San Luis & Delta-Mendota Water Authority

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April 21, 2011

Via Federal Rulemaking Portal
www.regulations.gov (*Docket No. EPA-R09-OW-210-0976)*

United States Environmental Protection Agency
Attn: Erin Foresman
75 Hawthorne Street
San Francisco, CA 94105

Re: Unabridged Advanced Notice of Proposed Rulemaking, Water Quality Challenges in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, Docket No. EPA-R09-OW-210-0976, 76 Federal Register 9709 (February 22, 2011)

Dear Ms. Foresman:

The San Luis & Delta-Mendota Water Authority (Authority)[1] and State Water Contractors, Inc. (SWC)[2] welcome the opportunity to comment on the above referenced advance notice, which raises important questions concerning the United States Environmental Protection Agency's (US EPA) appropriate role in the ongoing cooperative State/federal effort to provide reasonable protection for beneficial uses of the Bay-Delta estuary. The advance notice is consistent with US EPA's commitment made in the December 22, 2009, Interim Federal Action Plan for the California Bay-Delta to:

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[1] The Authority, which was formed in 1992 as a joint powers authority, consists of 29 member agencies, 27 of which contract with the United States Department of the Interior, Bureau of Reclamation (Reclamation), for supply of water from the federal Central Valley Project (CVP). The Authority's member agencies hold contracts with Reclamation for the delivery of approximately 3.3 million acre-feet of CVP water. CVP water provided to the Authority's member agencies supports approximately 1.2 million acres of agricultural land, as well as 51,500 acres of private waterfowl habitat, in California's Central Valley. The Authority's member agencies also use CVP water to serve more than 1 million people in the Silicon Valley and the Central Valley. A list of the Authority's member agencies is included in Attachment 1.

[2] The SWC represents 27 public agencies that contract with the State of California for water from the State Water Project ("SWP"). These agencies are each organized under California law and provide water supplies to nearly 25 million Californians and 750,000 acres of prime farmland from Napa County to San Diego and points between. A list of the SWC member agencies is included in Attachment 1.

April 26, 2011

Via Overnight Mail

United States Environmental Protection Agency
Attn: Erin Foresman
75 Hawthorne Street
San Francisco, CA 94105

Re: *Unabridged Advanced Notice of Proposed Rulemaking, Water Quality Challenges in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, Docket No. EPA-R09-OW-210-0976*

Dear Ms. Foresman:

On April 25, 2011, the San Luis & Delta-Mendota Water Authority submitted comments to the United States Environmental Protection Agency (US EPA) regarding the Unabridged Advanced Notice of Proposed Rulemaking, Water Quality Challenges in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, Docket No. EPA-R09-OW-210-0976. This transmission provides the US EPA with a CD that includes copies of the papers referenced in section 4.0 of the Cardno Entrix memorandum which is attached to the Authority's April 25, 2011 comments. The Authority requests the US EPA to include in the administrative record for the above-referenced rulemaking this letter and copies of the referenced papers.

Sincerely,

Daniel Nelson, Executive Director

Enclosure

Question #5. *Should EPA and our state partners move away from evaluating isolated aquatic species for one or two pollutants, and towards evaluations of water conditions more representative of actual aquatic conditions in the Bay Delta Estuary? How might this be done?*

Yes. Derivation of water quality criteria for contaminants of concern with site-specific characteristics (e.g., chemistry, hydrology, and native organisms), although very difficult to produce, would be more protective of aquatic life in the Bay Delta estuary.

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***We would like to thank Tom Mongan for his comments regarding selenium during the preparation of this review.**

> [W]ork with the State [Water Resources Control] Board in issuing an Advance Notice of Proposed Rulemaking (ANPR) to solicit public input on the array of water quality stressors and approaches to better protect water quality for all beneficial uses, including the interactive/additive effects of various stressors, which are difficult to address under the current regulatory framework.

Interim Federal Action Plan for the California Bay-Delta, pp. 14-15. The comments set out below, however, will be divided into two discrete sections, representing, first, our recognition of US EPA's proper role with respect to water quality stressors, and, second, our concern that US EPA may overstep its jurisdictional boundaries and has introduced bias in the area of water flows through the Bay-Delta system. In both sections of this letter, the Authority and the SWC will also reference and discuss additional materials that should be considered by US EPA and respond to what we view as incorrect interpretations of some of the scientific data referenced in the Bay-Delta ANPR. The Authority and the SWC hope the US EPA will use that information to focus the US EPA's future efforts and funding priorities and to ensure the US EPA is objective when it considers science issues that must underlie important Delta-related policy decisions.

I. Responses To Contaminant Areas Identified In The Bay-Delta ANPR

A. General Comments

On page 21, the Bay-Delta ANPR states "existing research indicates that contaminants are likely contributors to the POD and ecosystem collapse." The best available science supports that statement. Thus, the US EPA should actively and aggressively engage in regulatory efforts to reduce existing, and prevent future, contaminant effects on the ecosystem, as well as on other beneficial uses. It is also true that "[i]t is difficult to evaluate and address contaminants in the Bay Delta Estuary in the absence of a comprehensive water quality monitoring program" (page 21). For this reason, the US EPA should promote efforts to improve contaminant monitoring, assessment, and reporting within the estuary.

B. Ammonia: Toxic and Nutrient Effects

- *What, if any, information is available on the sources or impacts of total ammonia nitrogen in the Bay Delta Estuary that is not reflected or cited above?*

The Bay-Delta ANPR describes nicely the toxic and nutrient effects of ammonia and ammonium on the Bay Delta estuary; however, the US EPA should address nutrients more broadly. There is a large body of literature documenting the impacts of increased loading and changing forms and ratios of nitrogen and phosphorus both within the Bay-Delta and globally. The Bay-Delta ANPR states that the US EPA will be working with the State Water Resources Control Board and Regional Water Quality Control Boards, and the US EPA should follow through with that intention. *See* Water Agencies' Comments on the Tentative Waste Discharge Requirements Renewal for the Sacramento Regional County Sanitation District Sacramento Regional Wastewater Treatment Plant (Oct. 8. 2010); (Alameda County Water District et al., 2010b); San Luis Delta-Mendota Water Authority and State Water Contractors Comments on Draft Report Titled "Nutrient Concentrations and Biological Effects in the Sacramento-San Joaquin Delta" (June 14, 2010), (San Luis Delta-Mendota Water Authority and State Water Contractors, 2010); Water Agencies' Comments on Aquatic Life and Wildlife Preservation Issues Concerning the Sacramento Regional Wastewater Treatment Plant NPDES Permit Renewal (June 1, 2010) (Alameda County Water District et al., 2010a), each of which (including the data and scientific literature cited therein) is hereby incorporate herein by this reference.[3]

The ratios of nitrogen to phosphorus are known to have profound influences on food webs. Sterner and Elser (2002) state: "[s]toichiometry can either constrain trophic cascades by diminishing the chances of success of key species, or be a critical aspect of spectacular trophic cascades with large shifts in primary producer species and major shifts in ecosystem nutrient cycling."

The N:P ratio has long been shown to influence phytoplankton community composition and the presence – or absence – of native species and vegetation, as extensive studies have repeatedly demonstrated in systems around the world including: Hong Kong, Tunisia, Germany, Florida, Spain, Korea, Japan, and Washington D.C. (Chesapeake Bay), to name just a few. The Potomac River (Chesapeake Bay) was invaded by submerged aquatic vegetation, *Hydrilla* and clams, *Corbicula*, when the N:P ratio of effluent from the large Blue Plains sewage treatment facility increased after phosphorus was reduced in the 1980s (Ruhl and Rybicki 2010). In Spain's Ebro River estuary, *Hydrilla* and *Corbicula* invaded shortly after phosphorus was removed from effluent (Ibanez *et al.* 2008). In Tolo Harbor, Hong Kong, nutrient loading, particularly phosphorus loading, increased due to population increases in the late 1980's. The result was that a distinct shift from diatoms to dinoflagellates was observed in the harbor, coincident with a decrease in the N:P ratio (Hodgkiss and Ho 1997; Hodgkiss 2001). Once the phosphorous was removed from the sewage effluent that was being discharged into the harbor and stoichiometric proportions were re-established, there was a resurgence of diatoms and a decrease in dinoflagellates (Lam and Ho 1989). In Tunisian, aquaculture lagoons dinoflagellates have been shown to develop seasonally

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[3] All of the papers referenced in this comment letter are listed in attachment 2. For the convenience of the US EPA and to ensure they are part of the administrative record, the Authority and SWC will provide the US EPA copies of each of the referenced papers. The Authority and SWC expect to have those copies to the US EPA on or above April 29, 2011.

when N:P ratios decrease (Romdhane, *et al.* 1998). Comparable results have been observed in systems in Germany (Radach et al., 1990) and along the coast of Florida (Glibert et al., 2004; Heil et al., 2007).

N:P ratios have also been shown to influence zooplankton community composition. Norwegian studies monitored lakes for many years and found that different zooplankton tend to dominate under different N:P ratios, due to the different phosphorus content of different species found in the lake (Hessen 1997). Hessen (1997), for example, showed that a shift from calanoid copepods to *Daphnia* tracked N:P; calanoid copepods retain proportionately more N, while *Daphnia* are proportionately more P rich. Studies from experimental whole lake ecosystems found that zooplankton size, composition and growth rates changed as the N:P ratio varied (*e.g.*, Schindler 1974, Sterner and Elser 2002).

