United States Department of the Interior

Comments Regarding the California State Water Resources Control Board's Notice of Public Informational Proceeding To Develop Delta Flow Criteria for the Delta Ecosystem Necessary to Protect Public Trust Resources

February 12th, 2010

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I. Summary

a. Introduction

The U.S. Department of the Interior (Interior) submits this written summary and witness testimony on behalf of both the Fish and Wildlife Service (Service) and the Bureau of Reclamation (Reclamation), pursuant to the State Water Resources Control Board's (Board) Public Notice and Revised Notice: Public Informational Proceeding to Develop Delta Flow Criteria Necessary to Protect Public Trust Resources. The summary and witness testimony will address the questions set forth on page 10 of the Public Notice, and related topics.

In 2008 and 2009 Reclamation concluded consultations regarding the effects of continued long-term operations of the Central Valley Project (CVP) and State Water Project (SWP) with the Service and the National Marine Fisheries Service (NMFS), respectively, pursuant to Section 7 of the Endangered Species Act (ESA). Those consultations focused on the effects of CVP and SWP operations on federally listed aquatic species and their designated critical habitats. While those consultations utilized the best scientific and commercial data available and therefore may provide useful information for the Board proceeding here, by law, the Biological Opinions focus on the questions of whether a proposed action jeopardizes the continued existence of a species or adversely modifies or destroys designated critical habitat, and if it does, whether there are any alternatives to the action that avoid jeopardizing listed species or adversely modifying or destroying designated critical habitat. Per Senate Bill 1 of the 2009-2010 Seventh Extraordinary Session (S.B. 1), our biological witnesseses for this process have focused not on jeopardy or adverse modification standards, but are rather focused on providing the best available scientific information regarding flow criteria in the context of protecting and restoring a healthy Sacramento-San Joaquin Delta ecosystem on a sustainable basis, and identifying biological objectives for the species of concern dependent on the Delta.

At the end of this proceeding we believe the Board should have three primary products: defined ecosystem goals (using specific biological/physical indicators to track progress), Delta flow criteria that were developed to meet the defined ecosystem goals, considering watershed hydrology, and a process to adaptively manage flow criteria to meet the ecosystem goals. The flow criteria that the Board adopts should be viewed as a starting point that will be monitored, evaluated and adaptively managed to meet the ecosystem goals. We stand ready to work with Department of Fish and Game and NMFS to assist the Board in developing Delta flow criteria and quantifiable biological objectives for aquatic and terrestrial species of concern dependent on the Delta.

b. Background

As the Board is aware, the challenges in restoring the Delta are contentious, complicated and have hit the headlines in not only California, but the entire nation. Data from the Delta ecosystem suggests that what we are doing now is not adequate to protect and restore the Delta on a sustainable basis. Changes in Delta flows have caused changes in the physical habitat components of the system, which has contributed to the decline of the Delta ecosystem. Fish populations dependent on the Delta have declined across the board, with some species on the brink of extinction. Food web dynamics have undergone significant changes in both abundance and composition.

Salmon populations in the Central Valley are in serious decline, with the adult escapement of Chinook salmon in 2008 estimated to be approximately 10% of the escapement in 2003 (CDFG GrandTab, 2009). Of the four races of Chinook salmon, two are listed under the Endangered Species Act (ESA) (winter run and spring run) and fall run Chinook salmon are at historical lows. Central Valley steelhead (threatened) are also in serious decline. Preliminary adult escapement estimates for the fall of 2009 show little improvement.

