue and are they controlled from disseminating potential hatchery disease outbreaks to the wild?

In conclusion I suggest that the dBiOp incorporates and utilizes a considerable and appropriate amount of reasonably current information relevant to the potential effects of hatchery fish on listed coho. While there is likely a potentially significant amount of additional literature that could be used to embellish the negative impacts of hatcheries, few if any unused references would contribute much 'added value' to the case for increased risks to extinction of wild coho salmon. It would also seem that after nearly two decades of scientific literature on the negative and potential negative impacts of hatchery fish on wild fish that the precautionary approach would be invoked regarding the future operation of the Trinity River Hatchery program.

References

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Significant Unit. NOAA Tech Memo NOAA-TM-NMFS-SWFSC-432, US Dept. Commerce, NOAA, NMFS, SWFSC, 113p.

ToR 3. Does the draft biological opinion utilize the concepts of viable salmonid populations and the population structure of listed coho salmon?

NMFS indicates within the dBiOp that it does utilize *'the concept of VSP to systematically examine the complex linkages between project effects and viability while also addressing key risk factors such as climate change and ocean conditions. The four VSP parameters (**abundance**, population growth rate (**productivity**), population **spatial structure**, and population **diversity**) reflect general biological and ecological processes that are critical to the growth and survival of coho salmon and are used to evaluate the risk of extinction of the SONCC coho salmon ESU'*...these in turn… *'are used as surrogates for the "reproduction, numbers, or distribution" criteria found within the regulatory definition of jeopardy (50 CFR 402.02). The fourth VSP parameter, **diversity**, relates to all three jeopardy criteria*. .e.g.*, numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or constrained resulting in reduced population resilience to environmental variation at local or landscape-level scales.*

NMFS does use the historical population structure of SONCC coho salmon derived by Williams *et al.* (2006) and the application of the concept of VSP to evaluate the condition of the species in terms of their chances of surviving and recovering, and whether the Proposed Action can be expected to reduce these likelihoods. The population units consist of the Upper Trinity, Lower Trinity, South Fork Trinity and Lower Klamath and are among 45 historical populations (50 disaggregated in the text? p 4-22) within 9 *diversity* strata within the SONCC coho salmon ESU (Williams *et al*. op cit).

The dBiOp relies almost entirely on the credibility of the work of Williams *et al.* (2006; 2008) for guidelines on viability criteria, e.g., minimum number of spawners for each stratum of spawners to be categorized at low risk, the proportion of populations in a stratum that need to be viable for the strata to be viable etc. (Section 4.6). This reliance speaks strongly of those works and presumably the core of both the 2006 and 2008 NMFS reports will soon find a place in the primary literature.

In the absence of much data, population abundance, growth rate (productivity), spatial structure and diversity are each evaluated by NMFS on the basis of the status review for SONCC coho salmon populations and Expert opinion as to their viability and risk of extinction (Sections 4-7 to 4-11).

Within the Species Baseline (Section 6), NMFS extends the analysis of the four VSP parameters to each of the Upper Trinity, Lower Trinity, South Fork and Lower Klamath population units that are affected by the Proposed Action. Here, NMFS with the significant support of the document by Williams *et al*. (2008), evaluates each parameter, and assesses the current risk of extinction of each population unit. It is against these findings that "*NMFS performs two evaluations: whether it is reasonable to expect the Proposed Action, is not likely to (1) reduce the likelihood of both survival and recovery of the species in the wild by increasing the risk of extinction of the species and (2) result in the destruction or adverse modification of designated critical habitat by limiting the ability of the habitat to establish the essential features and functions necessary for the conservation of the species'* (Integration and Synthesis; Section10)

The framework of this approach is highly logical but the assessment, even of the Baseline, (Section 6) requires a fair degree of 'trust" in the facilitator(s) of the report. Estimates of required adult population abundance are taken from Williams *et al*. (2008) with little/ no explanation, as in most cases population estimates are not available or not current. Productivity has seldom been quantified and it is assumed that historical declines of the ESU population relate to each of the population units within. Spatial structure is assessed on the basis of IP km habitat values plucked from Williams (*op cit*) and anecdotal information on presence/ absence/ degree of abundance e.g., juveniles. Information on life history diversity is not well documented and therefore based on any observed anecdotes that are suggestive of an answer. While all of the above concerns would normally call for the introduction of estimates of uncertainty, it is probably the norm to discount such concerns in the case of a 'listed' species, i.e., there just aren't enough fish to say very much about them.