There has been a measureable change in the N:P ratio in the Bay-Delta, an increase in total N loading, a decrease in total P loading, and a change in the dominant form of nitrogen from nitrate to ammonium. In a retrospective analysis of 30 years of data from the Bay Delta, Glibert (2010) found that the variation in these nutrient concentrations and ratios is highly correlated to variations in the base of the food web, primarily the composition of phytoplankton, to variations in the composition of zooplankton, and to variations in the abundance of several fish species.

Winder and Jassby (2010) provide additional documentation of the shift that has occurred in the phytoplankton and zooplankton community.

The shift in the phytoplankton community has ripple effects through the food web. Cloern and Dufford (2005) state: "[t]he efficiency of energy transfer from phytoplankton to consumers and ultimate production at upper trophic levels vary with algal species composition: diatom-dominated marine upwelling systems sustain 50 times more fish biomass per unit of phytoplankton biomass than cyanobacteria-dominated lakes [citation omitted]." Slaughter and Kimmerer (2010) provide further support. They observed lower reproductive rates and lower growth rates of the copepod, *Acartia* sp. in the low salinity zone compared to taxa in other areas of the estuary and conclude that: "[t]he combination of low primary production, and the long and inefficient food web have likely contributed to the declines of pelagic fish."

There is also a growing body of literature documenting improvements in ecosystem functions in systems where nutrient loading is reduced. Reducing nutrient loading in the Chesapeake Bay, Tampa Bay, and coastal areas of Denmark has proven to be effective at reversing the harmful effects of previously undertreated discharges and restoring the native systems. For example, within several years of increasing nutrient removal at the Blue Plains treatment plant in Washington DC, N:P ratios in the Potomac River declined, the abundance of the invasive *Hydrilla verticillata* and

Corbicula fluminea began to decline (Figure 1), and the abundance of native grasses increased (Ruhl and Rybicki 2010).

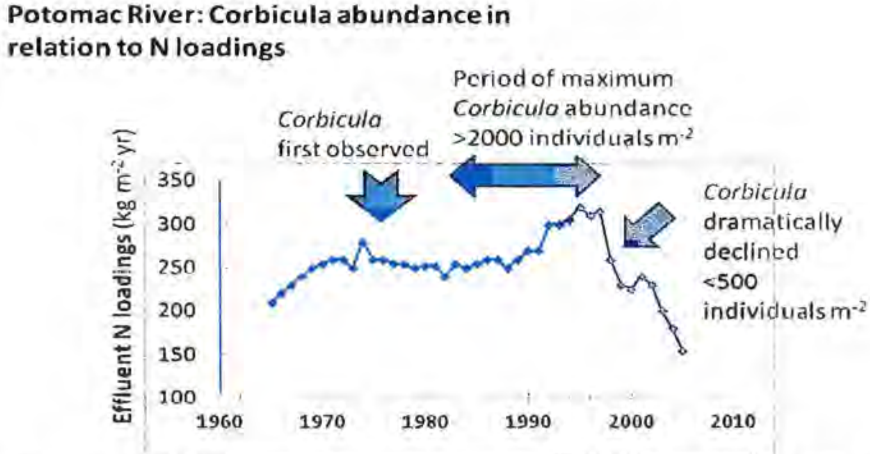

Figure 1. Comparative relationships for the Potomac River showing the change in effluent N loading and the relative abundance of the invasive clam, *Corbicula fluminea* clams. Data derived from Dresler and Cory (1980), Jaworski et al. (2007), and Cummins et al. (2010).

Tampa Bay provides another important example. Eutrophication problems in the Bay were severe in the 1970s, with N loads approximating 24 tons per day, about half of which was due to point source effluent (Greening and Janicki 2006). Several years after nitrogen and phosphorus reductions were achieved, native seagrass began to increase. Lower nutrient discharges also had positive effects on the coastal waters around the island of Funen, Denmark (Rask *et al.* 1999). Since the mid 1980s, there has been a roughly 50% reduction in the loading of N and P in the region due to point source reductions. Again, native grasses returned and low oxygen problems were reversed.

Moreover, there is recent evidence that diatom blooms can be restored in the Bay-Delta if ammonium loading were reduced. In Suisun Bay a diatom bloom reached chlorophyll concentrations of 30 µg L^{-1} during spring 2000 when ammonium concentrations declined to 1.9 µmol L^{-1} (Wilkerson *et al.* 2006). Similarly, chlorophyll concentrations in Suisun Bay reached 35 µg L^{-1} during spring 2010 when ammonium concentrations declined to 0.5 µmol L^{-1}. These blooms are comparable to spring chlorophyll levels from 1969-1977 (Ball and Arthur, 1979) when ammonium concentrations were 1.8 µmol L^{-1} during summer and 4.0 µmol L^{-1} during winter (Cloern and Cheng, 1981). If clam abundance declines, as has occurred in San Pablo Bay and South San Francisco Bay (Cloern *et al.*, 2007), chlorophyll levels may also be restored during summer in Suisun Bay if ammonium loading were reduced.

Additionally, as Glibert (2010) reported: "[s]upporting the idea that correct balance of nutrients is important for restoration of delta smelt and other pelagic fish, there is a small but apparently successful subpopulation of delta smelt in a restored habitat, Liberty Island. Liberty Island is outside the immediate influence of Sacramento River nutrients. It has abundant diatoms among a mixed phytoplankton assemblage, as well as lower NH_4 levels and higher ratios of NO_3:NH_4 than the main Sacramento River [citation omitted]."

The Bay-Delta ANPR states on page 26 that "other research shows that high water temperature and stream flows has a stronger relationship with *Microcystis* cell density than nutrient loadings to the Bay Delta Estuary." It is true that *Microcystis* does well in warmer, calmer water; however, *Microcystis* cannot generate biomass from flow and temperature; it needs nutrients to generate biomass. Based on stable isotope analyses of particulate organic matter and nitrate, Kendall (2010 and 2011) observed that ammonium, not nitrate, is the dominant source of nitrogen utilized by *Microcystis* at the Antioch and Mildred Island sites in the summer 2007 and 2008.

Nutrients affect more than *Microcystis* growth. Nutrients may also affect its production of toxins. In Daechung Reservoir, Korea, researchers found that toxicity was related not only to an increase in N in the water, but to the cellular N content as well (Oh *et al.* 2000). A very recent report by van de Waal (2010) demonstrated in chemostat experiments that under high CO_2 and high N conditions, microcystin production was enhanced in *Microcystis*. Similar relationships were reported for a field survey of the Hirosawa-no-ike fish pond in Kyoto, Japan, where the strongest correlations with microcystin were high concentrations of NO_3 and NH_4 and the seasonal peaks in *Microcystis* blooms were associated with extremely high N:P ratios (Ha *et al.* 2009). Thus, not only is *Microcystis* abundance enhanced under high N:P, but its toxicity is as well (Oh *et al.* 2000).

Additional evidence of the toxic effects of ammonia on important Delta copepods come from life cycle tests conducted by Teh *et al.* (2011). Teh *et al.* found that total ammonia nitrogen at 0.36 ± 0.01 mg L^{-1} significantly affects the recruitment of new adult copepods and total ammonia nitrogen at 0.38 ± 0.01 mg L^{-1} significantly affects the number of newborn nauplii surviving to 3 days old. These concentrations are regularly exceeded for a 30 mile stretch of the Sacramento River downstream of the Sacramento Regional Wastewater Treatment Plant (Foe *et al.*, 2010).

- *Is there any information available that suggests site-specific water quality standards for total ammonia nitrogen in the Bay Delta Estuary may be more effective than current standards due to unique hydrological, chemical, biological, or physical conditions?*

As the Bay-Delta ANPR correctly notes on page 26: "[r]ecent independent investigations in the Bay Delta Estuary raise the possibility that the 1999 EPA ammonia criteria may not be protective of pelagic species in the Bay Delta Estuary." The recent life-cycle tests by Teh et al. (2011) with *Pseudodiaptomus forbesi* provide additional support for this conclusion.

There are no current standards that protect the Bay-Delta Estuary from the inhibitory effects of ammonium observed by Wilkerson *et al.* (2006) and Dugdale *et al.* (2007). US EPA should develop or participate in the development of nutrient standards to protect the Bay-Delta Estuary from the inhibitory effects of ammonium.

There are no current standards that protect the Bay-Delta Estuary from detrimental shifts in aquatic community composition precipitated by changing nutrient forms and ratios from anthropogenic loadings of nutrients. US EPA should participate in the development of nutrient standards for the Bay-Delta Estuary that restore nutrient forms and ratios to levels that were observed prior to the changes in community composition observed in the Bay-Delta Estuary over the last few decades.

- *What information is needed to determine effective site-specific water quality standards for total ammonia nitrogen, including narrative or numeric criteria?*

Dugdale and Marchi (2010) developed a model that can be used to calculate numeric criteria for total ammonia nitrogen to protect against the inhibitory effects of ammonium. Dugdale and Marchi (2010) determined three criteria that must be met in order for primary productivity to be unimpaired by ammonium. First, ammonium concentration must be below the level that inhibits phytoplankton from assimilating nitrate (Inhibition Criterion: 4 μmol L^{-1}) (Wilkerson *et al.*, 2006; Dugdale *et al.*, 2007). Second, ammonium loading must be less than what phytoplankton are able to assimilate otherwise the ammonium concentration will continue to increase (Loading Criterion for Suisun Bay: 0.49 mmol m^{-2} d^{-1}). And, third, the basin exchange rate must be less than the phytoplankton growth rate otherwise the phytoplankton will be washed out of the system before they can accumulate (Washout Criterion for Suisun Bay: 42,000 cfs). The loading and washout criteria will be different for different areas of the Bay Delta estuary.

