San Luis & Delta-Mendota Water Authority

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Dear Mr. McInnis and Mr. Lohoefener:

The San Luis & Delta-Mendota Water Authority ("Authority") and the State Water Contractors ("SWC") , on behalf of our member agencies (see Appendix 1), respectfully submit this letter to the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) (collectively referred to herein as the "Services") for the purpose of providing comments on the Biological Assessment (BA) of the Continued Long-Term Operation of the Central Valley Project (CVP) and State Water Project (SWP).

The Authority, formed in 1992 as a joint powers authority, consists of 31 public agencies, each of which contracts with the United States Department of the Interior, Bureau of Reclamation ("Reclamation"), for water from the Central Valley Project. The Authority's members hold contracts with Reclamation for the delivery of approximately 3.3 million acre-feet of CVP water annually. Of that amount on average, the Authority's members put to beneficial use approximately 2 million acre-feet of water on about 1.2 million acres of agricultural lands within the western San Joaquin Valley and parts of San Benito and Santa Clara Counties, California; 200,000 acre-feet for municipal and industrial uses, including those within the Silicon Valley; and approximately 300,000 acre-feet for environmental purposes, including for waterfowl and wildlife habitat management in the San Joaquin Valley, California.

The SWC is a non-profit association of 27 public agencies from northern, central, and southern California that purchase water from the California State Water Project. Collectively, members of the SWC deliver water to more than 25 million residents throughout the state and more than 750,000 acres of agricultural lands. SWP water supplies are vital to the cities, farms, and industries served by the members of the SWC.

The Authority and the SWC participated in the preparation of the BA as designated non-Federal representatives, pursuant to 50 C.F.R. § 402.08. The Authority and the SWC appreciate the extensive effort by Reclamation and DWR to prepare the BA. The BA describes the manner in which Reclamation and DWR operate the CVP and SWP and analyzes the potential effects the CVP and SWP might have on listed fish species and their critical habitat. The comments presented by the Authority and the SWC in this letter are intended to supplement the information presented in the BA, and assist the Services as they prepare biological opinions based on the best scientific and commercial data available.

I. *Overarching Comments*

A. When Developing Their Biological Opinions (BiOp), The Services Should Recognize That The Bay-Delta System Is Highly Modified

The Sacramento-San Joaquin Delta ("Delta") was formed about 6,000 years ago. (The Bay Institute, From the Sierra to the Sea: The Ecological History of the San Francisco Bay-Delta Watershed ("Bay Institute"), pp. 2-3.) During the last 6,000 years its "features [have] continued to evolve through geomorphic, hydrologic and ecological processes into [its present] ecosystems." (*Id.* at 2-4.) And in those recent millennia, California experienced two "century-scale 'epic' drought periods" as well as a "three century period … of abnormally cool conditions …. in which glaciers formed." (*Id.* at 2-4 – 2-6.) In light of these dynamic conditions, experts studying the Delta appropriately recognize that the term "habitat," as the term is used in the context of the Delta, "refers to the space and time within which an organism lives and the abiotic resources *in that space and time*." (Independent Science Advisors Report, Bay Delta Conservation Plan ("Independent Science Advisors"), p. 7, emphasis added.).

Beyond the Delta's dramatic, ongoing, natural changes, human activities have also transformed the Delta. Substantial changes attributable to human activities began around the time of the Gold Rush, more than 150 years ago. While few attempts have been made to quantify human impacts on the Delta, it is estimated that "more than 95%" of the Delta's original tidelands are "gone" (Bay Institute at p. 4-17.); and some Delta researchers believe that there is a perpetual conflict between the natural, estuarine Delta, which provides habitat for native biological species, and the freshwater Delta, which supports agricultural and urban uses of Delta resources, as well as alien biological species (some of which are considered useful). (Envisioning Futures for the Sacramento-San Joaquin Delta ("Envisioning Futures"), pp. 62, 63.) Despite these projections and observations, human impacts on the Delta – and their reversibility – remain highly uncertain. (Bay Institute at p. 3-2; Independent Science Advisors at p. 10; Envisioning Futures, p. 83.) Delta-restoration advocates acknowledge the impacts of this evolutionary history, stating that many changes that differentiate the mid-19th century Delta from today's Delta are "irreversible," and that attaining a "historic" Delta condition is "not possible." (Independent Science Advisors at p. 5; Bay Institute at p. 5-1; Envisioning Futures at p. 149.) Furthermore, even if a certain historical Delta condition could be achieved, Delta experts concede doing so might not be "desirable" in light of the need for human uses of the Delta's resources. (Bay Institute at p. 5-1.) In light of the Delta's uncertain characteristics, it is impracticable, if not impossible, to restore the Delta to its historical condition at, for example, the time period just preceding the Gold Rush. Instead, resource managers should focus on development and implementation of policies that will sustain the Delta over the long-term in order that it may continue to support the remaining native flora and fauna while at the same time meeting societal needs.