This reviewer had difficulty with the rather sudden introduction without background/ context in the ESU of IP km, depensation threshold, spawner density and spawner thresholds for the four populations under consideration. This issue was resolved by referencing Williams *et al*. 2008, Tables 1 and 4, which I believe are important enough to append to the dBiOp. At the same time I found Table 2 therein which resolved my Sections 1, 2 and 3 and elsewhere questions about geographic boundaries of the population units. These data at least for the population units considered in the dBiOp, are worthy of inclusion very early in the text. This gives rise to another issue of concern especially for those of us that need to see a map/ Figure of the area and place names mentioned in the text (of which there are many). Figure 1 was missing but which from the text description could not possibly have had the information required to appreciate the geographical names and their relative positions within population units. For this I suggest the inclusion of an appendix of maps showing all of the mainstem Trinity and Lower Klamath rivers (and possibly the South Fork) much like Figure 4.1 "The Trinity River mainstem and tributaries from Lewiston to the confluence …" (including rkm) *in* USFWS and Hoopa Valley Tribe (1999).

In conclusion, the dBiOp utilizes the concepts of viable salmon populations and the population structure of listed coho in a framework that provides a clear basis for evaluating the potential impacts of the Proposed Action. However, had the coho ESU been unlisted, I suspect that the various assumptions, anecdotes and general dearth of data considered in the determination and assessment of VSP parameters, might have been a show-stopper. Clarity within the text could be achieved by including more background information from Williams *et al.* (2008), large scale maps of the area in question (needed for general purpose through the document) and summary text table(s) of VSP results from Sections 6 and 10.

<u>References</u>

USFWS and Hoopa Valley Tribe.1999. Trinity River Flow Evaluation. Final Report to the Secretary, U.S. Department of Interior.513p. Available at: http://www.fws.gov/arcata/fisheries/reportsDisplay.html. Accessed March, 2008

Williams, T.H., E.P. Bjorkstedt, W. Duffy, D. Hillemeier, G. Kautsky, T. Lisle, M. McCain, M. Rode, R. G. Szerlong, R. Schick, M. Goslin, and A. Agrawal. 2006. Historical population structure of coho salmon in the Southern Oregon / Northern California Coasts Evolutionarily

Significant Unit. U.S. Department of Commerce, NOAA Technical Memorandum NMFSSWFSC- 390

Williams, T.H., B.C. Spence, W. Duffy, D. Hillemeier, G. Kautsky, T. E. Lisle, M. McCain, T.E. Nickelson, E. Mora, and T. Pearson. 2008. Framework for assessing viability of threatened coho salmon in Southern Oregon / Northern California Coast Evolutionary Significant Unit. NOAA Tech Memo NOAA-TM-NMFS-SWFSC-432, US Dept. Commerce, NOAA, NMFS, SWFSC, 113p.

ToR 4. Does the draft biological opinion consider the effects of the project on the habitat of listed coho salmon?

The draft biological opinion considers at length the effects of the project on the habitat of listed coho salmon. The analyses/ discussion occurs principally in Section 7 'Effects of The Action' where the authors 'identify the risks to extinction that individual coho salmon and essential features of critical habitat will experience as a result of the 'Proposed Action'. The two main effects of the 'Proposed Action are hydrologic and hatchery. Therein the authors identify the environmental stressors (physical, chemical or biotic) and evaluate the response to essential features of critical habitat (and coho salmon), of the addition of the Proposed Action to an Environmental Baseline (Section 6). The intent is to help determine if addition of the 'Proposed Action' to the Baseline will affect the function and value of critical habitat features and the growth, survival or reproduction of wild coho salmon.