Nitrogen and phosphorus levels from times and places when or where the Bay Delta Estuary aquatic community resembled more desirable conditions (e.g. a diatom-calanoid copepod-pelagic fish food web) can be used to determine numeric criteria for N:P and NO3:NH4. For example, according to Glibert (2010), diatoms began to decline in the Suisun Bay area around 1982; therefore, restoring nutrient conditions to those that existed prior to 1982 could be an appropriate target. Alternatively, N:P conditions upstream of major anthropogenic inputs of nutrients into the system could be used as a target. A third alternative would be to use nutrient conditions in the Liberty Island area where a desirable pelagic community exists as a target condition.

- *Other*

Although the State Water Resources Control Board has initiated the development of nutrient numeric endpoints (NNEs) to serve as nutrient objectives, the process is currently limited to the Bay; the effort needs an expanded geographic scope to include the Delta. In addition, the State Water Board has already acknowledged they do not have sufficient resources to complete the process of developing an objective. US EPA should consider supporting this effort to bring additional resources.

The toxic affects of ammonium need to be recognized as a violation of the narrative toxicity objectives contained in the Basin Plans of both the Central Valley and San Francisco Bay Regional Boards. Algal inhibition is toxicity. While regulation under the narrative is appropriate, the State Water Board is developing numeric toxicity limits. US EPA should encourage the State Water Board to promulgate the numeric toxicity objective as soon as possible. In addition, US EPA needs to finalize and promulgate the 2009 draft Ammonia Criteria.

Another significant way to reduce nitrogen loading to the Bay Delta would be to update NPDES permits in a more timely fashion. The existing permit for the Sacramento Regional Wastewater Treatment Plant took an additional five years to adopt. This permit authorizes another ten years of toxic ammonium loads. US EPA should work with the State Water Board, Regional Water Quality Control Boards, and Sacramento Regional County Sanitation District to reduce nitrogen, and especially ammonium, loads as quickly as possible. The spring diatom bloom in 2010 demonstrates that ammonium load reduction to a level that allows phytoplankton is already possible. There is no excuse to delay reductions further.

C. <u>Selenium</u>

The Bay-Delta ANPR relies on a study that drastically overstates the quantity of selenium likely to be transported into the Delta from agricultural drainage sources in the San Joaquin Basin and that also contains statements that characterize the likelihood of transport of selenium from that Basin as posing a major threat of increasing selenium contamination that would require additional intervention by US EPA. Such reliance and statements are not supported.

There is an approved TMDL for selenium in the San Joaquin River and that along with current data should be used when estimating agricultural impacts from the San Joaquin River to the Delta.

The most glaring limitation of water quality standards is the lack of consideration of selenium species (e.g., selenate and selenite) during the derivation process. Total selenium water column concentrations are not practical for predicting biological effects. Selenium speciation is critical to the understanding of ecosystem impacts. Selenium can be found in both reduced and oxidized forms, which behave differently in the water column and sediments, and exhibit significant differences in toxicity. There is little ecological relevance to using a "total selenium" criterion as it may grossly overestimate the potential for adverse ecological effects if its derivation is not adequately understood. Specific water quality criteria for the highly bioavailable selenite and less bioavailable selenate forms of selenium should be developed.

The impacts to higher trophic level wildlife that consume prey items contaminated with different forms of selenium (e.g., selenate and selenite) have not been adequately modeled. This should be a priority in the development of new or revised selenium water quality standards.

D. <u>Pesticides</u>

The Bay-Delta ANPR correctly identifies the significant data gaps regarding pesticide use, sources, toxicity, and contributions to the Bay-Delta Estuary ecosystem collapse (page 39). The lack of verifiable information regarding the sources and toxicity of pesticides in the Bay-Delta Estuary and watersheds presents a significant data gap. The contribution from urban sources (Weston et al. 2005; Weston and Lydy 2010) directly to the Bay-Delta Estuary needs further analysis. In addition, upstream agricultural sources are being managed under the Irrigated Lands Regulatory Program (ILRP). Reports show that, on the Westside of the San Joaquin Valley, the ILRP program is making progress. See Hall 2010a, Hall 2010b, Hall 2010c.

Pesticides are applied to to manage crop production and quality. Unlike selenium and some other metals, pesticides are not native to soils and therefore can be managed more effectively on farm at the source during agricultural application and prevention of runoff. Adaptive management of pesticide use including the development of best management practices could provide the required water quality improvements. The use of pesticides on irrigated lands in the San Joaquin Basin, Sacramento Basin and Delta are currently regulated under the ILRP, which requires implementation of best management plans on the regional level with compliance by individual landowners to maintain regulatory protection. TMDL's for major pesticides are already in effect, and progress is being made. On the other hand, inputs of pesticide to the Delta from urban areas, especially those within the Delta, that are not so regulated are an area where additional action from US EPA is merited. The Central Valley Regional Water Quality

Control Board is developing the Central Valley Pesticide TMDL and Basin Plan amendment. This project is addressing pyrethroid pesticides and potentially other high risk pesticides. The US EPA should provide support and assistance to this project.

- *What, if any, additional scientific information is available on (a) the effects of pesticides in stormwater discharges, or (b) the potential interactive effects of combinations of pesticides on aquatic resources in the Bay Delta Estuary?*

Use of the organophosphates diazinon and chlorpyrifos has been reduced in agriculture and eliminated from urban use; however, pyrethroid pesticides have largely taken their place (Weston and Lydy 2010; Amweg et al. 2005). In addition, there has been a significant shift to more toxic pyrethroid pesticides in the last decade corresponding with the POD years (Figure 2). In 2008 and 2009, pyrethroids were found in all but one of the thirty-three urban runoff samples collected from locations in Sacramento, Stockton, and Vacaville (Weston and Lydy 2010). The testing determined that 88% of these samples were toxic, causing death or inability to swim in the aquatic test species *Hyalella azteca*. The study concluded that this toxicity was likely caused by the pyrethroid concentrations in the water.

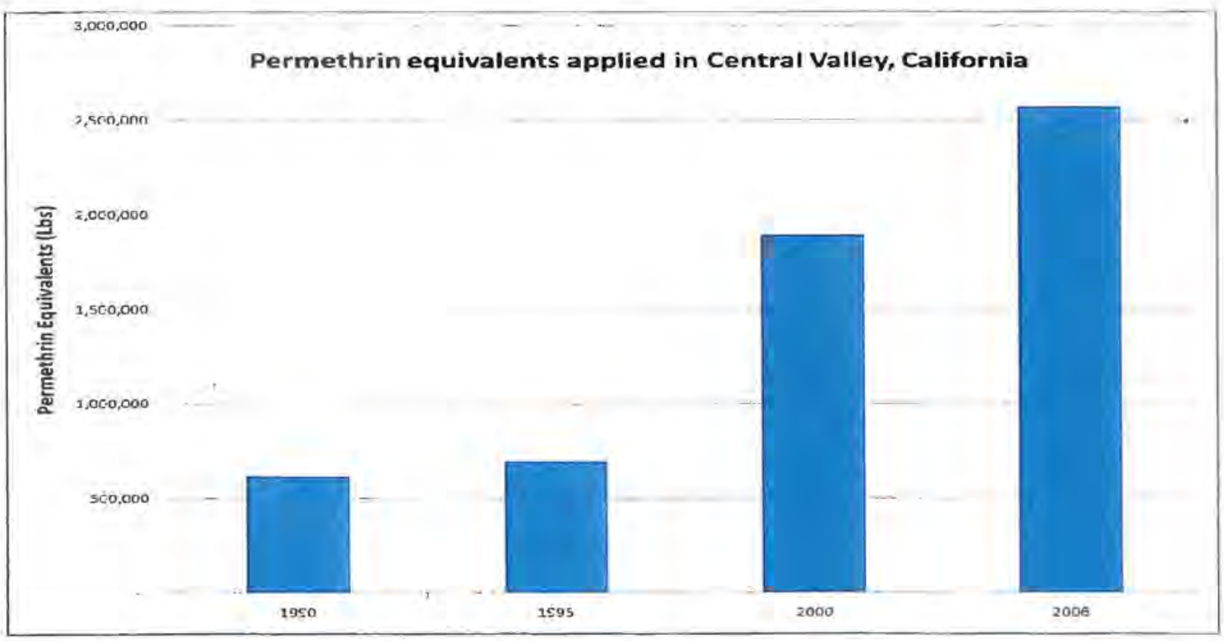

FIGURE 2. Permethrin equivalents applied in Central Valley, California. Pounds of pyrethroid applied were obtained from the Department of Pesticide Regulation DPUR database and converted to permethrin equivalents using the methods described in Amweg et al 2005. Including the urban usage not recorded in the DPUR database would likely show an even larger increase in the last decade due to the phase out of OP pesticides from non-commercial residential use.

Connon et al. (2009) reported: "exposure to esfenvalerate affected swimming behavior of larval delta smelt at concentrations as low as 0.0625 $\mu g.L^{-1}$, and significant differences in expression were measured in genes involved in neuromuscular activity."

Bennett et al. (2001) measured concentrations of copper in delta smelt in the Sacramento River at 6.5 mg kg^{-1} (wet weight), which is over 32 times higher than normal background concentrations.