B. The Services Must Use the Best Scientific and Commercial Data Available in Developing their BiOps

During a consultation pursuant to Section 7 of the ESA, the Federal agency requesting consultation has an obligation to provide the Service(s) with the "best scientific and commercial data available," 16 U.S.C. § 1536(a)(2), and the Service(s) has an obligation to use the "best scientific and commercial data available." 50 C.F.R. § 402.14(g)(8). The purpose behind these reciprocal obligations "is to ensure that the ESA not be implemented haphazardly, on the basis of speculation or surmise." *Bennett v. Spear*, 520 U.S. 154, 176 (1997). Thus, while the Services "can draw conclusions based on less than conclusive scientific evidence, [they] cannot base its conclusions on no evidence." *National Ass'n of Home Builders v. Norton*, 340 F.3d 835, 847 (9th Cir. 2003) (citation omitted). Further, when making a determination or recommendation, the Service(s) cannot "disregard scientifically superior evidence." *Trawler Diane Marie, Inc. v. Brown*, 918 F. Supp. 921, 930 (E.D.N.C. 1995).

While the implementing regulations do not provide a comprehensive list of what qualifies as the "best scientific and commercial data available," they do explain that it "may include the results of studies or surveys conducted by the Federal agency or [a] designated non-Federal representative." 50 C.F.R. § 402.14(d). The Section 7 Consultation Handbook, while not binding, also provides some discussion of the standard, stating that data should come "from credible sources such as listing packages, recovery plans, active recovery teams, species experts, State/tribal wildlife and plant experts, universities, peer-reviewed journals and State Heritage programs." *Final ESA Section 7 Consultation Handbook* (March 1998) at 1-7,

http://www.fws.gov/Endangered/consultations/s7hndbk/s7hndbk.htm (last visited July 8, 2008); *see also* Interagency Cooperative Policy on Information Standards Under the Endangered Species Act, 59 Fed. Reg. 34271 (July 1, 1994) (stating that any information used to implement the ESA should be "reliable, credible, and represent the best scientific and commercial data available). Thus, before the Services consider any proffered information, it must be found to be reliable, credible, and more than just speculation. *Bennett v. Spear*, 520 U.S. at 176.

It is difficult to translate data and analytical results from the scientific literature into facts that can guide management actions and policy. Scientists presenting findings in the scientific literature cannot possibly anticipate all future applications of that knowledge, and as such, rarely provide clear guidance to those who might apply their findings to management planning and future conservation actions. Certainly no rule-set has been adopted for transmitting scientific findings into "a thorough analysis of the continued operations of the CVP and SWP" -- the self-described purpose of the BA. Thus as the Services' staff draws their conclusions from original studies, largely by interpreting the scientific findings of others, there is a risk that rigorously gathered and analyzed data may be much less rigorously interpreted and applied. This lack of rigor may lead to misinformed policy decisions and management plans. We urge the Services' staff to analyze the BA to ensure that the findings from available scientific studies were correctly and consistently applied in a manner that could reliably inform future CVP and SWP operations.

In particular, the Services should review the BA and prepare the BiOps in a manner that avoids four analytical errors that commonly occur. The first of these is *incomplete presentation of available information*, which can lead to conclusions that would not be drawn if the complete information base had been considered. The dispersed nature of pertinent, available information can present serious difficulties to authors of an assessment document, which must be comprehensive in its presentation of information. An assessment relying on an incomplete presentation of available information can result in an inadequately informed reader drawing unsupportable conclusions and producing misguided management responses. The second type of potential analytical deficiency in the application of scientific information is the *misinterpretation of findings* from cited research. The third potential deficiency is *misrepresentation of available scientific findings*. The fourth potential analytical deficiency is *inappropriate emphasis*. This by-product of compromised neutrality manifests itself not by facts gotten wrong, but in the tone of the narrative, the choice of words.

One example of where a more complete presentation of information in the BiOp will strengthen the Services' analysis is in the BA's discussion of sources of mortality for the Chinook salmon that migrate through the Delta. The BA presents only a partial picture of salmon mortality which does not place the effects of CVP and SWP pumping in perspective. The BA accepts without challenge estimates of salmon mortality in the Delta published in the NMFS 2004 BiOp which assumed a 33% mortality rate for salmon entering the interior Delta (2004 BiOp, p. 301, Appendix A, Table A10), and then incorrectly applies that mortality to all salmon entering the Delta. It also assumes that all mortality of salmon entering the interior Delta is due to SWP and CVP pumping effects, which simply is not true (see Orsi 1967; Pickard 1982; Gingras 1997).

Recent filings with the United States District Court confirm that the 33% estimate is at least *5 times too large*. It fails to note that the 33% indirect mortality figure advanced by the earlier BiOp is 33% of the 20% of migrating salmon juveniles that enter the interior Delta, *not 33% of all migrating juveniles*—approximately 80% of which migrate past Chipps Island. See Declaration of Sheila Greene, filed September 5, 2008, in *PCFFA et al. v. Gutierrez et al.* a copy of which is appended hereto. At a Status Conference conducted by the United States District Court in *PCFFA v. Gutierrez* on September 11, 2008, attorneys for the federal defendants conceded that the 2004 BiOp was, in fact, in error in estimating the juvenile salmon mortality related to CVP and SWP operations and that the opinions of Ms. Greene are correct. The same attorneys also agreed that the 33% number used in the 2004 BiOp is a *maximum* and includes the effects of many non-CVP and SWP related factors such as predation, in-Delta toxic agricultural discharges, and entrainment by unscreened diversions. The BA's mischaracterization of impacts related to CVP and SWP pumping operations must be corrected in the BiOps. Many important controllable factors affect salmon survival, including legal harvest rates, illegal harvest, fish passage obstructions, hatchery operations, and predation. Uncontrollable factors, such as ocean conditions, are also extremely important.