The hydrologic effects on the habitat of coho salmon consist of discharges from the Lewiston Reservoir and accompanying river water temperatures, the ranges of which were mandated within the 'Record of Decision'. For an assessment of the discharge effects the authors impose the magnitude and extent of the 'Proposed Action' on unimpaired flows during the first half of the 20th century. This was accomplished by utilization of reach-level Weighted Usable Area (WUA) curves from Composite Suitability Indices developed by Saraeva and Hardy (2009; not read) to gauge the general change in instream habitat reaches availability (incorporating both quantity and quality) within the mainstem Trinity River brought about by the Proposed Action. To evaluate the changes in WUAs from implementation of the Project, daily average WUA values were first generated for pre-dam hydrographs. Least square regressions of the WUAs on discharge in each of spawning, fry, juvenile and rearing areas within four different mainstem reaches were then used for assessment of availability of the differing habitats under 'Project'-mandated discharges from Lewiston.

To assess the impact of river temperatures on the habitat, NMFS examines modeled temperatures under the "warm and dry" and "warm and wet" scenarios provided by Reclamation (USDI Bureau of Reclamation 2008) and compare those temperatures to those in the literature or other sources to determine if they meet the needs of coho salmon. This is because the Trinity River below Lewiston dam now, unlike prior to dam construction, has to provide for year round rearing for fry and juvenile coho salmon, as well as suitable temperatures for adult salmonid holding and egg incubation and spawning. The Lower Trinity, now with higher summer discharges and lower than historical summer temperatures as defined

within the Record of Decision, would apparently not be subjected to water temperatures above those that existed historically.

The authors arrange the 'effects analysis' on habitat (as well fish) in a hierarchical fashion headed by the Upper and Lower Trinity River (as well as Mainstem Klamath River) partitioned into three seasonal periods which are again partitioned into the Juvenile Summer and Winter Rearing areas, Juvenile and Adult Migration corridors, and Spawning areas, the components of critical habitat of coho salmon. The habitat categories are consistent with those of USDI Bureau of Reclamation (2008) (Table below).

The ToR does not specifically request a critique of the assessment of the effects of the project on habitat and so none is offered. It is assumed that the extensive modeling conducted within USDI Bureau of Reclamation (2008) and by Saraeva and Hardy (2009; not read) or possibly Saraeva *et al*. (2009; neither were read if in fact both exist) on habitat availability and background to the dBiOp is acceptable. The approach taken herein which focuses on habitat availability, as well as water quality, channel function, hydrologic behavioral cues, hatcheries, water quality (temperature, the effects of which have been rarely imposed in past assessments) and how they affect coho salmon individual fitness, appear from a non analytical perspective to have considerable merit as well as considerable uncertainty.

An attempt to convey a summary of 'Effects of the Action" for both hydrologic and hatchery effects on each of critical habitat and fish, pp. 80 -128 follows. Only a few cells have been filled, enough to illustrate that the task would require knowledgeable interpretation of the text. Such a table conveys only the first order effects. A second order negative effect would have to be inferred in e.g., the cell [smolt: Oct-Apr Htch] where there is a suggestion that wild smolt would not be influenced by the March 15 release of hatchery yearlings (or is it smolts?). The secondary effect is that some hatchery smolts will return as hatchery adults which are a disbenefit to the 'wild' population. Hence it may be that the entire 'Htch' column might be struck as the cells would all be red.

Table. Possible format and example entries for summary of hydrologic and hatchery effects of the 'Proposed Action' on three population units of wild coho salmon and their critical habitat in the mainstem Trinity and Klamath rivers. Effects are categorized as +ve; –ve and none.