Baldwin et al. (2009) modeled the effects of pesticide exposure on salmon populations and state: "[o]ur results indicate that short-term (i.e., four-day) exposures that are representative of seasonal pesticide use may be sufficient to reduce the growth and size at ocean entry of juvenile chinook. The consequent reduction in individual survival over successive years reduces the intrinsic productivity (lambda) of a modeled ocean type chinook population." They further conclude: "[a]lthough the models are simplistic and required several (transparent) assumptions, the magnitude of the responses indicates that common pesticides may significantly limit the conservation and recovery of threatened and endangered stocks in California and the Pacific Northwest."

Fish olfactory systems have been shown to be instrumental in several behavioral functions such as finding prey, predator avoidance, schooling, mate identification and avoiding offensive contamination. Several studies have demonstrated that low doses of some contaminants can have significant impacts on fish olfactory systems even after short duration exposures (Sandahl et al., 2004; Sandahl et al., 2007; Raloff et al., 2007).

It should also be noted that the California Department of Pesticide Regulation placed 542 products containing pyrethroids into reevaluation in August 2006 "based on monitoring surveys and toxicity studies revealing the widespread presence of pyrethroid residues in the sediment of California waterways dominated by both agricultural and urban runoff, at levels toxic to *Hyalella azteca (H. azteca)"* (Department of Pesticide Regulation, 2010).

Additional information on contaminants can be found on pages 33-48 of comments the Water Agencies (include included the Authority and SWC) submitted to the State Water Resources Control Board on during its administrative process to adopt flow criteria, (San Luis & Delta-Mendota Water Authority et al. (2010)),[4] and pages v-1 to v-11 of Appendix V to the biological assessment the United States Bureau of Reclamation prepared on the impacts of continued operation of the Central Valley

[4] San Luis & Delta-Mendota Water Authority, State Water Contractors, Westlands Water District, Santa Clara Valley Water District, Kern County Water Agency, and Metropolitan Water District of Southern California. 2010. Written Testimony for the information proceeding to develop flow criteria for the Delta ecosystem, Noticed for March 22, 23, and 24, 2010.
http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/exhibits/sfwc/sfwc_exhibit1.pdf.

Project and State Water Project, (US Department of Interior, 2008), each of which (including the data and scientific literature cited therein) is hereby incorporated herein by this reference.[5]

- *What, if any, actions should EPA take under its authority to improve the effectiveness of regulating pesticide contamination of the Bay Delta Estuary?*

The Irrigated Lands Regulatory Program (ILRP) has led to the development of watershed-based organizations to coordinate and conduct water quality monitoring, including for pesticides and toxicity testing, and requires coalitions to complete watershed management plans so that farmers implement best management practices (BMPs) to deal with issues as they develop. On the Westside of the San Joaquin Valley, the ILRP is making progress reducing pesticide contamination. See Hall 2010a, Hall 2010b, Hall 2010c. Once the current program expires, the Central Valley Regional Water Board has indicated that it will implement region-specific general waste discharge requirements to carry forward the regulatory program. US EPA should encourage the Regional Water Board to make certain that the general order prioritizes funding support to accelerate implementation of BMP's and reduction in discharges of pesticides.

In contrast, there is not an effective non-commercial urban pesticide use and monitoring program in place in the Bay-Delta Estuary. Recent monitoring by Weston and Lydy (2010) has shown that urban sources of pesticides far exceed agricultural sources. At a minimum, there should be a program to report non-commercial pesticide use data either on the retail or wholesale level.

US EPA should continue to participate in and support the Delta Regional Monitoring Program (Delta RMP). There are a lot of different monitoring programs in the Bay-Delta Estuary including the State Water Resources Control Board's Surface Water Ambient Monitoring Program, Irrigated Lands Regulatory Program, individual NPDES permit compliance monitoring, Department of Water Resources Environmental Monitoring Program, to name a few. However, there has been little effort to pull together and synthesize the data from all these programs into a single comprehensive spatial and temporal evaluation of contamination and toxicity in the Delta's waterways. The Central Valley Regional Water Quality Control Board is trying to coordinate many of these programs through the Delta RMP; however, more can and should be done to improve the effectiveness and efficiency of these disparate programs. US EPA's continued participation and support (including providing funding) may help achieve that. US EPA's continued participation, at a minimum, will ensure the Delta RMP progresses

[5] US Department of Interior Bureau of Reclamation. 2008. Central Valley Project and State Water Project Operations Criteria and Plan Biological Assessment, May 16, 2008. Appendix V. Available at http://www.usbr.gov/mp/cvo/OCAP/sep08_docs/Appendix_V.pdf.

and ultimately increase the likelihood that there will be greater knowledge of the impacts of contaminants in the Bay Delta Estuary.

Significant toxicity has been observed in sediment samples collected from throughout the Delta, particularly in urban streams. Amweg et al. (2006) tested sediment samples from the Sacramento area and found that 22 of the 33 samples caused significant toxicity to *Hyalella azteca* and 7 of the 8 creeks tested had toxic samples on at least one occasion. Pyrethroid concentrations were sufficient to explain the toxicity in 21 of the 22 toxic samples. Given our growing understanding of Delta smelt's preference for turbid water, the link between sediment contamination and the Pelagic Organism Decline needs to be explored further.

- *Are there testing protocols that would effectively and efficiently identify synergistic toxic effects in the Bay Delta Estuary?*

- *Should EPA and our state partners move away from evaluating isolated aquatic species for one or two pollutants, and towards evaluations of water conditions more representative of the actual aquatic conditions in the Bay Delta Estuary? How might this be done?*

The answer to these two questions is related. US EPA should move toward a more integrated health assessment that includes chemical analyses and biological responses. While there is certainly value in conducting species' sensitivity analyses on individual pollutants, this needs to be supplemented with in-situ analyses of species' health using biomarkers and other sublethal indications of contaminant exposure and effect. Aquatic organisms are exposed to contaminant mixtures, often at undetectable levels of each constituent, for their entire life and over multiple generations. Grab samples do not capture the variation of this mixture that can occur at hourly, daily, and seasonal time scales. In addition, short duration (e.g. 7-day) toxicity tests do not capture life cycle type effects on a population. A more integrated health assessment is required to capture the full effect of contaminant mixtures on species of concern and their prey items.

Biomarkers are becoming a useful tool in the investigation of contaminant effects on aquatic organisms. Anderson (2007) conducted an expert panel review of biomarkers for the pelagic organism decline. The panel made a recommendation for a 3-4 year integrated and tiered investigation that focuses on two of the POD species. The investigation includes field and laboratory investigations of larval, juvenile and adult fish and several possible special studies. The Aquatic Health Program at UC-Davis has developed many of the tools that can be used for this type of assessment; however, a steady and reliable source of funding is needed. We encourage EPA to fund such an integrated and comprehensive investigation.

- *What, if any, specific combinations of contaminants are of particular concern in the Bay Delta Estuary?*

Given the recent research results demonstrating the effects on fish olfactory and lateral line function of short term exposures to low levels of copper and other contaminants, US EPA should conduct, or fund, additional investigations on the effect of metals and other contaminants on Delta pelagic and anadromous fish olfactory function.

E. Contaminants of Emerging Concern

The report correctly identifies the significant data gaps regarding contaminants of emerging concern (page 48).

- *What, if any, additional information is available regarding the effects of CECs on aquatic resources in the Bay Delta Estuary?*

In addition to the studies cited in the Bay-Delta ANPR report, Brander and Cherr (2008) observed choriogenin induction in male silversides from Suisun Marsh and Riordan and Adam (2008) reported endocrine disruption in male fathead minnows following in-situ exposures below the Sacramento Regional Wastewater Treatment Plant.

Sommer (2008) reported that the sex ratio of young of the year striped bass in the Bay Delta Estuary is heavily skewed toward male (90:10 male:female). While the cause of this skewed sex ratio is unknown at this time, exposure to endocrine disrupting chemicals cannot be ruled out.

Connon et al (2010) reported that "exposure to water from Hood elicited significant transcriptional differences of genes involved predominantly in neuromuscular functions, suggesting that contaminants originating from the SRWTP effluent may impact on swimming performance, growth and development of larval delta smelt. Down-regulation of structural muscle genes may also indicate physiological damage."

- *What, if any, specific information exists to identify the sources and nature of discharges of CECs into the Bay Delta Estuary?*

The National Water Research Institute (NWRI) recently released a report entitled, "*Source, Fate, and Transport of Endocrine Disruptors, Pharmaceuticals, and Personal Care Products in Drinking Water Sources in California*" (NWRI, 2010). This study included the collection and analysis of samples from upstream and downstream of the Sacramento Regional Wastewater Treatment Plant. The concentrations of caffeine, carbamazepine, DEET, gemfibrozil, primidone, sulfamethoxazole, dilantin, and TCEP were higher in the Sacramento River at Hood downstream of the Plant than upstream in the Sacramento River at the West Sacramento Water Treatment Plant Intake and at the Fairbairn Water Treatment Plant intake on the American River. The contribution of the Sacramento Regional Wastewater Treatment Plant to the concentrations at Hood is unknown because the Sacramento Regional County Sanitation District did not participate in the study. Wastewater agencies in Las Vegas and in the Santa Ana River watershed participated in this study and provided effluent samples. The study's authors concluded that wastewater discharges were the primary sources of these compounds in the Colorado River and Santa Ana River watersheds.