Available data and model results (Newman 2004; Manly 2005) show that direct and indirect effects of entrainment at the CVP and SWP pumping facilities are so small as to be insignificant in almost all years. Recent studies undertaken by Hanson (2008), for example, that are also the subject of a recent filing with the District Court in *PCFFA v. Gutierrez, supra* demonstrate that pumping at the CVP and SWP facilities has no substantial effect upon the percentage of migrating juvenile salmon that pass Chipps Island on their way to the Pacific Ocean. See Declaration of Charles H. Hanson, Ph.D. In Support of Defendant-Intervenor State Water Contractors' Status Report, filed August 29, 2008, a copy of which is appended hereto. Dr. Hanson found that there is no relationship between direct mortality of juvenile salmon and diversion rates at the SWP and CVP pumping facilities. Further, he found little to no relationship between total mortality of juvenile salmon and steelhead from all causes prior to reaching Chipps Island, and diversions rates at the SWP and CVP pumping facilities. Furthermore, pumping by the CVP and SWP does not determine how many juveniles enter the interior Delta. As Tara Smith, a DWR hydrologist, confirms in work recently reported to the federal court—a copy of which is also appended hereto—the effect of pumping by the CVP and SWP at the locations where migrating juveniles may enter the interior Delta is minuscule to non-existent and is simply overwhelmed by the tidal incursions and excursions that occur at those locations. By comparison, available literature nowhere cited in the BA indicates that ocean conditions are far more important in determining salmon population status (Levin 2003; Beamish and Neville, 1994; Bisbal and McConnaha 1998).

Another area where the BiOp should better represent the available scientific information relates to the description of two key studies cited in the BA on the relationship between CVP and SWP pumping operations and delta smelt abundance. One of the studies cited by the BA as indicating that CVP and SWP pumping is contributing significantly to the decline of the delta smelt *actually* shows CVP and SWP pumping effects to be minimal (1-2%), thus not a significant cause of population decline and repression (Kimmerer 2008). The other study, by Brown et al. (1996), presents "an indication of the magnitude of the effects [of entrainment]," stating that "approximately 110 million fish were salvaged at the SWP screens and returned to the Delta over a 15-year period." However, without accompanying estimates of the total population of fish in the Delta system over the same 15 year period or the proportions of fish species composing the 110 million fish, the statement has no meaning. In fact, the Brown study actually indicates that the fish salvaged at the CVP and SWP pumping facilities were overwhelmingly not endangered. A more thorough consideration in the BiOp of available information is required to produce a more accurate analysis of the relative effects of CVP and SWP operations on listed species and to better inform management decisions related to operation of the CVP and SWP and protection of the listed species.

C. Certain Hypotheses Set Forth in the BA Do Not Meet the Standard of "Best Scientific and Commercial Data Available" and should not be considered in the BiOps.

The BA includes at least one undocumented hypothesis that is not supported by available empirical data. That hypothesis, presented by Dr. William Bennett, Research Ecologist with the John Muir Institute of the Environment at UC Davis, in several public fora, asserts that a disproportionate mortality of early-hatch and large second-year female delta smelt at the CVP and SWP pumping facilities is a major contributor to the decline of the species. Bennett's theory is that in a population of mostly smaller first-year fishes, these early-hatch and second-year females have higher fecundity, and would be expected to produce offspring that are themselves likely to survive longer and lay more eggs of higher quality. Bennett suggests that sustained declines in the sizes of late-season delta smelt over the past fifteen years can be explained by losses of these important individuals through "artificial selection" caused by entrainment of early-season females by the CVP and SWP pumping facilities, which is forcing the smelt population toward genetically smaller, less reproductively successful fish. However, Bennett has yet to write his theory or make available any empirical data that supports it.

In contrast, there are many other documented theories that can better explain the decline in delta smelt size. For example, the current population decline followed years-earlier observations of a trend toward smaller mean sizes of individual fishes (Sweetnam 1999). Moreover, this trend is also explained by the collapse of the food web that supports delta smelt, including a reduction in the availability of the prey species preferred by delta smelt, which appears to have led to a concomitant reduction in delta smelt growth rates (Bennett 2005; Feyrer et al. 2003). Limitations in food availability in the spring of each year better explain the absence of early-hatch individuals in later life stages later in each year than does the early-season entrainment by the CVP and SWP pumping facilities. In addition to food web collapse as an explanation for declining delta smelt growth rates, Bennett finds in a subsequent study of growth-selective mortality of year-class 2005 delta smelt that elevated summertime water temperatures were most responsible for delta smelt's poor year-class success in that year (Bennett et al. 2008).

Given that many, if not most, early-hatch females are found in areas of the Delta sufficiently far from the CVP and SWP pumping facilities such that they cannot possibly be entrained, given that no correlations exist between winter salvage (or pumping) and abundance of smelt, and given that no data show CVP and SWP pumping effects on the abundance of spawners, Bennett's claim that the CVP and SWP pumping facilities are causing a diminishment in the size of delta smelt and the size of their population should not be included in the BiOp, which must be based on empirical evidence linking environmental stressors to the decline of pelagic fishes.