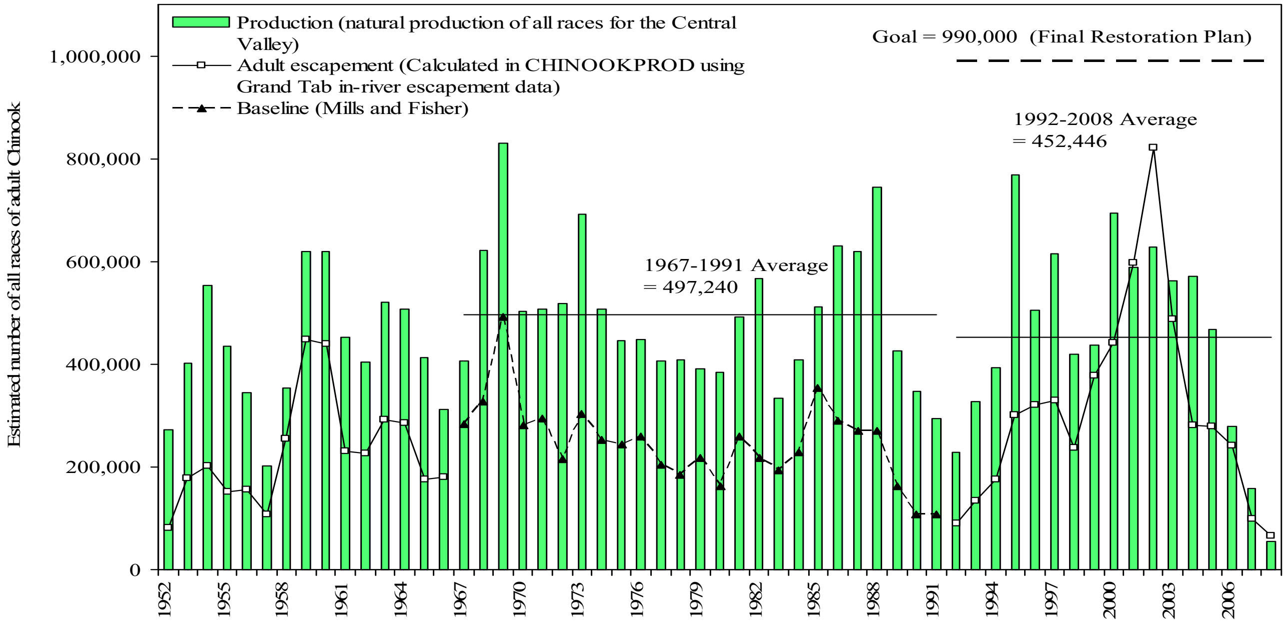


Figure 1. Estimated yearly natural production and in-river escapement of all races of adult Chinook Salmon in the Central Valley rivers and streams. 1952 - 1966 and 1992 - 2008 numbers are calculated in CHINOOKPROD using CDFG Grand Tab in-river escapement data (February 18, 2009). Baseline numbers (1967 - 1991) are from Mills and Fisher (CDFG, 1994).

In addition, the large scale pelagic organism decline (POD) in the Sacramento-San Joaquin Delta has not reversed its trend, although ESA/CESA protective actions are now being taken to alleviate some of the key hydrologic drivers contributing to the decline of delta smelt and longfin smelt. Note that the 2009 fall mid-water trawl index for Delta smelt is the absolute lowest on record (17) and the longfin smelt index was the second lowest on record (65).

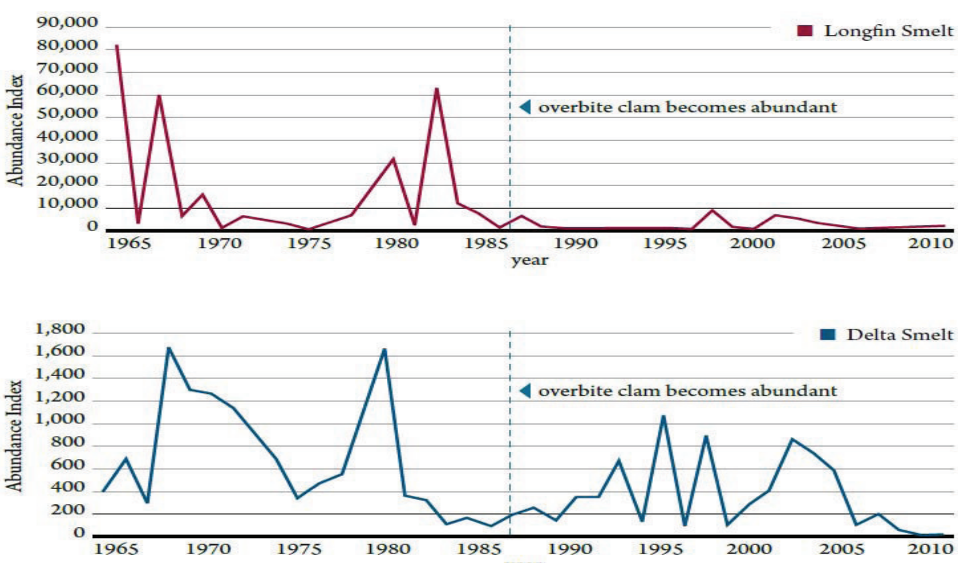


Figure 2. Changes in abundance indices for longfin smelt, Delta smelt, and striped bass over time in the Delta. (Source: Fall Midwater Trawl Survey 2008) copied from Calfed 2008. The state of Bay Delta Science. Calfed Science Program. Sacramento, CA.

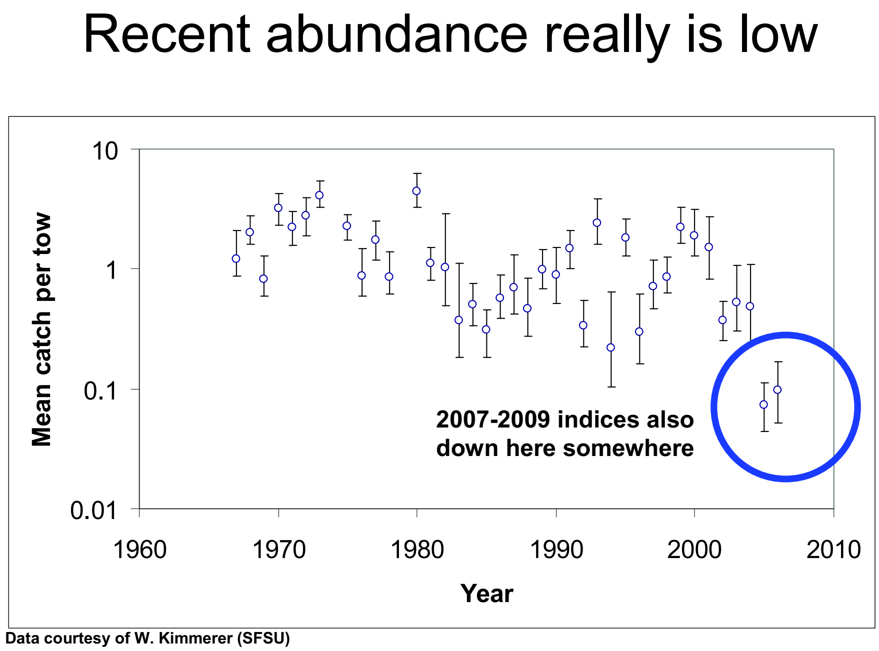


Figure 3. Mean Catch per tow . Nobrega January 2010 Presentation NAS.