Population and Effects on:	October thru April		May thru July		August thru September	
	Hydro	Htch	Hydro	Htch	Hydro	Htch
Upper Trinity						
Critical Habitat						
Juvenile Winter Rearing Area	-ve	-ve	n/a	n/a	n/a	n/a
Juvenile Summer Rearing Area	n/a	n/a				
Juvenile Migration Corridor	-ve	-ve				
Adult Migration Corridor	none	n/a				
Spawning Areas	+ve-ve	-ve	n/a	n/a	n/a	n/a
Fish						
Egg	+ve-ve	-ve			n/a	n/a

Fry	-ve	-ve			n/a	n/a
Juvenile	-ve	-ve			n/a	n/a
Smolt	-ve	+ve-ve				
Adult	+ve-ve	-ve				
Lower Trinity River						
Critical Habitat						
Juvenile Winter Rearing Area			n/a	n/a	n/a	n/a
Juvenile Summer Rearing Area						
Juvenile Migration Corridor						
Adult Migration Corridor						
Spawning Areas						
Fish						
Egg			n/a	n/a		
Fry						
Juvenile						
Smolt						
Adult			n/a	n/a		
Lower Klamath						
Individual Fish						

In conclusion, the text of the dBiOp does consider at length, the effects of the project on the habitat of listed coho salmon. A summary table of the analyses would be a significant contribution to an indelible image of the effects of the project on the habitat as well as fish.

References

USDI Bureau of Reclamation. 2008. Biological Assessment on the Continued Long-term Operations of the Central Valley Project and the State Water Project. U.S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region, Sacramento, California, 1,089p.

ToR 5. Does the biological opinion represent the best scientific information available?

There is little evidence that the dBiOp does not represent the best scientific information *available*. Comments follow with respect to the data, models and literature used.

There can be little issue with most physical data employed in the climate models, discharge records for the Trinity River, Dam and Lewiston Dam, as well as precipitation, water and air temperatures relevant to the basin predate dam construction. Classical estimates of stream substrate are not available and thus units of potential habitat capacity (IP km; definition not included) were developed for stream reaches from mean gradient, mean annual discharge, and valley constraint (Williams 2006; not read). No account of the derivation of these units is brought forward. Doing so, if only in simple terms would enhance the completeness of the document. It is presumed however, that the IP takes stream area at different river discharges into account but it is not absolutely clear how IP values of critical habitat are integrated with

habitat suitability criteria (HSC) / weighted useable areas WUAs provided NMFS by Saraeva *et al*. (2009; not read) in Section 7.

In contrast to the physical data, information on the past and present abundance and biology of wild coho salmon that remain in the Basin is sparse. Proxies for life history parameters of Trinity coho have been adequately teased from the literature, but past and present abundance estimates which were apparently convincing for 'listing' purposes, leave much to be desired. Most past and present estimates of abundance external to the mainstem below the Lewiston Dam, are "assumed" which is perhaps not a serious issue once one is convinced that there are so few fish (at least other than below Lewiston Dam). Nevertheless, a greater acknowledgement of the uncertainty of all base estimates might be appropriate.

For the most part, the models used in the assessment have been used elsewhere and as such presumably well vetted. Included are those of Reclamation (USDI Bureau of Reclamation 2008) for both air temperature and precipitation (Section 6.3.10) under climate change scenarios even though NMFS substituted more Trinity River proximate data. Variations on these models, e.g., climate and temperature are not provided in detail leaving one to assume that the collective 'experience' of NMFS have these matters in hand.

NMFS also utilized reach-level Weighted Usable Area (WUA) from several Trinity River reaches and pre-dam flows to evaluate the implementation of the Project mandated flows from Lewiston on the change in area of each of spawning, fry, juvenile and rearing areas (see ToR 4). For this there is a text description but little feel for data used and little discussion about the results which appear within Figures in the Appendix.

These initiatives demonstrate another of NMFS' desires to extend analyses with the best (albeit couched with uncertainties) data and techniques available. The approach and development is described and referenced but was not accessed by this reviewer. Tastefully however, NMFS acknowledges the limitations of the WUA analysis and points out that their analysis focuses not only on habitat availability, but also considers other important (but more subjective with potentially equal uncertainty) components of the flow regime (water quality, channel function, hydrologic behavioral cues, *etc.*), hatcheries, water quality, and how they affect coho salmon individual fitness.