Schaefer and Johnson (2009) conducted monitoring up and downstream of the largest POTW in the Delta and detected caffeine, trimethoprim, sulfamethoxazole, gemfibrozil, fluoxetine, ibuprofen, carbamazepine, xylene, nonylphenol, and nonylphenol ethoxylates at one or more of the downstream monitoring sites. None of these compounds were detected in the upstream samples. Schaefer and Johnson (2009) state, "All of the compounds detected in the monitoring effort have been shown to have an adverse effect on one or more aquatic species." In fact, ibuprofen was detected at concentrations far greater than those observed to reduce activity in *Gammarus pulex* (Aquatic Ecosystems Analysis Laboratory 2009).

Huang and Sedlak (2001) measured concentrations of up to 4.05 ng/L 17-beta-estradiol (E2, the natural estrogen) and 2.45 ng/L EE2 in treatment plant effluent after secondary treatment/chlorination, while concentrations were mostly below 1 ng/L in effluents treated with more sophisticated methods.

Barnes et al. (2002) sampled 139 streams in 30 states and detected one or more organic wastewater contaminant in 80% of the streams. Half the streams contained seven or more chemicals. Six of the sites are in the Central Valley. Samples from the Sacramento River at Freeport had cholesterol at 383 ng/L, acetaminophen at 25 ng/L, and mestranol at 11 ng/L. Acetaminophen was estimated at 4 ng/L in Orestimba Creek and San Joaquin River at Vernalis. The Turlock Irrigation District Lateral 5 that drains to the San Joaquin River contained 2 ng/L 17 β-estradiol, 10 ng/L estriol, 113 ng/L 19-norethisterone, 1,110 ng/L cholesterol, 624 ng/L coprostanol (measure for the presence of human fecal matter), 390 ng/L acetaminophen, 680 ng/L caffeine, 17 ng/L diltiazem (potent vasodilator of peripheral and coronary vessels), 210 ng/L 1,7-Dimethylxanthine (caffeine metabolite), and 19 ng/L codeine.

- *What, if any, methods are most effective to minimize introduction of CECs into the Bay Delta Estuary?*

As all three of the studies described above indicate, wastewater treatment plant effluent has been identified as one of the main sources of constituents of emerging concern. As such, NPDES permits should require monitoring for these constituents. A mechanism similar to the Unregulated Contaminant Monitoring Rule for drinking water treatment plants could be imposed on wastewater treatment plants such that the larger plants are responsible for monitoring a larger number of constituents of emerging concern with a goal of obtaining more information on fate and occurrence of these constituents for future regulatory purposes.

The Clean Water Act requires all wastewater treatment plants to provide at least secondary level treatment unless an exception is requested and granted based on site-specific considerations. Given the growing number of constituents of concern identified in wastewater treatment plant effluent nationally, the State Water Board has convened a panel of expert scientists to advise the State Water Board and Regional Water Quality Control Boards on how to regulate for these constituents in both recycled water and treatment plant discharge. The panel has recommended that monitoring data within California and elsewhere be assessed to evaluate the ability of different treatment techniques in removing specific contaminants. Effective treatment is possible with advanced treatment. US EPA should support the State Water Board efforts to require advanced treatment where justified.

II. The US EPA Must Restrain From Rulemaking In Flow Related Areas Identified In The Bay-Delta ANPR

A. Clean Water Act And US EPA Jurisdiction

As noted earlier in this letter, the Authority and the SWC are concerned that the Bay-Delta ANPR, after it discusses the too-long ignored key water quality issues that need priority attention, strays into flow related, state water rights issues that are outside federal jurisdiction. Foray into those issues would overlap and likely unnecessarily complicate other initiatives, such as the State Water Resources Control Board's continual evaluation of Bay-Delta water quality standards, the Delta Stewardship Council's attempt to synthesize hundreds of local, State, and federal actions relative to the Bay-Delta, and the Bay Delta Conservation Plan. In all of those efforts, the federal government has been well represented by the United States Fish and Wildlife Service, National Marine Fisheries Service, United State Bureau of Reclamation, and/or the U.S Army Corps of Engineers. Finally, the discussion of those other issues, in some instances, reflect biases that have, for at least two decades, impaired efforts to adequately protect beneficial uses within the Bay-Delta. Executive Order No. 12866 directs against that:

> *Federal agencies should promulgate only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling public need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being of the American people. In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs*

> *and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.*

Consistent with that Executive Order, the Interim Federal Action Plan informs the public that the Bay-Delta ANPR would be acutely focused (Six Federal Agencies, 2009). The Interim Federal Action Plan explained that US EPA would be working with the State Water Resources Control Board and Regional Water Quality Control Boards in areas that are "difficult to address under the current regulatory framework." Interim Federal Action Plan for the California Bay-Delta, pp. 14-15. US EPA would then evaluate and synthesize the input, work with the State Water Board and Regional Water Quality Boards and collaborate with National Academy of Sciences. *Id.*, p. 15. It is important that the US EPA maintain that focus, as it considers whether future rulemaking or other Bay-Delta related efforts by US EPA are needed.

There are more than 200 federal, state, and local governmental agencies that have some jurisdiction in the Delta. Delta Vision Strategic Plan, p. VI (Blue Ribbon Task Force, 2008). From 2006-2009 the Delta Vision Blue Ribbon Taskforce considered, and since then the Delta Stewardship Council has been considering, in part, how those agencies might best exercise their respective authorities to protect and enhance beneficial uses dependent upon the Bay-Delta. Two clear principles relevant to the Bay-Delta ANPR emerged from those planning exercises: (1) agencies must respect their legal authorities, and (2) when exercising those authorities, each agency should strive to undertake actions that complement, and do not conflict with or overlap actions or authorities of other agencies. Those principles are reflected in the Interim Federal Action Plan. It would likely frustrate, rather then facilitate efforts within the Bay-Delta, if the US EPA did not adhere to those principles.

Unfortunately, the Bay-Delta ANPR indicates the US EPA is considering actions that do not adhere to those principles. Of greatest concern at this point is the indication in the Bay-Delta ANPR that the US EPA is equating Bay-Delta flow requirements with water quality standards under the Clean Water Act (CWA or Act). Importantly, the CWA does not authorize the US EPA to establish flow-based standards.

> *Water quality standards* are provisions of State or Federal law which consist of a designated use or uses for the waters of the United States and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the Act.

40 C.F.R. § 131.3(i). As used in this definition: "[c]riteria are elements of State water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use...." 40 C.F.R. § 131.3(b).

When read together, a water quality standard must address the constituents affecting the designated use or uses. The definitions exclude physical attributes and thus flow. Compare with 40 C.F.R. 101.3(g) (defining use attainability analysis as "structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors").[6]

Not unexpected, US EPA Water Quality Standards Handbook is consistent with those definitions. The Handbook recognizes that US EPA published criteria for multiple categories, but none of those categories concern physical characteristics of water. All of them are focused on chemicals within the water. *See* Water Quality Standards Handbook: Second Edition, Appendix J, water.epa.gov/scitech/swguidance/standards/handbook.

Also, other related US EPA policies are consistent with the definitions of water quality standards and criteria. For example, the US EPA Assistant Administrator for Water and Waste Management wrote to the Regional Administrators and explained:

> ... it is obvious that Congress did not intend to prohibit EPA from taking such measures as may be necessary to protect water quality. It is noteworthy that ... the 1977 Amendments left untouched both § 301(b)(1)(C), which requires without exception that point source discharges be controlled to meet water quality standards, and §101(a)(2), which declares the national "fishable, swimmable" water quality goal.
>
> * * *
>
> It is important to recognize, however, that §101(g) reinforces §510(2)'s general proscription against unnecessary Federal interference with State water rights. EPA should therefore impose requirements which affect water usage only where they are clearly necessary to meet the Act's requirements.

Nov. 7, 1978 Memorandum from US EPA Assistant Administrator for Water and Waste Management available at water.epa.gov/scitech/swguidance/standards/library_index.cfm.

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[6] The Authority and SWC recognize the objective of the CWA to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. 33 USC 1251(a). However, that objective is a general objective. The role of water quality standards is narrower.

B. Protecting Estuarine Habitat, Fish Migration Corridors and Wetlands

Notwithstanding, our jurisdictional concerns and the lack of need for US EPA action in these flow related areas, the Authority and SWC are compelled to respond to serious misstatements in the Bay-Delta ANPR as to the status of the science on certain flow related topics.

1. Estuarine Habitat

The section of the Bay-Delta ANPR, (page 52) on estuarine habitat does not appear to be seeking information from an unbiased baseline. Instead, US EPA appears to have accepted as true the heavily debated hypothesis that the location of X2, used as a surrogate for the low salinity zone (LSZ) plays an important role in the abundance of many pelagic organisms of the upper Bay Delta estuary, including the threatened delta smelt (*Hypomesus transpacificus*), the state-listed longfin smelt (*Spirinchus thaleichthys*) and juvenile striped bass (*Morone saxatilis*). Considering the fact that more favorable flow conditions, which have placed X2 in locations considered important for healthy fish populations, have not resulted in increased abundances (Kimmerer et al. 2009), the predictive ability of X2 is questionable. Delta smelt abundance has never been associated with the position of spring X2 (Jassby et al. 1995; Kimmerer 2002, Kimmerer et al., 2009). Longfin smelt are anadromous, confounding any associations with estuarine conditions (Kimmerer et al. 2009).

There is no evidence that shifting the estuary to either a higher or lower salinity in the western Delta will affect the distribution or impact of the Amur River clam *C. amurensis*; it has a wide salinity tolerance from <1 to 33 psu (Carlton et al. 1990).