D. The BiOps Must Include a Mechanism for Flexible Decision Making

The CVP and SWP are complex systems of interacting natural and artificial features. This, in conjunction with the limited understanding of the working biological mechanisms and effects of management decisions on the natural environment, compels the need for an effective, flexible, and certain decision making processes. Further, tools currently within the control of the Services intended to address the ongoing effects of CVP and SWP operations sometimes provide a wide range of discretionary latitude with respect to how they are used. While the BA describes actions that allow for flexible management, it fails to set forth an adequate working framework. The BiOps should include descriptions of a process that clearly describes how decisions will be informed and made, how resources will be used and prioritized, and how the process will respond to certain future change. Acknowledging that it is uncertain whether changes in CVP and SWP operations can benefit listed species, adjustments to the timing and volume of flows and other management actions of the limited available water supply must be accompanied by a reasonable biological justification for such changes with minimal disruption in the underlying CVP and SWP projects purposes.

Even where operations objectives are agreed upon, uncertainty about the ability of possible actions to achieve desired objectives is commonplace, thus dictating the need for flexibility based upon consideration of real-time conditions. Under appropriate conditions, one should expect the triggers that cause modification of CVP and SWP operations during periods of heightened biological sensitivity to generate the expected results, thus producing the anticipated biological benefit. However, as an example of how the indiscriminate use of fixed triggers undermine both the biological benefits and the CVP and SWP purposes, during the winter of 2007 reductions in CVP and SWP pumping were required based upon a spike in turbidity as measured at a single turbidity monitoring station. Almost immediately, it was determined by the USGS that this turbidity was caused by high winds and not by high-sediment Sacramento River inflows that might accompany the potential migration of delta smelt. Thus, there was little or no risk that this turbidity spike would cause a salvage event at the CVP and SWP pumping facilities. However, because there was no discretion to consider the true conditions and reverse the action, an enormous loss of water resulted with no corresponding benefit for the target species. Without vastly superior monitoring, data analysis, and understanding of key biological mechanisms, real-time decision making processes must include adequate levels of flexibility and certainty in order to optimize biological benefit and water supply management within the regulatory parameters established by the BiOps.

II. *Specific Comments*

A. Assessment of Water Project Impacts on Delta Smelt

The BA states that "the past population level effects [of CVP and SWP pumping] have been difficult to determine." (BA at 15-6.) Further, it indicates that "the present understanding of the factors affecting smelt has many limitations." (BA at 13-3.) These observations were affirmed in a recent article by Kimmerer, who stated that there is a "lack of evidence for population-level effects," but that nevertheless a strong influence at the population level for delta smelt and other fishes "has been assumed." (Kimmerer 2008.) Thus, to date scientific research has not resulted in empirical evidence that CVP and SWP pumping has population-level effects on Delta smelt or any of the salmon species at issue in the ongoing consultation. That said, many parties have advanced the assumption described by Kimmerer, which is simply a hypothesis that is not well tested to date, as if it were a theory verified by multiple, reproducible analyses.

For example, Baxter et al. (2008) postulates that changes in CVP and SWP pumping regimes have contributed to the recent decline of Delta smelt via entrainment. Increased pumping by the CVP and SWP during the winter months have particularly been blamed for higher losses of early spawning delta smelt and, especially, early-hatch larvae. (BA at 7-22.) Some have hypothesized that this winter entrainment by the CVP and SWP has population level effects, but this hypothesis is not consistent with results of a number of analyses, including studies of other Delta fish species from which strong inferences can be drawn when considering Delta smelt (Kimmerer 2008; Kimmerer and Nobriga 2008; Kimmerer 2004).

Delta smelt spawn during the late winter and spring months. While spawning can begin as early as late February and extend into July, most spawning occurs during April through mid-May (Moyle 2002.). Historically, spawning has occurred primarily in the northern Delta and Sacramento River above Rio Vista; although spawning has occurred throughout Delta smelt habitat, as shown elsewhere in these comments, based on April Kodiak Trawl data. Recently, spawning has occurred primarily in the Sacramento River side of the Delta and downstream. Eggs are demersal, and are not considered to be affected by water flows. Larvae are believed to behave somewhat like free-floating particles, but can adjust their position (depth) in the water column, which, in a tidal environment, is a mechanism that can be used to maintain their position (Kuivila and Moon 2004; Bennett et al. 2002). About 25-40 days after hatching, the larvae develop fins and a swim bladder, at which point they typically migrate to the western Delta and Suisun Bay, indicated by results of the 20 mm Survey (Bennett 2005).

Until they move downstream, delta smelt larvae and juveniles are subject to entrainment into the SWP and CVP pumping facilities in the southeastern Delta; however, several studies give reason to question the population level effect of entrainment. Other pelagic fishes have been evaluated for the influence of the CVP and SWP pumping facilities on populations. Sommer et al. (1997) found the CVP and SWP pumping facilities did not have a significant effect on splittail populations (*Pogonichthys macrolepidotus*). Stevens et al. (1985) reported that the abundance of young striped bass surviving to midsummer was reduced by the combined entrainment of the CVP and SWP pumping facilities, in-Delta agriculture, and the power plants located in the Delta, but Kimmerer et al. (2001) noted that while striped bass are entrained in large numbers during larval and juvenile stages, effects on recruitment to the adult population are negligible. Manly and Chotkowski (2006) found that Old and Middle River flows had a statistically significant effect on delta smelt abundance, but that effect explained no more than a few percent of the variability in the fall abundance index for Delta smelt during the study period.