Flow in the Delta is one of the most important components of ecosystem function. Timing, magnitude and variability of flow are the primary drivers of physical habitat conditions including: turbidity, temperature, particle residence time, nutrient loading, etc. These physical habitat conditions created by flow are part of what drives ecosystem function and define the key attributes comprising ultimate habitat utility and quality for resident and migratory fish species. It is technically very difficult to define the optimal timing, magnitude, and volume of flows required to provide sufficient habitat quantity and quality to protect our trust aquatic species. However; it is generally logical to presume that flow conditions more similar to natural flows will provide beneficial flow conditions and improved habitat for native species; while the further flow conditions are from what naturally occurs, the less adequate habitat conditions are for our native species. Figure 4 below presents a basic conceptual model linking the various drivers of fish populations in the estuary.

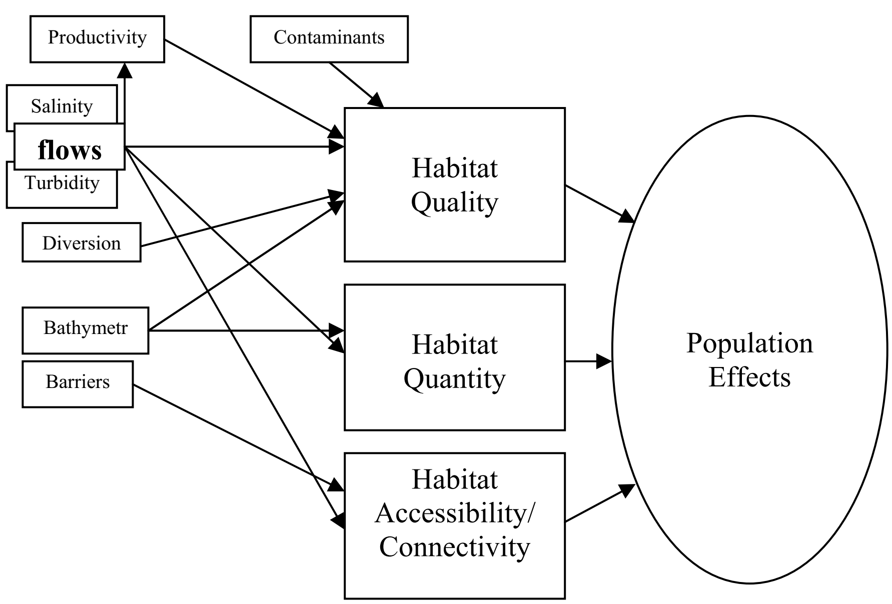


Figure 4. Conceptual model of various drivers of fish populations in the Delta estuary

The 1996 U.S. Fish and Wildlife Service Delta Native Fish Recovery Plan states: "Flow patterns in Delta channels are the principal element used to describe habitat conditions because most channels have been dredged and shallow areas have been separated from the river by an extensive series of levees. Thus, little connection to shallow wetland habitats and little diversity in salinity or depth remain. The flow patterns are determined largely by the interactions of freshwater inflow, tidal action, and water diversion." Figure 5 below depicts the conceptual relationship linking the physical ecosystem attributes to higher level scales of resolution or attributes such as population abundance.

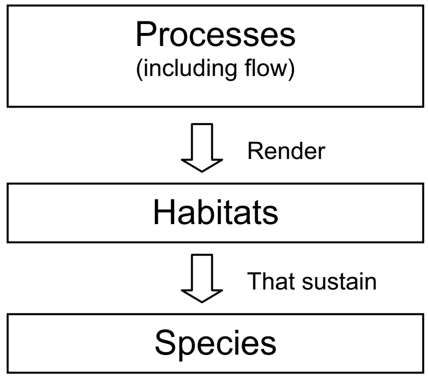


Figure 5. Conceptual relationship of processes and species.

This Board proceeding is an opportunity to review where we are, and chart a new course to achieve a healthy Delta ecosystem to protect aquatic resources. These flows will also contribute towards other goals that the Board and resource agencies have including: the anadromous fish doubling goals, recovery of threatened and endangered species, reducing and or eliminating non-native species, and contributing to a healthy commercial fishery.

Clearly articulating the ecological and biological goals should be the starting point in the Board's process of developing Delta flow criteria. The goals of the 1996 U.S. Fish and Wildlife Service Delta Native Fish Recovery Plan include: "to establish self-sustaining populations of the species of concern that will persist indefinitely. For Chinook salmon, green sturgeon, and splittail, the goals include having large enough populations so that a limited harvest can once again be sustained. The basic strategy for recovery is to manage the estuary in such a way that it is better habitat for aquatic life in general and for the fish species of concern in particular. Restoration of the Delta ecosystem should also include efforts to reestablish the extirpated Sacramento perch."