- *What information is available on the effect of lower salinities in the western Delta on undesirable species such as Microcystis, overbite clams, or jellyfish? What, if any, information is available to determine if an increase in low salinity habitat would affect the fate, concentration and distribution of nutrients and toxics that are potentially negatively affecting the estuarine food web?*

The Bay-Delta ANPR attributes the increase of jellyfish in the Bay-Delta to changes in fall X2 position, (page 52), supported by Schroeter (2008). Schroeter (2008) explains that gelatinous zooplankton are increasing worldwide due, in part, to excess anthropogenic nutrient inputs. Support for its proliferation in Suisun Bay was found at lower Boynton Slough, which is ~200 m downstream from a local sewage treatment plant. Schroeter (2008) reported that medusae were found there in high abundance in spite of low salinity, in fact, so high that the data was treated as an outlier and removed from the salinity analysis. After removal of the outlier, salinity was found to be the most important predictor of medusa abundance. The moderation in marsh salinity is attributed to operation of the Suisun Marsh Salinity Control Gates in Montezuma Slough rather than to fall X2. It is worth noting that ammonia/um was not analyzed by Schroeter (2008). Jellyfish are known to tolerate ammonia/um (Pitt et al. 2009) and are strongly associated with nutrient loading in other estuaries, e.g., the Cheasapeake Bay (Purcell et al. 1999).

Microcystis are likewise positively associated with ammonia/um (von Ruckert and Giani 2004; Lehman et al. 2010). Lehman et al. (2008) reported that low stream flow was strongly associated with the seasonal variation of *Microcystis* cell density; however, ammonium concentration, stream flow and temperature were found to account for most of the variation. As described previously in the section on ammonia effects, Kendall (2010 and 2011) also found a positive association between ammonium and *Microcystis*. In this instance, low flows may have been implicated because of reduced dilution of ammonium.

Benthic bivalves also show tolerance to ammonia/um. Glibert (2010) observed changes in nutrient loadings and forms were related to changes in clam abundance. Glibert found that the Amur River clam *C. amurensis* was positively related to ammonium concentrations and to nitrogen to phosphorus ratios.

Use of water rights to modify the location of the LSZ for the purpose of diluting anthropogenic nutrient and toxic discharges would result in an unreasonable use of water in violation of California statutory and constitutional provisions.

- *Could the frequency, area, and/or duration of low salinity habitat be changed so as to achieve ecosystem benefits for the suite of species that use the low salinity zone? If so, how? Is historical data on inter-or intra-annual frequency of variability the best basis for setting goals or are there other bases that could be used? How might climate change impacts, including sea level rise, affect the size, frequency, and duration of low salinity habitat?*

Changing the location of the LSZ through increasing Delta outflows without an understanding of the biological mechanisms supporting the need for changes is ill advised[7]. Recent history has shown that changing the location of the LSZ has failed to improve species abundances. If species abundances were to improve by such action, there would be no way to know <u>why</u> improvements were happening. If the biological mechanism were related to the effects of nutrients and ratios on the food web, as the

[7] For example, Sommer et al. (2007) showed that floodplain inundation was the plausible mechanism behind the correlation of Sacramento splittail with X2. This example illustrates that different management actions result from understanding the mechanisms driving population abundance, in this case, increase floodplain habitat for Sacramento splittail rather than attempt to control a specific location of the LSZ.

available science supports, then regulating even more water to Delta outflow would be unnecessary and a waste of a valuable resource.

Historical data on inter- or intra-annual frequency of flow variability has been poorly studied to-date, as are linkages between variability and fish abundances. Moyle et al. (2010) describes historical salinity variability in the Bay-Delta largely based on conjectures and presumptions. Enright and Culberson (2010) specifically examined the widely held conceptual model that water project reservoir and Delta export operations reduce seasonal and annual outflow variability. They reported that the water projects exert far less influence on variability than climate. These results cast scientific doubt on the need to increase salinity variability by further manipulating the location of the LSZ.

- *Are methods available for more systematically addressing ecological or biological connections between springtime X2 and subsequent fall X2 conditions? If so, what are they and what are their strengths and weaknesses?*

The question presupposes that fall X2 is a valid scientific finding. For at least four reasons, the available science does not support the hypothesis that fall X2 is a determinant in subsequent delta smelt abundance, each of which is discussed below.

a. *The abiotic characteristics used to define "habitat" in Feyrer et al. (2007, 2010) represents far too narrow a definition.*

The definition of "habitat" in Feyrer et al. (2007, 2010) is "environmental quality" (EQ) as used in Rose (2000). Rose (2000) defined EQ as the suite of abiotic variables that either exert a direct effect on individuals of a population of interest, or cause an indirect effect via directly affecting the population's competitors, predators, or prey. Abiotic variables considered by Rose (2000) include water temperature, water velocity, water depth, contaminants, substrate type and size, and dissolved oxygen concentrations, all of which can influence the many processes affecting the growth, mortality, and reproductive rates of individuals.

Several readily available sources define "habitat" as:

> The place where an organism or a biological population normally lives or occurs. The location or environment where an organism (or a thing) is most likely to be found. The home to a particular organism where the species will attempt to be as adaptive as possible to that particular environment. The place being occupied by an organism, population, or community. (http://www.biology-online.org/dictionary/Habitat).

> The place or environment where a plant or animal naturally or normally lives and grows. The typical place of residence of a person or a group. A housing for a controlled physical environment in which people can live under surrounding inhospitable conditions (as under the sea). The place where something is commonly found. (http://www.merriam-webster.com/dictionary/habitat).
>
> A place where a plant or animal can get the food, water, shelter and space it needs to live. (https://www.uwsp.edu/natres/nres743/Definitions/Habitat.htm).
>
> Habitat for fish is a place—or for migratory fishes, a set of places—in which a fish, a fish population or a fish assemblage can find the physical and chemical features needed for life, such as suitable water quality, migration routes, spawning grounds, feeding sites, resting sites, and shelter from enemies and adverse weather. Although food, predators, and competitors are not habitat, proper places in which to seek food, escape predators, and contend with competitors are part of habitat, and a suitable ecosystem for fish includes habitat for these other organisms, as well" (Orth and White 1993).
>
> Habitat is simply the place where an organism lives.... Physical, chemical and biological variables (the environment) define the place where an organism lives. Niche, a closely related term defines the way a species adjusts to other related species in this space." (Hudson et al. 1992).

The habitat of a species therefore includes the "place" or geographic areas it occupies and the resources it uses. Those resources include both physical or abiotic and biological or biotic resources; combined, they provide the environmental elements necessary for the survival, reproduction, and persistence of an organism.

"Habitat" is a species-specific concept; no two organisms exhibit identical habitat requirements because no two organisms use identical resources and or require the same environmental conditions. While aquatic zones, like the Bay-Delta's LSZ with its unique physical conditions, are often referred to as habitats, they are not. They do, however, provide some or most of the essential resources that are necessary to support specific fish species and the habitat requirements of those same species may be met in part or in total in those waters with their distinctive characteristics.

Habitat for each Bay-Delta fish species is more appropriately defined as the geographic location that the species occupies, the portions of the water column in which it resides, the substrates that it uses and is otherwise associated with, and the biotic and abiotic resources and resource conditions that it requires or can tolerate.

The subset of EQ variables used by Feyrer et al. (2007) – salinity, clarity, and temperature – is too narrow to be useful in the context of the many definitions of "habitat" mentioned previously, which include both biotic and abiotic characteristics, or even of the definition of EQ as used by Rose (2000). Feyrer et al. (2007) acknowledged that their analysis could be improved by adding additional biotic characteristics, such as predation, competition, and food availability (p. 732). Feyrer et al. (2007) even acknowledged that their study could be improved by incorporating data on predation, competition, and food availability and noted that earlier studies suggest that food availability plays an important role in delta smelt abundance. Yet Feyrer et al. (2007) and the more recent Feyrer et al. (2010) both failed to do so.

b. <u>*Biological concerns with fall X2*</u>

Kimmerer et al. (2009) postulated that suitable habitat area expands when the location of spring X2 is more seaward. Theoretically, increased suitable habitat area should yield more fish; however, Kimmerer et al. (2009) found that the physical quantity of spring habitat is related to abundance for only a few estuarine fish, notably northern anchovy, which have abandoned the estuary (Kimmerer 2006).

Interestingly, the causal mechanisms between the location of X2 and fish abundances are largely not understood. This is testament to the scientific uncertainty of the spring X2 flow standard embodied in the Water Quality Control Plan for the Bay-Delta Estuary. Baxter et al. (2008, 2010) and the U.S. Fish and Wildlife Service's ("USFWS") biological opinion on delta smelt (USFWS 2008) identify numerous contributing factors to fishery declines. These include contaminants, predation, food availability and co-occurrence, water clarity, grazing by the Amur River clam *C. murensis*, shifts in nutrient concentrations, invasive species, U.S. Army Corps of Engineers permitting activities that have resulted in simplifying stream and riparian habitat, upstream water temperatures, unscreened in-Delta diversions, ocean conditions, water project operations including entrainment, and many other potential stressors.