Kimmerer and Nobriga (2008) ran particle tracking models to model the movements of pelagic organisms in the estuary, particularly as these relate to entrainment by the CVP and SWP pumping facilities. The simulation of delta smelt losses showed that assuming delta smelt behave as neutrally buoyant particles – an assumption contradicted by data – substantial cumulative losses could occur in low outflow years when accompanied by high pumping volume -- a condition virtually never realized (see Declaration of Tara Smith, filed September 5, 2008, in *PCFFA et al. v. Gutierrez et al.).* Entrainment effects on more mature life stages of delta smelt could not be determined because these fish do not act like free-floating particles; accordingly, results of these and similar experiments (e.g., Kimmerer 2008; Sommer et al. 2005) conducted in the spring have been inconclusive regarding the influence of pumping and Delta Cross Channel gate position on subsequent survival.

The Spring Kodiak Trawl samples adult delta smelt during pre-spawning and spawning stages. It is performed every month beginning in January of each year except 2003, when it began in February. Supplemental surveys are sometimes taken to sample where delta smelt are thought to be. The survey takes 4-5 days and samples 39 stations from the Napa River to Stockton on the San Joaquin River and up to Walnut Grove on the Sacramento River. Examining the Spring Kodiak Trawl samples reveals that most spawning delta smelt are located in areas of the Delta where there is a very low likelihood of entrainment by the CVP and SWP. Indeed over the POD years from 2002 to 2008, 93% of the Delta smelt that were sampled were sufficiently far from the SWP and CVP pumping facilities that they could not be subject to entrainment by those facilities.

Nonetheless the BA cites a number of observations and conclusions drawn by Kimmerer (2008) that attempt to quantify losses of Delta smelt from CVP and SWP pumping. These projections are based on assumptions that are contradicted by publicly available IEP data. Kimmerer (2008) postulated that pre-spawning adults may suffer substantial losses to entrainment at the CVP and SWP pumping facilities using data from six monitoring stations in the south Delta to extrapolate estimates of numbers of delta smelt subject to entrainment at the CVP and SWP pumping facilities (e.g., stations 902, 906, 910, 914, 915, and 918). But Spring Kodiac Trawl sampling data from 2002-2008 show that only 47 pre-spawning adult delta smelt were sampled from these stations during that period, less than 2% of the total sampled at all stations. The highest number of sampled delta smelt occurring at these six stations was in 2004 and they represented just 3% of the total sampled. Kimmerer (2008) acknowledges a lack of evidence for population-level effects of entrainment at the SWP and CVP pumping facilities, attributing this fact to the much greater effect of other factors. Kimmerer also states that manipulating "[pumping by the CVP and SWP] (and, to some extent, inflow) is the only means to influence the abundance of delta smelt that is both feasible and supported by the current body of evidence, even though [CVP and SWP pumping] effects are relatively small." According to estimates provided by Kimmerer, "relatively small" means that CVP and SWP pumping effects on subsequent spawning abundance are about 0.2% of the gross effect when compared with other factors.

Kimmerer (2008) further speculates that larvae and early juveniles may suffer substantial losses to entrainment at the CVP and SWP pumping facilities. The 20-mm survey measures abundance of larval and juvenile delta smelt every two weeks, from March or April until June or July. Based on the data gathered from the six south Delta monitoring stations that Kimmerer utilized in his study, 79% of sampled fish were located in the western Delta, sufficiently far from the SWP and CVP pumping facilities that they were not subject to entrainment by those facilities. The most significant entrainment risks were in 2002 and 2004, when an unusually high percentage of sampled fish were located in relatively close proximity to the CVP and SWP pumping facilities. In all other years, 90% or more of Delta fish were located sufficiently far from the SWP and CVP pumping facilities that they would not be subject to entrainment by those facilities.

By the summer, when delta smelt have grown to juvenile sizes, they are more mobile and more widely distributed than larvae, and maintain an association with the low salinity zone (Bennett 2005). The Summer Townet Survey (STN) indexes the abundance of delta smelt juveniles (http://www.delta.dfg.ca.gov/baydelta/monitoring/townet.asp). An examination of the STN data shows that, once again, juvenile delta smelt are found well beyond the effects of entrainment by the SWP and CVP pumping facilities.

Nonetheless, Kimmerer (2008) notes that subsequent variability in survival rates complicated analyses of population effects from SWP and CVP entrainment losses though the distribution data indicate the majority of delta smelt are not within the zone subject to entrainment. While not stating this conclusion explicitly, Kimmerer (2008) acknowledges that there is a lack of evidence for population-level effects on delta smelt from entrainment at the SWP and CVP pumping facilities, stating that such effects are relatively small. Kimmerer (2008) then goes further to estimate annual losses of adult and larval-juvenile delta smelt to entrainment in the SWP and CVP pumping facilities. If percentage entrainment had an important effect on abundance, some relationship would be expected between Kimmerer's estimates of total entrainment percentage and the ratio of FMWT to previous FMWT, that is, one would expect that the higher the percentage entrainment, the lower the ratio of FMWT to previous FMWT. However, there is no relationship that shows such effects; indeed, Kimmerer's own data show that entrainment effects are only about 0.2% of gross impacts from the CVP and SWP pumps on delta smelt when compared with other factors.