One goal of the Central Valley Project Improvement Act (CVPIA) is to: "ensure that…natural production of anadromous fish in Central Valley Rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967 – 1991." The Board's Water Quality Control Plan (WQCP) has a narrative salmon protection objective with a similar doubling goal: "Water quality conditions shall be maintained together with other measures in the watershed, sufficient to achieve a doubling of natural production of Chinook salmon from the average production of 1967 – 1991, consistent with the provisions of State and Federal law."

c. Limitations of this proceeding

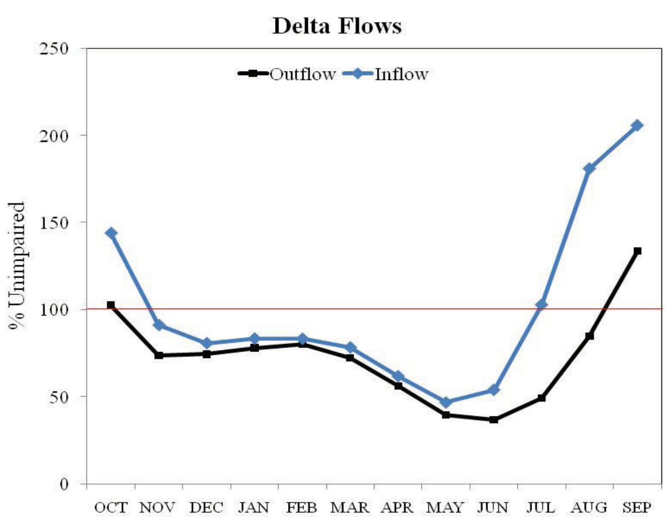
Interior commends the Board for taking on this difficult task of reviewing Delta outflow criteria; however, this process has several limitations. While the timeline in this informational proceeding is short, Interior encourages the Board to not defer these important decisions on Delta flows. The scope of this process has been limited to Delta flow criteria; however, Delta flow is just one of the important factors contributing to the health of the ecosystem. We appreciate that the Board (in its revised notice on January 29, 2010) broadened the scope of the informational proceeding to include information regarding other stressors that affect the Delta ecosystem along with the topics of hydrology and hydrodynamics.

The approach taken in this process focused on flows. It's important that this process should start by defining ecosystem goals and specific biological and physical process objectives to model what flows are necessary to meet those objectives. Once ecosystem goals are defined the Board should consider broadening the scope to address all components that affect the stated ecosystem goals and identify a suite of management actions to attain the stated ecosystem goals that would include flow, but not limited to flow. Some of these other stressors are also under the purview of the Board's regulatory domain, and this governance structure will be critical to successfully integrating and adaptively managing the estuary to maintain habitat conditions required for native fish recovery. An adaptive management process and appropriate monitoring program should be created to provide the framework for meeting the ecosystem goals. We encourage the Board to facilitate this process of developing Delta flow criteria consistent with the timeframes set forth in S.B. 1 and will work with the Board to achieve that end.

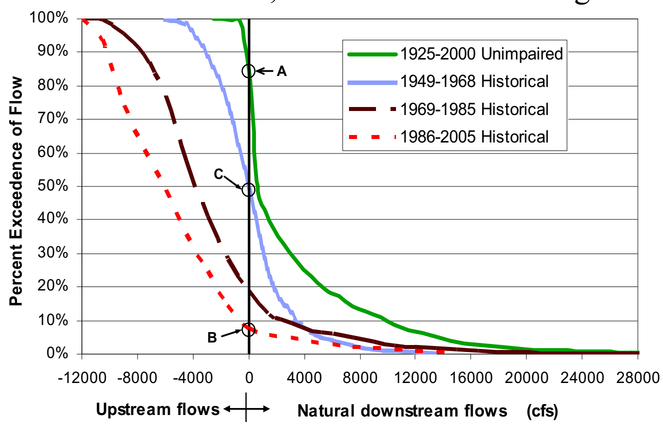
This process should also give consideration to not only the source of the flows, but the balancing of flow needs for aquatic resources in the Delta and flow needs upstream in the rivers. When considering the needs of anadromous fish, for example, the conditions in the Delta are important and the conditions upstream (such as temperature) are important and both affect fish populations at different life stages.

d. Delta flow criteria and biological objectives

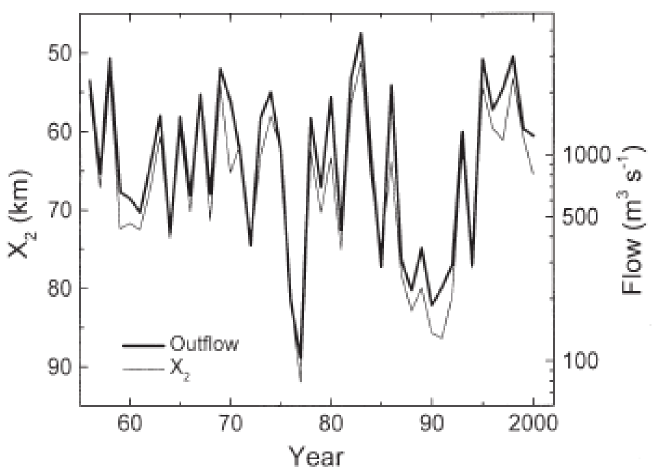
The Delta ecosystem evolved and adapted to natural flows, conditions, variability, and resulting habitat. The annual dry season is typically during the late spring through early fall, and variable wet season during the winter through spring months. Given our understanding of the evolution of the Delta ecosystem, consideration to the timing, magnitude and variability of unimpaired flow can be used to guide what conditions species within the ecosystem have evolved and adapted under.