The location of the 2 psu salinity isohaline is frequently used to identify the geographic position of the LSZ in the estuary (Jassby et al. 1995; Kimmerer 2002, 2004; Bennett 2005; Baxter et al. 2008). Although it might seem logical to characterize the distribution of delta smelt by the position of X2 and the extent of delta smelt habitat as the region just upstream and downstream of X2 (roughly 0.5 – 6.0 psu), that interpretation is incorrect. Substantial percentages of delta smelt live outside the low salinity zone; more than half are found in the Sacramento Ship Channel and Cache Slough regions, well away from the influence of X2. Therefore, X2 is not an appropriate surrogate for delta smelt habitat, nor is it a reliable predictor of delta smelt distribution or abundance. In a review of the delta smelt biological opinion's reasonable and prudent alternatives, a National Research Council committee (2010) made three important points regarding fall X2 and habitat:

(1) The controversy about the [fall X2] action arises from the poor and sometimes confounding relationship between indirect measures of delta smelt populations (indices) and X2. The weak statistical relationship between the location of X2 and the size of smelt populations makes the justification for this action difficult to understand.

(2) Although the position of X2 is correlated with the distribution of salinity and turbidity regimes (Feyrer et al. 2007), the relationship of that distribution and smelt abundance indices is unclear.

(3) The relationships between environmental variables to habitat and habitat to X2 are correlative with substantial variance being left unexplained at each step.

Feyrer et al. (2007) used a generalized linear additive model to determine the effect of fall X2 on delta smelt abundance. The standard practice in fisheries management is to use a multiplicative stock-recruit model, such as the Beverton-Holt or Ricker models, both of which are multiplicative models and are among the standard tools of the trade. (Bradford et al. 2010). A Peer Review Panel informed United States Fish and Wildlife Service of a basic analytical error in the 2008 biological opinion for continued operations of the CVP and SWP. That panel informed the United States Fish and Wildlife Service its analysis improperly incorporated the Feyrer et al. (2007) linear additive model. In developing that 2008 biological opinion, the United States Fish and Wildlife Service acknowledged that other types of models would better represent the data but then simply declined to consider them.

There are two fundamental problems with linear additive models that make them inappropriate for modeling fish populations. First, linear additive models can produce the biologically infeasible result that the total absence of adults in one year—no mature fish to mate and lay eggs—could still result in the presence of newborn fish the next year. This biologically nonsensical result is the product of the basic mathematical structure: if A (number of juveniles) = B (constant) + C (adults) – D (Fall X2), then A can be positive even if C is zero, as long as B is larger than D. The second fundamental problem with a linear additive model is that it treats X2 as a purely additive factor, which is to say that under the Feyrer et al. (2007) model an increase of X2 by one unit will always reduce the delta smelt population by a certain number, no matter how large or small the total population may be. This makes no biological sense. If we hypothetically imagine that increases in X2 position were somehow harmful to delta smelt, we would expect that an increase in X2 would affect a considerably higher absolute number of delta smelt in a population of 1,000,000 than in a population of 1,000 in the same distribution. A linear additive model, however, produces the unrealistic result that X2 will have the exact same effect on the exact same number of delta smelt regardless of the total size of the population.

Fundamental to the premise that fall X2 is a driver of delta smelt abundance is the assumption that delta smelt are habitat limited; however, the volume of habitat is currently not likely a limiting factor for delta smelt abundance (NRC 2010). Kimmerer et al. (2009) found that delta smelt abundance as measured in the Summer Townet Survey and X2 were not related and that delta smelt abundance appears to be regulated by as-yet unidentified factors other than X2. Jassby et al. (1995) failed to find a correlation between delta smelt abundance and spring X2. The Bay-Delta ANPR can draw from this that delta smelt abundance is not related to X2 position at any season of the year and that volume of available habitat is not a biological bottleneck. In fact, abundance levels as low as those in recent years should, and do, result in an excess of habitat relative to abundance; the carrying capacity of the available habitat is greater than the delta smelt population (Kimmerer 2008).

As shown by Feyrer et al. (2007) and in Figure 3 below, most sub-adult delta smelt occur at salinities less than 5,000 µS/cm EC, and almost all occur below 15,000 µS/cm EC. Data for this figure were derived from FMWT catch per unit effort data at each FMWT station compared to EC at each station. When comparing the volume of habitat with salinities less than the maximum values of 5,000, 10,000 and 15,000 µS/cm EC to the FMWT index of sub-adult abundance for the same year, it is clear that the recent low abundance of delta smelt has resulted in much more habitat per fish than in the past (Figure 4). Data for this figure was derived by summing water volumes of FMWT stations with average fall salinities less than the maximum specified.

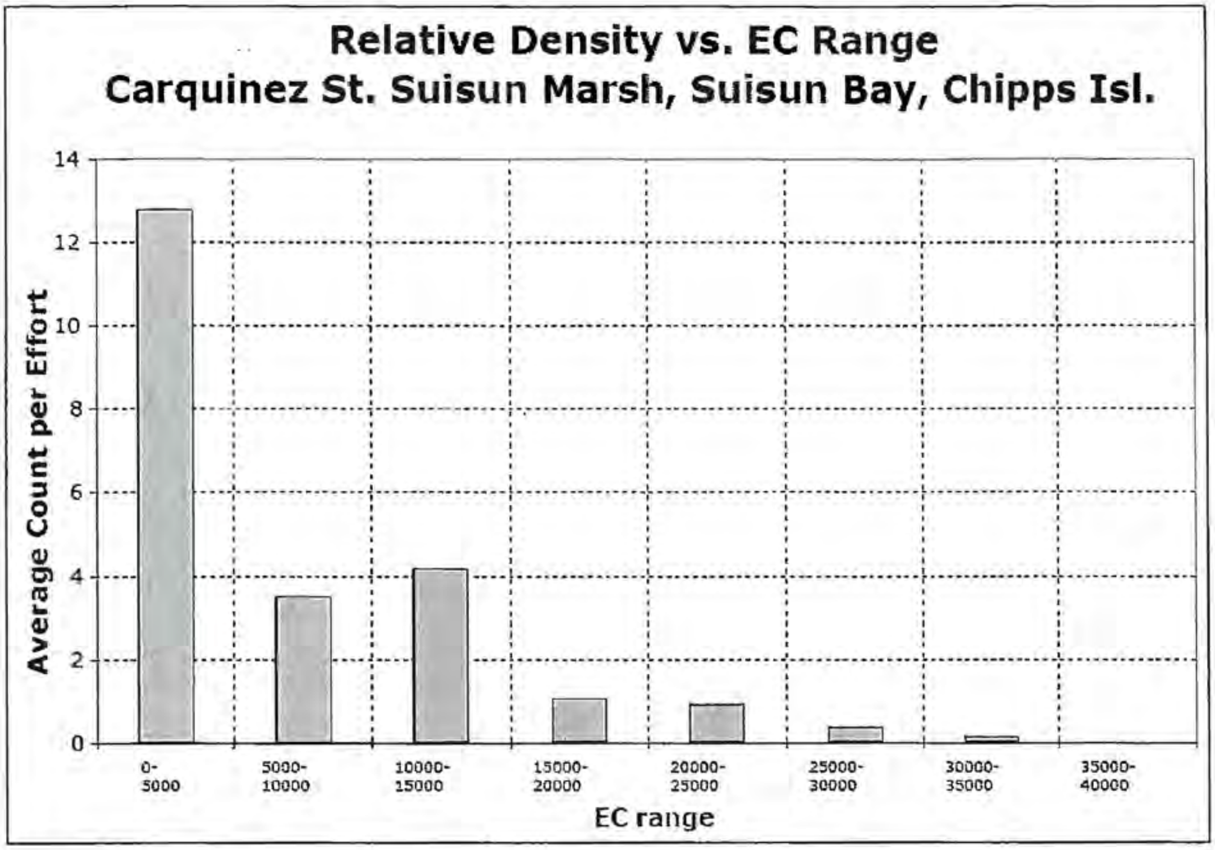

Figure 3. Relative density of delta smelt versus salinity at Carquinez Strait, Suisun Bay, and Chipps Island for 1987-2005. Data from FMWT.