With respect to the literature utilized, it has been noted elsewhere that the references respecting climate change and effects of hatchery fish on listed fish are laudable. Also, the dBiOp stems from a lengthy documented history including: the Department of Interior's Record of Decision, Trinity River Mainstem Fishery Restoration Final Environmental Impact Statement /Environmental Impact Report in 2000; the Biological Opinion on Trinity River Mainstem Fishery Restoration in 2000; Reclamation's Biological Assessment on the continued Long-term Operations of the Central Valley Project and State Water Project in 2008; and the NMFS final Operation of the Central Valley Project (OCAP) Biological opinion in 2009 (the latter being exclusive of Trinity coho and green sturgeon), etc. The 2008 and 2009 documents would certainly facilitate a quick review of previously relevant material and an easy search for new materials. I also suspect that the interagency 'debate' challenges staff to provide the best scientific analyses and information available.

In conclusion, there is little evidence or reason to believe that the dBiOp does not represent the best scientific information available. New analyses contain considerable uncertainty but the end results are generally consistent with observations on the present dearth of wild coho, literature gleaned expectations and a listed species. That being said, attention to the detail of assembling a totally impressionable and readable document was overlooked. The text imbedded citations are inconsistent in their format and accuracy with respect to information given in the Reference Section and many more are absent from the Reference Section (see Appendix 3). Entries in the Reference Section are inconsistent in format and convention. Omission of Figure 1 and Figures that identify specific locations in the text which are important to the understanding of areas, reaches, distances between etc., are significant oversights. A full edit review would have been appropriate prior to release.

References

Williams, T.H., E.P. Bjorkstedt, W. Duffy, D. Hillemeier, G. Kautsky, T. Lisle, M. McCain, M. Rode, R.G. Szerlong, R. Schick, M. Goslin, and A. Agrawal. 2006. Historical population structure of coho salmon in the Southern Oregon / Northern California Coasts Evolutionarily Significant Unit. U.S. Department of Commerce, NOAA Technical Memorandum NMFSSWFSC- 390.

6. Conclusions and Recommendations

Conclusions and recommendations are provided at the end of each of the five questions within the Terms of Reference and as well in aggregate in the Executive Summary.

7. Appendices

Appendix 1. Bibliography of Materials Provided

Naman, SW. 2008. Predation by hatchery steelhead on natural salmon fry in the Upper Trinity River, California. M.S. Thesis, Humbolt State University, Dec 2008. 74p.

NMFS. 2009a. Draft Biological Opinion for the Trinity River Division of the Central Valley Project. NMFS Southwest Region. 161p.

NMFS. 2009b. Appendix. Tables and Figures for the 2009 Biological Opinion on the effects of the Central Valley Project and State Water Project on Southern Oregon/Northern California Coastal Coho Salmon. 6p.

USDI Bureau of Reclamation. 2008. Biological Assessment on the Continued Long-term Operations of the Central Valley Project and the State Water Project. U.S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region, Sacramento, California, 1,089p.

USFWS and Hoopa Valley Tribe. 1999. Trinity River Flow Evaluation Study Final Report. A Report to the Secretary, US Dept. Interior in Consultation with US Geological Survey, US Bureau of Reclamation, National Marine Fisheries Service and California Dept. Fish and Game. 513p.

Williams, T.H, B. Spence, W. Duffy, D. Hillemeier, G. Kautsky, T. Lisle, M. McCain, T. Nickelson, E. Mora, and T. Pearson. 2008. Framework for assessing viability of threatened coho salmon in Southern Oregon / Northern California Coast Evolutionary Significant Unit. NOAA Tech Memo NOAA-TM-NMFS-SWFSC-432, US Dept. Commerce, NOAA, NMFS, SWFSC. 113p.