- Annual Delta Inflow reduced 22% from unimpaired conditions
- Winter / early spring inflows shifted to summer / early fall
- Annual Delta Outflow reduced 34% from unimpaired conditions
- Winter / early spring outflows shifted to summer / early fall
- Reverse flows, i.e. OMR flows shifting to more negative (upstream)
- Unimpaired OMR estimates positive approximately 85% of the time



- Current operations result in negative OMR flows greater than 90% of the time



- Historical X2 position highly correlated with historical Delta outflow
- X2 position inversely related to outflow with a time lag of about two weeks
- X2 variability reduction from unimpaired conditions

Figure 6. Changes to Delta Hydrology and hydrodynamics. See expert testimony of Craig Anderson for more information.

Delta Outflow:

Inflow to the Delta and outflow to the Bay must be sufficient to support successful spawning, larval and juvenile transport, rearing, and adult migration of Delta fish. Different regions of the Delta provide different habitat conditions for different life stages, but those habitat conditions must be present when needed, and have sufficient connectivity to provide migratory pathways and the flow of energy, materials and organisms among the habitat components (USFWS 2008). Delta smelt critical habitat consists of four primary constituent elements: physical habitat, water, river flow and salinity, and flow is a constituent of each of these.

The scientific information that we reviewed indicates that generally fish abundance is higher when suitable habitat is available, and suitable habitat is related to X2 among other variables. The Delta native fish have declined as habitat suitability has declined. Delta flow is a component of habitat suitability.

When X2 is in the relatively shallow waters of Suisun Bay at particular times of the year, phytoplankton growth rates are higher, productivity is maximized and fish rearing is supported. Having X2 further westward also may reduce entrainment of estuarine species into the State and Federal export facilities.

The strategic placement of X2 is intended to have two benefits for delta smelt (1) improvement of environmental quality and (2) minimization of entrainment into the SWP and the CVP (Project) export facilities. While reverse flows or OMR are the proximal mechanism of entrainment, X2 is a distal mechanism. For example, if X2 is relatively seaward, then larval and juvenile delta smelt would be expected to be distributed such that they would be less likely to be entrained (Dege and Brown 2004; Kimmerer 2008), but if X2 is upstream, then the distribution of delta smelt is relatively nearer to the export facilities and the risk of entrainment may be greater (Kimmerer 2008). Prior to when adult delta smelt migrate upstream, X2 explains intra-annual salvage patterns, presumably because they have a shorter distance to enter the footprint of the exports once migration occurs (Grimaldo et al. 2009). However, X2 only matters in this case when Old and Middle River flows are negative. Kimmerer and Nobriga (2008) used Particle Model Tracking to show that it only takes a few tidal cycles for particles modeled with surfing behavior to move within the footprint of the exports during high outflow periods. (Bennett 2006; Feyrer, et al. 2007; Kimmerer, et al. 2009).

The most recent period of relatively robust annual abundance numbers for several species of concern should be used to guide the development of Delta flow criteria needed to protect the public trust resources.

Reverse Flow:

Old and Middle River flow is a hydrodynamic metric used to examine the SWP and CVP export affects on entrainment of fishes because it best characterizes the "footprint" of the exports as it extends into the Delta, integrating for river inflows, barrier operations, and exports (Arthur et al. 1996; Monsen et al. 2007). When exports are greater than San Joaquin river inflow, combined Old and Middle river net flows move upstream (i.e., negative or reverse) towards the SWP and CVP. Recent studies show that entrainment of delta smelt and other pelagic species increases as OMR flows become more negative (Grimaldo et al. 2009; Kimmerer 2008). Kimmerer (2008) found that entrainment losses increased as OMR flows became more negative, with as much 50 % reduction in the delta smelt population during some high export years.

Indirect and direct mortality of juvenile salmonids increases as OMR flows become more negative as well. For example, not only does juvenile salmonid entrainment increase as OMR flows become more negative, but so does their residence time which results in greater losses due to predation. To address the biological objective of increased survival of emigrating salmonid smolts, the AFRP identified the importance of maintaining positive QWEST flows (AFRP Working Paper, 1995). It's important to note, that in 1992, the Board also acknowledged the importance of maintaining positive QWEST flows, in order to protect and stop the decline of the public trust resources in the Delta, and included a new standard (requirement) that "there shall be no reverse flow for all year types on a 14-day running average in the western Delta… between February 1 and June 30." OMR flows and Qwest are highly correlated variables, since both represent net flow of Delta interior hydrodynamics.

In trying to evaluate the mechanism(s) for increased winter-time salvage of four primary fishes, including delta smelt, pelagic organism decline (POD) studies identified three key observations (IEP 2005). First, there was an increase in exports during winter as compared to previous years (Figure 16). Second, the San Joaquin River inflow decreased as a fraction of total inflow around 2000, while Sacramento River increased (Figure 17). Finally, there was an increase in the duration of the operation of barriers placed into south Delta channels during some months. These changes may have contributed to a shift in Delta hydrodynamics that led to record-high entrainment levels of delta smelt during a period when their population abundance plummeted to record-low levels (POD Report 2007).

Based on the most recent scientific information, maintenance of Old and Middle River flows at levels that do not result in significant entrainment losses of federally listed species during winter and spring periods when they most vulnerable to exports is important.

Floodplain Inundation:

Seasonal floodplain inundation has a positive effect on growth rates and on the apparent survival of juvenile Chinook salmon in the Central Valley. The restoration of floodplains and other off channel habitat is potentially important for increasing production of juvenile salmonids in California's Central Valley. The biological objectives of seasonal floodplain inundation would be to provide off channel areas conducive to salmonid rearing and growth, as well as for other native species such as splittail.

