Comments on
The Draft Technical Report On The Scientific Basis For
Alternative San Joaquin River Flow And Southern Delta Salinity Objectives

Submitted by
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3 December 2010

On Behalf of the
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The Draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives provides well justified summaries of the evidence of the importance of streamflow to the viability of the salmon and steelhead populations in the San Joaquin Basin. However, the recommendation to provide 60% of unimpaired flows in the San Joaquin River at Vernalis from February through June ignores several important flow requirements of Chinook salmon. First, there is very little discussion of the importance of water temperature, as affected by flow management, during the spring when most juvenile salmon undergo smoltification as a highly important determinant affecting juvenile salmon survival and adult salmon production. Second, there are no recommendations to provide fall pulse flows from each tributary to minimize the straying of adult San Joaquin River Basin Chinook salmon to the Sacramento River Basin. Finally, there are no recommendations to minimize losses at the State and Federal pumping facilities considering that there are no plans to install a physical Head of the Old River Barrier (HORB) in the future and the Bio-Acoustic Fish Fence (BAFF) was not very effective at protecting salmon smolts during studies in 2009 and 2010.

Managing Water Temperature for Smoltification

As discussed in the Draft Technical Report, I provided evidence in February and March 2010 that the number of adult Tuolumne River Chinook salmon produced is highly correlated with the number of smolts that migrate from the Tuolumne River in spring (Mesick 2009). Furthermore, the rate that smolts migrate from the Tuolumne River is correlated with water temperatures near the mouth of the river that are less than 59$^{o}$F, which are suitable for smoltification (Mesick 2009). The EPA has provided ample evidence that water temperatures greater than 59$^{o}$F impair smoltification and increase the risk of disease (Table 1 in EPA 2003). I provide an additional report with these comments that provides evidence that the number of days that water temperatures were below 59$^{o}$ F from March 20 to June 15 in the lower Merced River is an excellent predictor of the number of adult naturally produced Merced River Chinook salmon that returned to spawn as well as those harvested in the ocean fisheries (Mesick 2010a). My analyses in the Tuolumne (Mesick 2009) and Merced rivers (Mesick 2010a) suggest that if juvenile

salmon do not complete the smoltification process during their first spring due temperatures that exceed 59°F, they remain in the tributary where most eventually die, presumably from predation or disease. The likelihood that most juveniles die if they do not complete smoltification during their first spring is based on otolith microchemical analyses that show that very few if any adult fall-run Chinook salmon in the San Joaquin River Basin are produced from yearlings (juveniles that migrate approximately 12 months after they hatch). Microchemical analyses of otoliths taken from about 100 naturally produced adult salmon collected in the Stanislaus River that belonged to the 2000 and 2003 cohorts indicated that none of the adults were produced from yearlings; whereas about 92% of the adults were produced from juveniles that migrated downstream as parr and smolts and 8% as fry in spring 2000 and 2003 (R. Barnett-Johnson, Fisheries Biologist, U.S. Bureau of Reclamation and others, unpublished data).

The Draft Technical Report summarizes the National Marine Fisheries Service analyses (page 52) that suggest that the relationship between adult escapement and flow is more variable at low flows (< 5,000 cfs at Vernalis) than at high flows. My analyses for the Tuolumne (Mesick 2009) and Merced (Mesick 2010a) rivers suggest that this low-flow variability in escapements is primarily due to the influence of water temperature in the lower tributaries. Water temperatures can be suitable for smoltification at low flows during early spring if air temperatures are low.

The issue of managing water temperatures in the lower tributaries versus managing the magnitude of the flow releases as a percentage of unimpaired flows is important for two reasons. First, if the State Water Board requires that at least 60% of the unimpaired flows in the San Joaquin River at Vernalis is to be provided from February through June each year, it is possible that the required flows will not provide water temperatures suitable for smoltification ($\leq 59^{o}$ F) throughout the San Joaquin tributaries to their mouths and thereby not substantially improve smolt survival during the drier water year types. For example, my flow recommendations submitted in February 2010 (Mesick 2010b) would require releases in the Stanislaus and Merced rivers of about 50% to 82% of the total annual unimpaired flows to provide water temperatures at or below $59^{o}$ F on average only during a brief migration period (March 15 to April 20) during Critical and Dry years. Providing the same volume of water over a much longer period would certainly not be sufficient to manage water temperatures for smoltification. Instead, it would be more beneficial, particularly during Critical and Dry years, to focus the flow requirements on temperature management in March and April, when flow releases can best control water temperatures. Providing suitable water temperatures for smoltification in the lower tributaries during all years (Critical through Wet) for at least the March 15 to April 20 period is critical for maintaining the viability of the salmon populations in the San Joaquin River Basin (Mesick 2009, 2010). In addition, increasing salmon escapements in the San Joaquin River Basin will require increased minimum flows and water temperature management for each of the tributaries, rather than just at Vernalis. Improved flows in the Stanislaus River will not benefit the salmon populations in the Tuolumne and Merced rivers. I recommend that the State Water Board should include my flow recommendations (Mesick 2010b) that were based on meeting the EPA (2001) water temperature criteria for smoltification as an alternative in the Water Supply Impact Analysis. I was the primary author of the Anadromous Fish Restoration Program (USFWS 2005) flow recommendations and I used the same methods to generate my February 2010 flow recommendations to the State Water Board.