B. Other Factors Impacting Listed Species

Efforts to evaluate SWP and CVP effects would benefit from greater consideration of non-project related mortality. This context is valuable because it relates both to the population significance of SWP and CVP effects and to the potential for modified SWP and CVP operations to facilitate recovery of ESA listed species. While the topics which follow are addressed in the BA, the Authority and SWC suggest additional language, data, or references that could be included to better place the SWP and CVP in proper context with other sources of take. The information in Appendix V of the BA and in this section of the letter must inform the preparation of the Biological Opinions and be integrated into the effects analysis and text.

1. *Contaminants and Disease*

The body of the BA describes some of the contaminant studies that were funded through the Interagency Ecological Program Pelagic Organism Decline (POD) investigations, but there is a large body of research that has been conducted outside of the POD that provides additional insight into the potential role of contaminants in the health of all Central Valley fish populations including salmon, steelhead, and Delta and longfin smelt. The literature on this subject is included as Appendix V to the BA. (BA at V-1 to V-11.) This literature strongly suggests that contaminants are a significant problem to the biota of the Delta and that action is warranted to better understand and respond to that problem.

2. *Invasive Species*

The text of the BA does not fully account for the potential role of invasive species in the decline of pelagic fishes and the food webs that support them (Sommer et al. 2007; Baxter et al. 2008; Jassby 2008; Kimmerer et al. 2005). More serious consideration is given to invasive species in Appendix V to the BA. (BA at V-21 to V-29.) The facts indicate that the fundamental determinant of the decline of the delta smelt is the near disappearance of its preferred food sources, which likely initially resulted from the invasion of the overbite clam.

No fewer than 200 exotic species can be found in the highly invaded Delta ecosystem, and many have direct or indirect impacts on native fishes including delta smelt by competing for food and other essential resources, compromising habitat structure or availability, and creating a myriad of interspecies interactions that incidentally reduce the recruitment and survival of native fishes. Of 40 fish species now residing in the Delta, 28 are non-native. Predator fish species, such as largemouth bass, also compete with juvenile stages of salmonids and delta smelt for food. These predator species along with the new species at lower trophic levels have created an environment uniquely hostile to native fishes. In light of their history and their impacts, it is critical to analyze invasive stressors commensurate with their magnitude as they appear as the greatest source of imperilment to the Delta's at-risk species.

3. *Predation by introduced sport fish*

The BA's review of studies of predation as a factor influencing salmon, steelhead, and delta smelt abundance could be improved substantially on three points.

First, predation is largely treated (and somewhat dismissed) as a natural ecological process. While predation is a natural ecosystem process, much (if not most) predation loss is occurring as a result of introduced fish (e.g. striped bass, largemouth bass), and as such, should not be treated as natural and unavoidable. Exacerbating this impact, California Department of Fish and Game angling regulations actively encourage large populations of exotic predators for the benefit of the angling public to the detriment of the threatened and endangered native fishes. The losses associated with recreational fishery management should be addressed with as much rigor as any other anthropogenic sources of ESA species take.

Second, greater effort should be made to more accurately quantify and describe predation losses by predator species, especially take resulting from introduced fish. Conducting these analyses, or more sophisticated bioenergetic predation modeling, would better define the specific impacts related to species predation and thus better inform management decisions.

Third, the BiOps would benefit from consideration and analysis based on predation effect literature from several additional information sources, specifically:

A study by Ostrach et al. (2004) indicated that a large number of adult striped bass may never migrate to salt water bays and instead may congregate year-round in areas of higher prey densities, such as water diversion facilities and salvage release points.

Analysis of age-zero striped bass data indicates that individuals are substantially larger in the fall compared with 40 years ago. The larger size of age-zero striped bass allows for earlier piscivory relative to other Delta predatory fishes (Nobriga 2008, in press).

Striped bass are typically most piscivorous during summer and fall regardless of their size (Stevens 1966). The apparent association of striped bass piscivory with the seasonal cycle of juvenile fish production has significant implications for understanding and managing predatory impact on native fish species including delta smelt.

Incidence of piscivory is predominantly a function of size. With largemouth bass becoming predominantly piscivorous at sizes smaller than those of the native predator, Sacramento pikeminnow (about 115 mm versus about 190 mm, respectively -- Nobriga & Feyrer 2007), largemouth bass must be considered a significant potential predator of delta smelt.

4. *In-Delta Unscreened Diversions*

The BA discusses the effects of CVP and SWP pumping on Delta fishes much more extensively than the effects of numerous in-Delta, unscreened diversions. All of the available research on the effects of in-Delta, non-project diversions should be presented and considered. Indeed, understanding the impacts of CVP and SWP pumping on Delta fishes requires an understanding of the related effects of in-Delta, non-project diversions.