Appendix 2. Statement of Work

Attachment A: Statement of Work

External Independent Peer Review by the Center for Independent Experts

Biological Opinion for the Trinity River Division of the Central Valley Project

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. This Statement of Work (SoW) described herein was established by the NMFS Contracting Officer's Technical Representative (COTR) and CIE based on the peer review requirements submitted by NMFS Project Contact. CIE reviewers are selected by the CIE Coordination Team and Steering Committee to conduct the peer review of NMFS science with project specific Terms of Reference (ToRs). Each CIE reviewer shall produce a CIE independent peer review report with specific format and content requirements (**Annex 1**). This SoW describes the work tasks and deliverables of the CIE reviewers for conducting an independent peer review of the following NMFS project.

Project Description: The U.S. Bureau of Reclamation (BOR) proposed to operate the Trinity River Division of the Central Valley Project until 2030. The Project includes facilities to store, divert, and distribute water for irrigation, power generation and fish and wildlife mitigation and protection. The project blocks access to 109 miles of anadromous fish habitat on the Trinity River located upstream of the dam. The amount of water proposed to be diverted from the Trinity River to the Sacramento River equates to approximately 743,243 acre-feet, or 54% of average annual inflow to the Trinity River.

The Trinity River is the largest tributary to the Klamath River, draining approximately 7,690 km^2 in California. The Klamath River system is the second largest river system in California draining approximately 26,000 km^2 in California, and 14,000 km^2 in Oregon. It once supported large anadromous populations of fall and spring run chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), steelhead (*O. mykiss*) as well as Pacific Lamprey *(Lamptera tridentata)*, and green sturgeon (*Acipenser medirostris*) that supported commercial and recreational fisheries, as well as cultural, subsistence, and commercial needs of native tribes throughout the region.

In 1957 construction began on the Trinity River Division of Bureau of Reclamation's Central Valley Project (CVP), which transfers water from the Klamath Basin to the Sacramento Basin. The Division consists of a series of dams, lakes, power plants, a tunnel, and other related facilities. Lewiston Dam, part of the CVP, was constructed in 1963 near Lewiston, California and is now the upper limit of anadromous fish migration on the Trinity River. At times, 90% of the of the Trinity River flow was diverted to the Sacramento Basin, contributing to the decline

of chinook salmon and coho salmon. These water withdrawals, which extracted a large portion of Trinity River water, caused severe degradation to fish habitat of the Trinity River. Trinity River Hatchery (TRH), located at the base of Lewiston Dam, was constructed to mitigate for the loss of 109 miles of anadromous fish habitat upstream of the dam. However, the hatchery does not mitigate for habitat altered or lost downstream of the dams. Trinity River Hatchery releases roughly 4.3 million Chinook salmon, 0.5 million coho salmon and 0.8 million steelhead annually.

Out of concern for declines in anadromous fish populations, Congress enacted the Trinity River Fish and Wildlife Restoration Act (P.L. 98-541) in 1984. This act directed the Secretary of the Interior to take actions necessary to restore the fisheries resources of the Trinity River Basin. The Central Valley Project Improvement Act (CVPIA) of 1992 (P.L. 102-575) legislated alterations in the operation of the CVP for the improvement of fish and wildlife habitat and resources.

In December 2000, Interior signed the Record of Decision (ROD) for the Trinity River Mainstem Fishery Restoration Environmental Impact Statement (EIS) and EIR. The ROD, based mainly on the Trinity River Flow Evaluation Study, was the culmination of years of investigations on the Trinity River. The ROD adopted the preferred alternative, a suite of actions that included a variable annual flow regime, mechanical channel rehabilitation, sediment management, watershed restoration, and adaptive management. The EIS/EIR was challenged in Federal District Court. (Westlands Water District, et al. v. United States Dept. of the Interior, 275 F.Supp.2d 1157 (E.D. Cal, 2002)). Initially, the District Court limited increased flows to the Trinity River called for by the ROD until preparation of a supplemental environmental document was completed. On July 13, 2004, the Ninth Circuit reversed that part of the decision, ruling that Reclamation did not need to prepare a supplemental environmental document. (Westlands Water District, et al. v. United States Dept. of the Interior, 376 F.3d 853 (9th Cir. 2004)). Consequently, Reclamation has been and continues to implement the flows described in the Trinity ROD.