The second reason that managing water temperatures in the lower tributaries is important is that the State Water Board should consider that waiting to implement the Vernalis Adaptive Management Plan studies, which include tributary pulse flows and export curtailments, until late April or early May when the smolts are large enough to implant sonic tags is harming the naturally produced fish. The protective measures should be implemented from mid-March to mid-April to protect naturally produced smolts. If the studies must be implemented after April 20th, then additional water and/or export curtailments should be provided for the studies.

Fall Pulse Flows To Minimize Straying

As stated in the July 20, 2010 draft report on the *Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem* by the State Water Board, fall pulse flows on the San Joaquin River are needed to provide adequate temperature and dissolved oxygen conditions for adult salmon upstream migration, to reduce straying, improve gamete viability, and improve olfactory homing fidelity for San Joaquin basin salmon. The State Water Board should require increased flows from the Stanislaus, Tuolumne, and Merced rivers as well as Delta export restrictions to reduce stray rates and improve conditions for adult upstream migration (Mesick 2010a). An efficient use of water would be to provide a 10-day pulse flow in late October of 3,600 cfs at Vernalis, when high water temperatures might delay migrating salmon, and then rely on a combination of base flows of 275 cfs and a maximum Delta export rate of 250% of Vernalis flows during October and November throughout the remainder of the migratory period to provide suitable conditions for spawning and egg incubation in the tributaries as well as the necessary flows through the Delta to provide homing cues for adult salmon (Mesick 2010a). Monitoring should be conducted to determine whether these measures would be adequate to minimize adult San Joaquin River Basin salmon stray rates.

Losses At The State And Federal Pumping Facilities

The analyses of adult escapement trends and the VAMP smolt survival studies as summarized in the Draft Technical Report suggest that Delta exports have relatively little effect on the survival of juvenile salmon compared to the effect of spring flows. However, it is likely that losses at the Delta pumping facilities affect the survival of juvenile salmon particularly during Dry and Critical years when spring flow releases from the San Joaquin River tributaries are limited and a physical HORB cannot be installed during the smolt migratory period. The naturally produced adult escapement trends are primarily affected by the unsuitably high water temperatures in the lower tributaries that kill the juvenile salmon before they reach the pumping facilities. However, downstream effects such as losses at the pumping facilities will probably become more important as spring flows are increased. In addition, the VAMP smolt survival studies were conducted during the spring-pulse flows in April and early May and do not represent base flow conditions and a majority of the studies were conducted when the HORB was installed. Finally, loss rates of juvenile salmon are known to be high at the pumping facilities. The total juvenile salmon loss rate, which includes pre-screen mortality, louver efficiency rates, collection-handling-trucking-and release impacts, and post-release survival, is estimated to be 83.4% for the State pumping facilities and 65.0% at the Federal pumping facilities (page 352 in NMFS 2009). These estimated loss rates are probably conservative at the Federal pumping facilities because the pre-screen losses, which are primarily due to predation, have not been studied at the Federal facilities

(page 352 in NMFS 2009). There are numerous striped bass near the trash racks and within the fish bypass pipes between the louvers and the salvage holding tanks at the Tracy Fish Facilities and it is likely that the actual pre-screen losses are much higher than the assumed 15% rate currently used to estimate losses. There are also predators that feed on the salvaged fish as they are released in the Delta (see the YouTube Didson camera video named "Feeding Frenzy" at http://il.youtube.com/watch?v=sIoc5SIqpCo&feature=related). During Dry and Critical water year types, approximately 75% of the San Joaquin River flow at Vernalis and 75% of the juvenile salmon enter the Old River (page 58 of the Draft Technical Report) and the pumping facilities. Without protective measures, such as the HORB, more than half of the juvenile salmon die at the Delta pumping facilities. These losses should be minimized to the extent possible, particularly during Dry and Critical water year types.