The main discussion of in-Delta diversions is in Chapter 7, page 7-31. This same text is repeated in Chapter 17, page 17-17. The "Agricultural Diversions" section gives the number of such diversions in the Delta and mentions that the majority of these are not screened. These sections argue that delta smelt may not be vulnerable to in-Delta unscreened diversions for the following three reasons. First, adult delta smelt move into the Delta to spawn during winter-early spring when unscreened, agricultural diversion operations are at a minimum. Second, larval delta smelt occur transiently in most of the Delta. And third, Nobriga et al. (2004) examined delta smelt entrainment at an unscreened diversion in Horseshoe Bend and found that delta smelt entrainment was low compared to density estimates from the Department of Fish and Game 20 mm Delta Smelt Survey.

This discussion, however, fails to address the fact that Nobriga et al.'s 2004 study was limited to the month of July and was therefore related to post-larval delta smelt and not earlier larval stages, which display limited mobility and great shallow water affinity. Since spawning and larval development is likely to occur in shallow shoreline locations, entrainment of these life stages by unscreened diversions may be more significant. In addition, larval and post-larval individuals, which measure less than 25 mm in total length, would not have been excluded by the screens used for this study.

The "Agricultural Diversions" section of Chapters 7 and 17 also fails to mention an important study of this issue. Cook and Buffaloe (1998) evaluated five sites in the west and south Delta using a 2.4 mm egg and larval net staked in the diversion outlet ditch just downstream of the area of turbulence; a fyke net was used to capture later life stages. They found that a large diversity of fish species are entrained by small agricultural diversions, especially the young-of-year fish that are present from May through August. While the catch per unit effort (CPUE) for delta smelt suggested that relatively lower densities of these were entrained compared to other fishes, at one site a CPUE of 5.0 was calculated for early-life stage delta smelt, indicating five delta smelt entrained for each acre-foot of water sampled. Extrapolated over the delta smelt habitat area in the western and southern Delta, this could represent a significant impact on the population. However, it is important to note that the significance of this impact is not because the small diversions are agricultural but rather, because they are unscreened.

The California Department of Fish and Game's (1993) action plan for the protection of salmonids emphasizes the importance of screening or installing fish protective devices on diversions. Likewise, the Ecosystem Restoration Program Plan (CALFED 1998) lists unscreened diversions as an important stressor on populations of salmonids and other fishes, and the plan indicated that elimination of unscreened diversions should be a high priority action.

C. Salmon Mortality

Because the BA emphasizes CVP and SWP pumping-related take of outmigrating juvenile Chinook salmon over other factors, it creates the impression that operations of the SWP and CVP are the principal determinants of adult Chinook salmon abundance. However, a complete evaluation of mortality sources throughout the Chinook salmon life cycle indicates that this is not the case.

First, extensive scientific analysis of survival study data compiled by the USFWS from coded wire tag surveys of Sacramento River winter-run, spring-run and fall-run juvenile salmon was undertaken by Dr. Charles Hanson for the purpose of better understanding the relationship between CVP and SWP pumping and the mortality of migrating juvenile salmon. Not only does Hanson's analysis show that there is no relationship between the direct mortality of juvenile salmon and diversion rates at the CVP and SWP pumping facilities, it also shows that CVP and SWP pumping rates have essentially no impact upon the total survival of juvenile salmon between their point of release and Chipps Island. Instead, the factor most strongly affecting the total survival of migrating juvenile salmon appears to be Sacramento River flow, with higher flows resulting in a lower percentage of fish migrating to the interior Delta and a higher percentage of migrating fish passing Chipps Island.

These findings are consistent with work recently undertaken by Sheila Greene of DWR which demonstrates that prior conclusions of the NMFS regarding the potential indirect mortality of juvenile salmon caused by CVP and SWP pumping are flatly erroneous. Rather than the 33% of migrating juvenile salmon surmised by NMFS to be lost to indirect mortality of CVP and SWP pumping, Ms. Greene shows that, at best, the loss is 33% of the 20% of migrating juveniles that enter the interior Delta—or, about 7% of migrating juveniles. As Tara Smith, a DWR hydrologist, goes on to demonstrate in recent hydrologic studies, the impact of CVP and SWP pumping at the locations where migrating juveniles might enter the interior Delta is minimal to non-existent. Indeed, any potential impact at those locations is overwhelmed by the movement of water generated by the tides that affect those same points of entry. (See Declaration of Tara Smith, filed September 5, 2008, in *PCFFA v. Gutierrez*). On September 11, 2008, at a Status Conference conducted by Judge Oliver Wanger in *PCFFA v. Gutierrez*, attorneys for the federal defendants conceded the substantial error regarding Project-related juvenile salmon mortality that appeared in the earlier BiOp and informed the Court that the opinions set forth in the Greene and Smith declarations in this regard are correct. They also agreed that many other factors besides Project operations contribute to the 33% figure that appears in the earlier BiOp. The BA must be revised to take the work of Ms. Greene and Ms. Smith into account.