Successful spawning and recruitment of splittail is highly dependent upon the availability of floodplain habitat for spawning and rearing.

The body of evidence indicates that frequent floodplain inundation will provide benefits to numerous native species with respects to abundance (Sommer et al. 1997) and growth rates (Sommer et al. 2001). Efforts to increase floodplain inundation through wier modification and increased outflows will provide benefits to native species consistent with protecting aquatic resources in the Delta.

Delta Inflow:

Delta inflow and outflow are important for Chinook salmon in the Delta. Freshwater inflow is an important cue for upstream migration of adult salmon and directly affects the abundance and survival of juveniles moving downstream through the Delta. Smolt survival increased with increasing Sacramento River flow at Rio Vista, with maximum survival observed at or above about 20,000 and 30,000 cfs (USFWS, 1987, pages 35 and 36). Survival through the Delta for juvenile fall run Chinook salmon originating from the San Joaquin basin has also been shown to increase with increased Delta inflows at Vernalis. In addition to juvenile salmon survival being higher with higher flows, the abundance of juvenile salmon leaving the Delta is also higher with greater river flow. USFWS has developed estimates of flows needed at Vernalis to achieve doubling in predicted Chinook salmon production for the basin, and help protect public trust resources.

Providing flows that mimic the natural hydrograph will benefit the native fishes in the Delta and should be used in determining the timing and magnitude of flow needed for the Delta ecosystem. Scientific information in current and past SWRCB exhibits, scientific publications and models may be helpful to determine the volume, quantity and timing of water needed for the Delta ecosystem.

In summary, based on the scientific information we reviewed, we believe consideration of all aspects of Delta flow criteria, including timing, magnitude, and variability of; outflow, reverse flows, floodplain inundation, inflow and hydrology are important for this Board process. The natural hydrograph can be useful in guiding flow decisions, as the conditions created by a natural hydrograph are what the species evolved and adapted to.

e. Uncertainty and the importance of adaptive management

Biological resource management decisions are always made with varying degrees of scientific certainty. The uncertainty with Delta flow criteria can be separated into categories: uncertainty in prescribing adequate flow criteria, and uncertainty in the affects of changing conditions. In a system as complex as the Delta, it is impossible to gather enough data to describe key processes, evaluate important variables, and predict results of management actions with absolute certainty. Analyses are subject to different interpretations by interest groups, and professional judgment plays a role in management decisions and this process will likely be no different.

By acknowledging varying degrees of scientific certainty in making decisions, biological resource managers engage in risk assessment. Anyone making a decision must balance the certainty of a predicted effect of a management action with the need to act. An example is the certainty of effects resulting from acting to recover delta smelt compared to the probable results of not acting, which are continued decline and possible extinction of the species. Adaptive management involves, a thoughtful approach to document, articulate, and manage uncertainty. It also likely requires accepting some degree of uncertainty and proactively approaching management decisions so that "learning by doing" is possible.

Interior has gone through a process using indicators of ecosystem health to develop Delta flow criteria, however; they are an oversimplification of a very complex ecosystem. The flows that the Board adopts should be viewed as a starting point that will be adjusted to meet specific ecosystem goals.

Appropriate, focused monitoring to evaluate the ecosystem response is critical in understanding the effectiveness of the flows in protecting the public trust resources. Setting ecosystem goals (tracked through indicator species and/or physical habitat targets) are a way to track the effectiveness of flow conditions. If the ecosystem goals are not attained the resources agencies can work with the Board to adaptively manage the flows to accomplish the defined ecosystem goals.

f. Alternative process the Board should consider to develop Delta flow criteria

Interior is interested in working with the Board to approach this process as a blueprint for the Delta ecosystem restoration. It should be a carefully planned process including all stressors to meet the defined ecosystem goals. Recovery plans serve as a road map for species recovery – they lay out where we need to go and how best to get there. The Delta recovery planning process must include the watersheds upstream to create an integrated management plan for the entire San Joaquin/Sacramento basin. Goals of the basin need to be stated upfront and a process, working with stakeholders, to achieve those goals, should be developed. Goals developed in other processes (e.g. Calfed Ecosystem Restoration Program) to address Delta ecosystem needs may help guide this process.

Some key concepts the Board should consider:

- Define ecosystem goals
- Use biological and physical indicators to track progress towards ecosystem goals
- Consider all stressors
- Approach as a basin plan that includes upstream watersheds
- Develop an adaptive management approach to learn and optimize performance of management actions in meeting ecosystem goals
- Consider the Delta flow criteria as a starting point that will be adapted to meet ecosystem goals

g. Board questions from the 12/15/09 notice

1. What key information, in particular scientific information or portions of scientific information, should the State Water Board rely upon when determining the volume, quantity, and timing of water needed for the Delta ecosystem pursuant to the board's public trust obligations? For large reports or documents, what pages or chapters should be considered? What does this scientific information indicate regarding the minimum and maximum volume, quality, and timing of flows needed under the existing physical conditions, various hydrologic conditions, and biological conditions? With respect to biological conditions, what does the scientific information indicate regarding appropriateness of flow to control non-native species? What is the level of scientific certainty regarding the foregoing information?

Much of the key information the Board should consider from Interior has been discussed throughout this report, and is included in our citations throughout this document. Generally, the scientific experts have referred to specific references and pages or chapters to be considered by the Board. Much of what this scientific information indicates regarding the Delta flow criteria needed for restoring the Delta ecosystem and recovering fisheries is summarized in Section III Summary of Delta flow criteria and biological objectives.