This is a controversial federal action with a recent litigious history. The project has large potential implications on the economy of California's Central Valley, coastal communities in California and Oregon, commercial and recreational fisheries in California and Oregon, and tribal and public trust resources. Additionally, the biological opinion will contain new and innovative analyses and assessment models to help quantify hatchery effects on listed coho salmon and the effects of the project on coho salmon habitat.

The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete the work tasks of the peer review described herein. CIE reviewers shall have the expertise, background, and experience to complete an independent peer review in accordance with the SoW and ToRs herein. CIE reviewer expertise shall include hydrology, Pacific salmon hatcheries, and river restoration.

Location of Peer Review: Each CIE reviewer shall conduct a desk review, therefore no travel is required.

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

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering committee, the CIE shall provide the CIE reviewer information (name, affiliation, and contact details) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The SoW with ToRs is established by the NMFS Project Contract, and CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents and reports for the peer review. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send by electronic mail or make available at an FTP site the CIE reviewers all necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE on where to send documents. The CIE reviewers shall read all documents in preparation for the peer review.

1. Trinity River Flow Evaluation Study (300 pages, much of which can be skimmed)
2. Bureau of Reclamation Biological Assessment (70 pages)
3. Coho salmon viability documents (100 pages)
4. Hatchery background information to be determined (50 pages)

This list of pre-review documents may be updated up to two weeks before the peer review. **Any delays in submission of pre-review documents or reports for the CIE peer review will result in delays with the CIE peer review process, including a SoW modification to the schedule of milestones and deliverables.** Furthermore, the CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein.

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

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

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

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

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

21 August 2009	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
21 August	NMFS Project Contact sends the CIE Reviewers the pre-review documents
21 August – 3 September	Each reviewer participates and conducts an independent peer review
4 September	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
18 September	CIE submits CIE independent peer review reports to the COTR
25 September 2009	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

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

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

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

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

Key Personnel:

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

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

2. The main body of the reviewer report shall consist of a Background, Summary of Findings for each ToR, Conclusions and Recommendations in accordance with the ToRs.

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

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

Annex 2: Terms of Reference for the Peer Review

Biological Opinion for the Trinity River Division of the Central Valley Project

1. Does the draft biological opinion incorporate and utilize the latest scientific information on climate change into the analysis of impacts from the project through the year 2030?
2. Does the draft biological opinion incorporate and utilize the latest scientific information on the effects of hatchery fish on listed fish?
3. Does the draft biological opinion utilize the concepts of viable salmonid populations and the population structure of listed coho salmon?
4. Does the draft biological opinion consider the effects of the project on the habitat of listed coho salmon?
5. Does the biological opinion represent the best scientific information available?

Appendix 3. Editorial Comments

Text citations without references; search was incomplete.

Araki *et al.* 2007	National Weather Service 2008
Araki 2009	Nelitz and Porter 2009
Barthalomew 2008	NMFS 1996
Beamish *et al.* 1997a	NMFS 1997
Beamish *et al.* 2004	NMFS 2003
Beeman *et al.* 2008	NMFS 2007
BLM 1997	NMFS 2008
BLM 2005	NMFS 2009
Church and White 2006	NRC 2005
Chao *et al.* 2008	NRC 2007
DOI 200	Rahmstorf 2007
Foott 2009	Regonal *et al*. 2005
FWS 1999	Reisenbichler and McIntyre 1977
Gore and Nestler 1988	Saraeva *et al*. 2009
Heath *et al*. 2003	Stewart *et al*. 2004
HVTF 2006	USFS 1997
Leurs *et al.* 2008	USFS 1999
Marchetti and Nevitt 2003	USFS 2000
Marshall 2008	USFWS *et al.* 2000
McMichael and Pearsons 2001	USFWS and Hoopa Valley Tribe 1999
Moser and Franco 2008	USFWS and HVT 1999
Mote *et al*. 2003	Williams and Reeves 2003
Mote *et al.* 2005	Williams *et al.* 2006
Mote 2006	Williamson and Hillemeier 2001
Naman 2009	YTFP 2005
National Academies of Science 2003	Zhu *et al.* 2005