To put these findings of CVP and SWP pumping effects in context, the Authority and SWC recently commissioned an exploratory analysis by Cramer Fish Sciences (Cramer) comparing direct take of Central Valley Chinook salmon runs at the SWP and CVP pumping facilities with direct take from ocean fishery harvest. Because CVP and SWP salvage facilities capture primarily juvenile salmon, as compared to the ocean fisheries harvest which capture largely adult fish, Cramer Fish Sciences converted the data to the equivalent number of adults that would have returned to Central Valley rivers and streams in the absence of these takes. Methodological details for this analysis can be found at http://www.fishsciences.net/links/CFS_WinterSpring_Take_Brief.pdf. The analysis found that the take of Central Valley Chinook salmon at the SWP and CVP pumping facilities and in the ocean fisheries varied widely by race and brood year (Table 1). However, direct take at the CVP and SWP pumping facilities, in terms of adult equivalents, was always less than the ocean fishery take for all four runs. On average, more than nine winter run Chinook are taken via ocean harvest for every one taken at the CVP and SWP salvage facilities. And on average, more than eight spring run Chinook are taken via ocean harvest for every one taken at the CVP and SWP salvage facilities.

	Adult equivalent take							
	Fall run		Late Fall run		Winter run		Spring run	
Brood year	Salvage pumps	Ocean landings	Salvage pumps	Ocean landings	Salvage pumps	Ocean landings	Salvage pumps	Ocean landings
1995	1,099	105,362	200	5,647	238	1,548	912	8,093
1996	753	364,521	10	19,656	68	1,253	1,556	4,433
1997	2,914	397,580	7	21,326	36	1,775	769	7,103
1998	4,313	212,260	6	11,438	130	2,011	3,418	6,451
1999	3,840	442,595	16	23,924	272	1,314	2,692	4,557
2000	2,163	169,764	7	9,171	771	2,531	1,128	4,444
2001	356	380,812	17	20,436	340	4,407	397	3,332
2002	338	377,211	48	20,281	924	3,208	1,169	4,484
2003	812	52,595	24	2,837	839	4,948	315	3,842
2004	1,119	85,379	16	4,596	180	7,303	842	5,502
2005	1,267	116,107	1	6,247	103	5,972	371	7,999
2006	81	78,475	0	4,222	165	7,353	143	8,639

Table 1. Comparison of adult equivalent takes of Central Valley Chinook salmon at salvage pumps and ocean landings by brood year Winter and spring-run Chinook take comparison (Cramer Fish Sciences 2008).

Direct take at CVP and SWP pumping facilities thus is demonstrated to be a small proportion relative to ocean harvest losses. More importantly, both of these sources of take are a tiny fraction of overall take and are dwarfed by juvenile salmon mortality in the marine environment (Table 2). Delta migration mortality (inclusive of all sources) can be shown to have minimal influence (just 3%), and the proportion of that mortality attributable to direct losses at the CVP and SWP pumping facilities is even less (only 0.2%) (Table 2). The BiOps should provide this necessary population-effect context when describing and evaluating SWP and CVP effects, both direct and indirect, on Chinook salmon.

Life Stage Category	Additional Spawner Equivalents	Percentage
Egg-Fry Mortality	9502	7
Emergence to Delta Mortality	21379	16
Delta Migration Mortality	4072	3
Direct Export Losses	323	0.2
Juvenile Ocean Mortality	97734	72
Adult Ocean Harvest	1699	1
Adult Ocean Natural Mortality	1958	1

Table 2. Life stage specific contribution to hypothetical adult spring-run Chinook spawning population. "Additional Spawner Equivalents" represents the number of adult fish that would be produced if no mortality occurred in each respective life stage. Numbers are based upon starting with 10 million eggs and then applying typical survival, harvest and maturity data to estimate life stage specific adult equivalents (Cramer Fish Sciences 2008).

D. Fall X2 and Delta Smelt

The section entitled "Physical Habitat" in Chapter 7 of the BA discusses research showing "a long-term decline in fall environmental habitat quality for delta smelt." This decline in habitat quality is defined to include salinity, which is synonymous with fall X2 position. The Physical Habitat section describes Feyrer et al.'s (2007) work wherein the inclusion of fall salinity and water clarity improved the fit of a stock-recruit model for delta smelt. Feyrer et al.'s work was the subject of extensive analysis and testimony before the United States District Court in *NRDC v. Kempthorne.* Among other things, the testimony showed that there was insufficient evidence demonstrating a relationship between the location of fall X2 and increasing delta smelt abundance. Further, the evidence showed that Mr. Feyrer recognized the need for additional work before his 2007 findings could be considered for regulatory purposes. More recent work by Feyrer et al. (2008 Interagency Ecological Program conference) shows that as fall X2 flows increase, the area of the Delta where smelt are most likely to occur decreases (Feyrer et al. 2008). This recent work also used forecast modeling of X2 management scenarios to show that allowing fall X2 to move upstream is more likely to benefit delta smelt than requiring it to be further downstream (Feyrer et al. 2008).

In light of the evidence presented to, and the conclusions of, the United States District Court as well as Mr. Feyrer's own recent analyses, it would be premature to conclude that fall X2 positioning is a factor that regulates delta smelt abundance.

CONCLUSION

The Authority and SWC appreciate all of the time and effort expended by the Reclamation, the Services, and the agencies of the State of California during the consultation. The Authority and SWC hope the comments presented in this letter assist the Services in preparing the BiOps, based on the best scientific and commercial data available. Under separate cover, we will transmit copies of the references cited herein.

Very truly yours,

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Terry L. Erlewine by LFM
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cc: Donald R. Glaser, Regional Director,
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