In general, the Board should rely on scientific information in current and past Board exhibits, scientific publications, the unimpaired hydrograph, and models to help determine the volume, quantity and timing of water needed for the Delta ecosystem pursuant to the Board's public trust obligations. Uncertainty should not limit the Board's considerations of Delta flow criteria, and can be addressed by monitoring, evaluation, and an adaptive management program to accomplish ecosystem goals, and the ultimate goal of protecting public trust resources.

Some of the key information that Interior relied upon includes:

USFWS 1987, USFWS 1992, AFRP Working Paper 1995, AFRP Restoration Plan 2001, Delta Native Fishes Recovery Plan, 1996, POD Report, 2007, the Long Term CVP and SWP Operations Biological Opinions, 2008 and 2009, the NMFS salmonid Recovery Plan, 2009, UC Davis preliminary draft report "On Developing Prescriptions for Freshwater Flows to Sustain Desirable Fishes in the Sacramento-San Joaquin Delta", 2010.

For example, the UC Davis preliminary draft report "On Developing Prescriptions for Freshwater Flows to Sustain Desirable Fishes in the Sacramento-San Joaquin Delta" provides modeling results indicating that OMR flows were positive approximately 50% of the time during the early water development (1949 – 1968) period. The model results indicate that OMR flows were positive less than 10% of the time during the 1986 – 2005 period, coincident with the decline of the delta smelt.

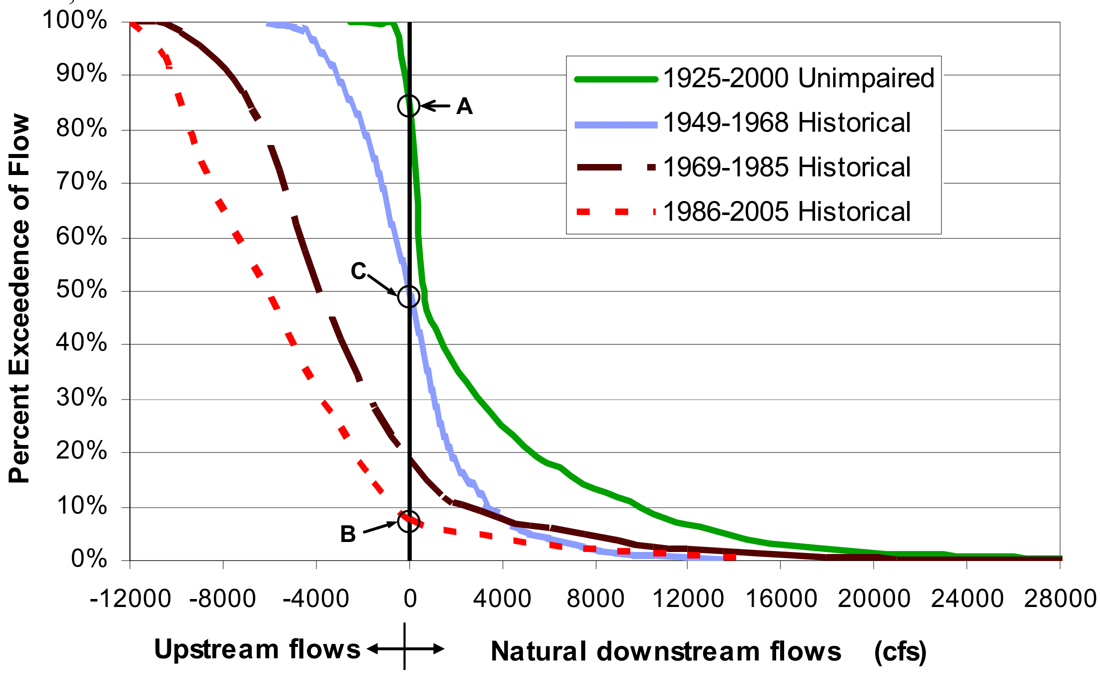


Figure 7. Cumulative probability distribution of sum of flows (cfs) in Old and Middle River resulting from pumping through the Delta showing unimpaired flows (green solid line) and three historical periods, 1949-1968 (light solid blue line), 1969-1985 (long-dashed brown line) and 1986-2005 (short-dashed red line). Fleenor et al., 2010.

It's important to note that the 1995 Anadromous Fish Restoration Plan identified the Delta as the highest priority watershed for achieving the anadromous fish doubling goals, and the AFRP 1995 working paper included Delta flow criteria needed to achieve the doubling of anadromous fish. I-IV-39 and 3-Xe- of the working paper, includes a Delta flow objective to maintain positive QWEST flows from Oct 1 through June 30 to address the biological objective of increased survival of emigrating salmonid smolts.

Maintaining a positive QWEST flow would increase the survival of smolts migrating down the mainstem rivers, decrease the number diverted into the Central Delta, increase the survival of smolts diverted into the Central Delta, and provide attraction flows for the San Joaquin Basin adults (October-December), and protect other public trust resources in the Delta. This is largely consistent with the Board's draft D-1630 issued in 1992 which includes a Delta flow standard of no reverse flow from February 1 through June 30 (Draft D-1630, pg 31, and pages 46-47).

In general, the scientific information indicates that the current minimum Delta flow criteria are not adequate to protect the aquatic resources and restore the Delta ecosystem.