Notes by page exclusive of literature citations (above)
p. 1-2 (ToC) should there be a section 7.3.1?
note: repletion of page numbers conflicting with those of Section 1 (Background)
p. 1-1 Figure 1 missing
p. 1-2 write out first time acronyms
p. 2-4 glitch with return key at bottom of page
p. 2-5 line 5??
p. 2-6 text, "Table 2-4 were"?
p. 3-7 hatchery coho "yearlings" or smolts as they are subsequently referred to ?
p. 3-9 "risk of extinction risk"?
p. 3-13 double "that" line 10
p. 3-14 several lines repeated in 1st para 3.7.2
p. 3-15 several climate related acronyms that could use explanation and source?; also clarification would help re: what if any *model* was developed by NMFS

p. 4-16 quotation marks or italics for threatened, endangered etc.?
p. 4-17 locate Iron Gate Hatchery?
p. 4-18 top para largely repeated from previous page
p. 4-19 “three large hatcheries” deserve locating in context of Trinity River
p. 4-22 “45 historical populations” but text accounts for 50?; 2nd last line “meaning that ?are”
p. 5-29 “ BRT” ?
p. 5-34 “SWE”?
p. 5-35 “snow melt will come occur earlier”
p. 6-41 RST (first time)
p. 6-46 first of several cases where e.g. a suggestion of negative population growth becomes factual only a few lines later
p. 6-47 first time IP?; ‘unit’ bounds from Williams *et al*. 2008
p. 6-48 prefer use of pers com rather than date
p. 6-61 middle of page…’on which coho salmon (?) are depending”, word missing?
p. 6-65 last para “analysiswater”
p. 6-66 Figure 6-7; X-axis labels?, also 2nd last line “three” ?
p. 6-68 2nd para “stow” and “will come occur”, last para “generally though to be”
p. 6-78 1st line, is “take” worth italicizing?
p. 7-81 2nd last para, “1942 to 1977”, should be 1976?
p. 7-82 understanding the location/proximity of reaches and Burnt Creek seems imperative to following the development of the WUA/ hydrograph analyses?
p.7-83 2nd line “per Project”; last para 1st line “how much water? maintained”; 2nd last line “proceeding two years”
p. 7-84 Table 7-1 column widths are problematic; why aren’t the signs mostly negative in column 5?
p 7-85 first time description of Upper Trinity geographic area!
P 7-86 suggest use of the same Y-axis scale for all 5 water year types
p. 7-91 label for X-axis
p. 7-94 text in middle of page, are Table numbers correct?
p. 7-95 middle of page, the relevance and context of “400,000 in a single day?
p. 7-102 X-axis label
p. 7-106 1st para “smolts couldmight be”
p. 7-107 X axis label
p. 7-108 X axis label
p. 7-113 1st para last sentence, “less potential to mitigate within” also Figure 7-8 mentioned in text is 6 pages later
p. 7-117 2nd para “will likely do not experience”
p. 9-129 2nd para 3rd line, not sure that 3 salmonid species were actually considered in the Opinion
p 10-131 2nd para, wording seems especially awkward
p. 10-132 4th para, “would maintain reduce”
p. 10-137 3rd para, (but not the only occasion), “The proposed Action would not decrease the amount” is rather definitive for something about which we know little or nothing...unlikely to?
p.12-141 Reference Section needs work, espc., with regard to consistency of style, formatting, alphabetical arrangement, italics/brackets for scientific names, etc, etc.

Appendix : do equations in Figures merit p values?; again “reaches should be identified on map(s)….see comments under ToR 5.