As described in the Draft Technical Report, the HORB has not been installed during spring since 2007 (page 30) and the BAFF had a low protection efficiency during low flows in 2009 due to high predation rates in the vicinity of the BAFF and it did not keep smolts from entering the Old River during moderate flows in 2010 (page 58). Therefore, it will be necessary to implement other measures to reduce losses of fish that enter the Old River and the State and Federal pumping facilities, particularly during Dry and Critical years when spring flows are minimal. Such measures should include predator reduction, export curtailments, and improved cleaning procedures for trash racks and louvers during the peak smolt migration periods. In the near-term, predator removal efforts should be increased at the Federal and State Facilities, including the canals and forebays leading to the pumps, as well as the release points for salvaged fish. A permanent solution would be to install screens that prevent salmon smolts from being entrained into the canals leading to the pumping facilities. In addition, export rates should be minimized during the smolt migratory period. Trash rack and louver cleaning procedures are in the process of being improved at the Tracy Fish Facilities to help improve louver efficiency. For example, the trash racks are now automatically cleaned at frequent intervals and plans are being implemented to install louvers that can be cleaned in place at the Tracy Fish Facilities. Similar improvements should be made at the State pumping facilities.

Flow Management Priorities

The development of alternatives for the Water Supply Impact Analysis should consider flow management priorities based on the relative importance of winter-spring flows, fall pulse flows, Delta export reductions, and base flows. The studies of adult escapements described in the Draft Technical Report clearly indicate that winter-spring flows, from February through June, are the most important factor affecting the survival of juvenile and adult fall-run Chinook salmon in the San Joaquin River Basin. These flows affect salmon survival by providing floodplain inundation to improve fry survival in the tributaries, suitable water temperatures for smoltification in the tributaries, and suitable water temperatures and water quality in the Delta to minimize stress that affects mortality due to disease and predation. The timing and magnitude of these flows are critical to juvenile salmon survival. Therefore, alternatives for the Water Supply Impact Analysis should vary the duration of spring flows and not reduce the magnitude of flows needed to provide benefits related to floodplain inundation, suitable water temperatures for smoltification, and minimize the risk to disease and predation. The spring flows should also focus on maintaining the magnitude of the flows during the early smolt migratory period, March

15 to April 20, when flow releases can best control water temperatures. Therefore, if flow reductions are necessary for alternatives development, reductions should be made during May and June.

Although other factors, such as fall pulse flows, Delta export rates, and base flows are less important compared to winter-spring flows, maintaining a viable salmon population requires protecting the salmon during all years, including Dry and Critical water years types, to ensure that the population's genetic diversity is maintained (Mesick 2009, 2010a). Therefore, it is most important to manage fall pulse flows and Delta export rates to protect salmon, particularly when salmon numbers are low. For example, during Dry and Critical years, it is particularly important to minimize Delta exports rates from March 15 until the number of smolts migrating in the Delta declines substantially. In addition, it is particularly important to minimize Delta exports and release pulse flows during October and November during years when San Joaquin Basin escapements are expected to be low to minimize the number of adult salmon that stray to the Sacramento Basin. Base flows should be managed to provide the minimally required habitat for spawning and egg incubation in all years to conserve water for spring flows and fall pulse flows.

Supporting Exhibits

[EPA] U.S. Environmental Protection Agency. 2003. *EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards.* EPA 910-B-03-002. Region 10 Office of Water, Seattle, WA.

Mesick, C.F. 2009. The High Risk of Extinction for the Natural Fall-Run Chinook Salmon Population in the Lower Tuolumne River due to Insufficient Instream Flow Releases. Report prepared for the U.S. Fish and Wildlife Service, Sacramento, CA.

Mesick, C.F. 2010a. The High Risk of Extinction for the Natural Fall-Run Chinook Salmon Population in the Lower Merced River due to Insufficient Instream Flow Releases. Report prepared for the California Sportfishing Protection Alliance.

Mesick, C.F. 2010b. Instream flow recommendations for the Stanislaus, Tuolumne, and Merced rivers to maintain the viability of the fall-run Chinook salmon populations. Report produced on behalf of the California Sportfishing Protection Alliance.

[NMFS] National Marine Fisheries Service. 2009. Biological opinion and conference opinion on the long-term operations of the Central Valley Project and State water project. Endangered Species Act Section 7 Consultation. National Marine Fisheries Service, Southwest Region, June 4, 2009.

[USFWS] U.S. Fish and Wildlife Service. 2005. Recommended Streamflow Schedules to meet the AFRP Doubling Goal in the San Joaquin River Basin. 27 September 2005. Prepared by the Anadromous Fish Restoration Program, USFWS, 4001 N. Wilson Way, Stockton.