2. What methodology should the State Water Board use to develop flow criteria for the Delta? What does that methodology indicate the needed minimum and maximum volume, quality, and timing of flows are for different hydrologic conditions under the current physical conditions of the Delta?

We believe an appropriate methodology to develop Delta flow criteria would include a combination of: the best available science concerning flow and relationships with indicator species, the best available science concerning flow and relationships with physical processes (eg geomorphic, hydrodynamic, etc), utilizing biological and physical modeling to inform the process, statistical analysis of all of the above, and using the natural/unimpaired hydrographs to help guide the process. Defining ecosystem goals is an important first step in developing flow criteria is to define ecosystem goals. Flow criteria are a tool that can be used to help meet ecosystem goals. With the help of the resource agencies, we encourage the Board to develop Delta flow criteria that are viewed as a starting point to meet the defined ecosystem goals. In addition to the flow criteria, the Board should consider developing a process to adaptively manage and learn from the flows to accomplish the ecosystem goals as efficiently and effectively as possible.

For example, the UC Davis preliminary draft report "On Developing Prescriptions for Freshwater Flows to Sustain Desirable Fishes in the Sacramento-San Joaquin Delta", 2010 "…explores approaches for establishing freshwater flow prescriptions for desirable fishes in the new Sacramento-San Joaquin Delta…" This draft report examines "...four approaches for prescribing environmental flows for the Sacramento-San Joaquin Delta: (1) unimpaired (quasi-natural) inflows, (2) historical impaired inflows that supported more desirable ecological conditions, (3) statistical relationships between flow and native species abundance, and (4) the appropriate accumulation of flows estimated to provide specific ecological functions for desirable species and ecosystem attributes based on available literature…Each approach explored provides a useful perspective on environmental flows for the Delta, and will require further examination and development…"

3. When determining Delta outflows necessary to protect public trust resources, how important is the source of those flows? How should the State Water Board address this issue when developing Delta outflow criteria?

We believe the source of flows is very important to determine Delta outflows. To ensure adequate Delta flow criteria, there must be adequate Delta inflow and outflow. This includes contributions from the Sacramento and San Joaquin Rivers and their tributaries. As stated in previous Board workshops, managing the San Joaquin system for flows only at Vernalis has not been effective in improving fish populations on the San Joaquin and its tributaries. The Board should consider utilizing a percentage of flows from the San Joaquin tributaries (Stanislaus, Tuolumne, and Merced Rivers). Freshwater inflows provide important olfactory cues for upstream migration, and adequate emigration flows for juvenile salmonids improve their survival when moving downstream through the Delta. Providing flows that mimic the natural hydrograph will benefit the native fishes in the Delta and should be used in determining the timing and magnitude of water needed for the Delta ecosystem.

Providing Delta inflows from multiple systems would help provide adult salmonids with the olfactory cues they need to successfully navigate through the Delta back to their natal streams, and would provide concurrent instream benefits in terms of habitat and temperature. Outmigrating smolts would benefit from higher instream flows in the spring months, and having a more balanced and diverse set of inflow sources could improve survival through the interior Delta where survival rates are low. Having multiple sources of inflow also provides benefits to more riparian communities by improving their habitat.

The historical hydrograph can be useful in guiding the timing and magnitude of flows to attain broad ecological benefits to native species.

4. How should the State Water Board address scientific uncertainty when developing the Delta outflow criteria? Specifically, what kind of adaptive management, monitoring, and special studies programs should the State Water Board consider as part of the Delta outflow criteria, if any?

Biological resource management decisions are always made with varying degrees of scientific certainty. By acknowledging varying degrees of scientific certainty in making decisions, biological resource managers engage in risk assessment. Anyone making a decision must balance the certainty of a predicted effect of a management action with the need to act. An example is the certainty of effects resulting from acting to recover Delta smelt compared to the probable results of not acting, which are continued decline and possible extinction of the species.

The Delta flow criteria the Board identifies may be viewed as a starting point that will be adjusted to meet specific ecosystem and biological goals. Appropriate, focused monitoring to evaluate the success of management actions to achieve ecosystem and biologic objectives is critical in understanding the effectiveness of the flows in protecting the public trust resources. We encourage the Board to set ecosystem goals (tracked through biological and physical indicators) to track the effectiveness of flow conditions. If the ecosystem goals are not attained, the Board, with the assistance of resource agencies, flows may be adaptively managed to accomplish the defined ecosystem goals. See Section IV below for more information on adaptive management and monitoring.

5. What can the State Water Board reasonably be expected to accomplish with respect to flow criteria within the nine months following enactment of SB 1? What issues should the State Water Board focus on in order to develop meaningful criteria during this short period of time?

Review of the existing water quality objectives and use of the best available science should be employed to develop flow criteria for the Delta ecosystem. We encourage the Board to facilitate this process of developing Delta flow criteria in order to meet the timelines included in SB 1, and based on the best available science, the Service will continue to work with DFG and NMFS, and will assist the Board to develop Delta flow criteria and quantifiable biological objectives for aquatic and terrestrial species of concern dependent on the Delta.

At the end of this proceeding we foresee the Board having three primary products: defined ecosystem goals (using specific biological and physical indicators to track success of flow standards), Delta flow criteria that were developed to meet the defined ecosystem goals, and a process to adaptively manage flows to meet the ecosystem and biological goals. The flow criteria that the Board adopts should be viewed as a starting point that will be monitored, evaluated and adaptively managed to meet the ecosystem goals.