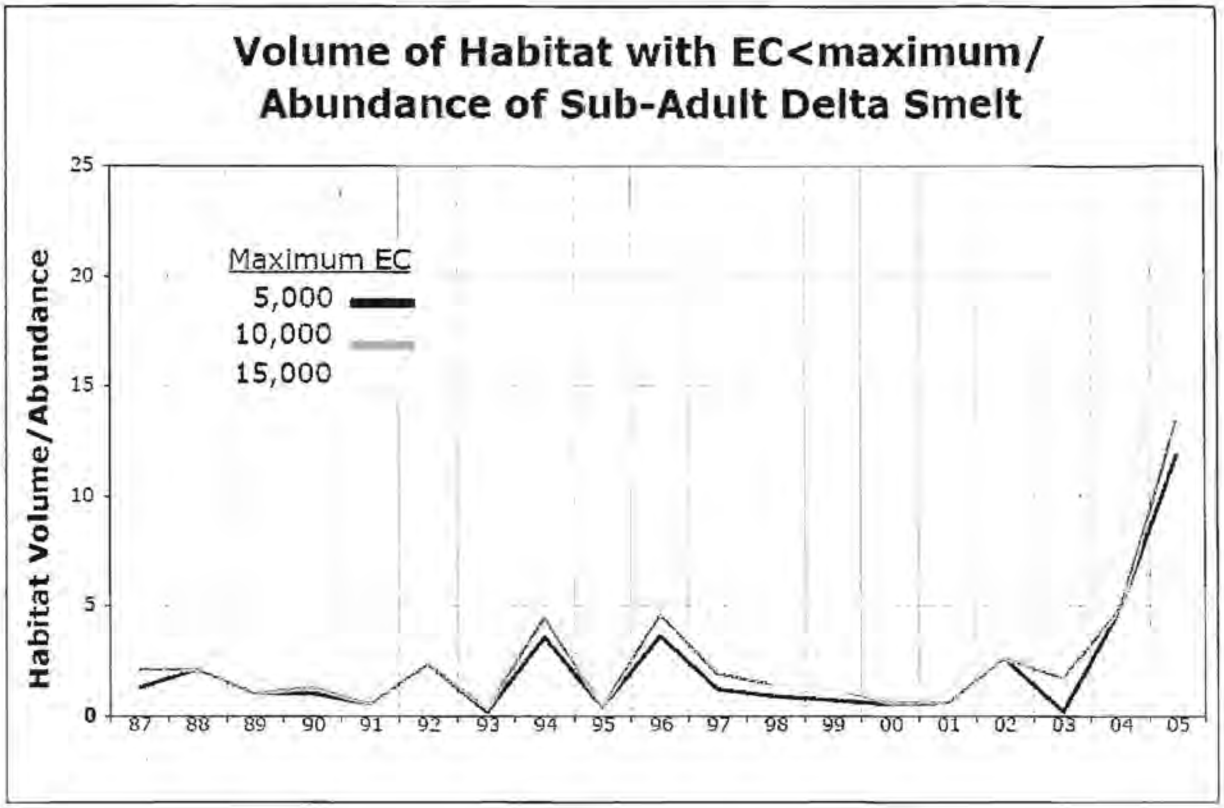

Figure 4. Total fall habitat volume with electrical conductivity less than a particular maximum value, relative to total abundance. Abundance data from FMWT; habitat volumes derived from Bay-Delta 1:40,000 navigation charts.

Feyrer et al. (2007) attributed changes in turbidity as measured by Secchi depth primarily to upstream dam construction and declines in sediment transport to the estuary from the Sacramento River. Wright and Schoellhamer (2004) have documented declines in sediment transport due to dam construction and washout of legacy sediments. Another major contributor to turbidity is phytoplankton. After the invasion of the Amur River clam *C. amurensis*, phytoplankton densities declined significantly in Suisun Bay, which understandably increased Secchi depth. By ignoring the effect of biological filtering by *C. amurensis* on Secchi depth, Feyrer et al. (2007) is unable to differentiate between Secchi depth changes caused by these two turbidity sources, one of which causes density independent effects and the other density dependent effects.

c. *Statistical concerns with fall X2*

Feyrer et al. (2007) found a correlation between fall X2 and delta smelt abundance by comparing historical X2 data and FMWT index from 1987-2007 with the results of the following year's Summer Townet Survey. In doing so, Feyrer et al. (2007)

ignored the fact that the data point for 1999 appears to be an extreme outlier. Simply removing this one year from the 21 years analyzed in the article causes the model to collapse: without the 1999 year, the relationship between X2 and delta smelt abundance becomes statistically insignificant at the 95% level of confidence. A peer review of the United States Fish and Wildlife Service analysis in the 2008 biological opinion for continued operation of the CVP and SWP suspected that "a few of the data points may have high influence on the outcome." (Rose et al. 2008).

That there was no statistically significant relationship between X2 and delta smelt abundance during the 1987-2007 period should not have been surprising given that Feyrer et al. (2007) found no statistically significant relationship between the two factors for the 1968-1986 period or for the entire 1968-2007 period. Nor was it surprising considering that – as the Feyrer et al. (2007) article conceded – the existing best available science on delta smelt showed no direct correlation between the location of X2 and delta smelt abundance: "Previous analyses have not shown simple relationships between X2 and delta smelt abundance."

As well, the residuals (difference between modeled and actual data points) are not normally distributed. Rose et al. (2008) noted this problem and suggested that some type of data transformation might be required (e.g., computing logarithmic values). Combined with the outlier problem mentioned above, Rose et al. (2008) suggested that the model used in Feyrer et al. (2007) was inappropriate for the data being used. Interestingly, a subsequent update of Feyrer et al. (2010) perpetuates the use of the same inappropriate linear additive model.

Also, the Water Agencies (2008) asked Dr. Bryan Manly to reexamine the statistical model used by Feyrer et al. (2007); Dr. Manly found that the fit of recent years' summer abundance is better if the fall X2 variable is omitted from the correlation. This also indicates that the previous fall X2 is unimportant to the recent decline in summer abundance.

The Feyrer et al. (2007) analysis found that its three abiotic variables explained only 25.7% of the variance in delta smelt abundance. While the correlations were statistically significant, approximately 75% of the variance is not explained. Based on this fact, a better question for the Bay-Delta ANPR to ask is: Is fall X2 a reliable predictor of delta smelt distribution and abundance?

Four analyses subsequent to Feyrer et al. (2007) analyzed numerous factors thought to affect abundance of POD species, many of which had 30+ years of data (MacNally et al. 2010; Thomson et al. 2010; Miller et al. submitted; Maunder and Deriso in review). MacNally et al. (2010) used multivariate autoregressive modeling to evaluate 54 relationships, including fall X2 and food supplies as expressed by total calanoid copepods. MacNally et al. (2010) did not find that fall X2 nor water clarity was a significant factor influencing the abundance of delta smelt (Feyrer and Newman co-authored MacNally et al. 2010). Thomson et al. (2010) used Bayesian change point analyses to evaluate 23 factors thought to affect abundance of POD species, many of which were the same as analyzed by MacNally et al. (2010). Thomson et al. (2010) likewise found that the location of X2 in the fall did not strongly affect any step declines in the abundance of delta smelt (Feyrer and Newman co-authored Thomson et al. 2010). Miller et al. (submitted) used multiple regression techniques formulated in a piece-wise hierarchy of effects to analyze 32 factors thought to directly affect the abundance of delta smelt in all its life stage. Miller et al. (submitted) found that fall X2 was not an important factor affecting delta smelt abundance, whether the 1999 data point was included or not, and found that food availability to be the most significant factor. Maunder and Deriso (in review) used a life cycle model to analyze various factors thought to affect delta smelt abundance, many of which were the same as analyzed by MacNally et al. (2010), Thomson et al. (2010), and Miller et al. (submitted). Maunder and Deriso (in review) likewise found that food availability was one of the most significant factors influencing delta smelt abundance while fall X2 was not found to be significant.

Here four separate analyses specifically looking for factors influencing the abundance of delta smelt (and other POD species in the case of MacNally et al. 2010 and Thomson et al. 2010) did not support the findings of Feyrer et al. (2007) on the importance of fall X2; Feyrer is listed as co-author on two of these analyses. The Water Agencies are left to wonder why the ANPR asks whether there are methods available to address the ecological or biological linkage of fall X2 when the corresponding author in Feyrer et al. (2007, 2010) has also co-authored two papers that did not find any significance of fall X2 to subsequent delta smelt abundance.

MacNally et al. (2010) did find a statistically significant relationship between fall X2 and striped bass; however, the authors admitted: "Our results, which identify trophic relationships, suggest the need to better understand the processes underlying the influence of abiotic conditions on the food web of the estuary." X2 could be masking the effects of the Amur River clam *C. amurensis* or contaminant effects on the food web. The conclusion of MacNally et al. (2010) that X2 seems to have a profound effect on the declining fish and their prey that might be managed via X2 cannot be experimentally demonstrated, given that other stressors in the Bay-Delta exert such a strong influence on both food web organism abundance and structure.

d. <u>*Methodological concerns with fall X2*</u>

Once much more widespread, more than half of adult and larval-juvenile delta smelt can now be found in the man-made portions of the Sacramento Ship Channel and the Cache Slough region (including an additional, as-yet unknown percentage of the population in Liberty Island). FMWT sampling in these regions was not begun until after Feyrer et al. (2007) was published. Based on densities of delta smelt from more recent surveys and volumes of water in these sub-regions of the Delta, the relative abundance and, therefore, the distribution of delta smelt can be estimated. These estimates indicate that a substantial portion of the adult and larval-juvenile delta smelt, in some years more than half, reside in the Cache Slough and Sacramento Ship Channel areas. Most of the remaining adults are found in the lower Sacramento River and Suisun Marsh. There is also now apparently a resident population of delta smelt in Liberty Island, which was flooded in 1998 (Sommer et al. 2009).

Bennett (2011) recently reported on preliminary results of a study in progress examining the effect of tidal stage and sampling location on delta smelt catches and found that delta smelt were captured in large numbers during the incoming tide, but not the ebb tide, in channel shoals even when midwater trawls caught few or none. Implications of this finding are far-reaching – any FMWT sampling done during the ebb tide could significantly under-report delta smelt abundance by looking in the wrong place at the wrong time.

Feyrer et al. (2010) updated the relationships of Feyrer et al. (2007) by adding data for the years 2005 and 2006; however, FMWT sampling in the Cache Slough region and the Sacramento Ship Channel did not begin until 2009. Therefore, Feyrer et al. (2010) still fails to consider the full range of available data and has not adjusted for location and time of day, as indicated by Bennett (2011).

Feyrer et al. (2007, 2010) both separate the years of analysis into pre- and post-Amur River clam *C. amurensis* periods, ostensibly to examine the role of suitable abiotic habitat area during periods of high and low food abundance in the estuary. This introduces a methodological difficulty in that the salinity, clarity, and temperature of the water do not have the same biological effect on delta smelt and its prey. Water clarity is widely thought to negatively affect delta smelt abundance (Baskerville-Bridges et al. 2004; Mager et al. 2004; Bennett 2005; Feyrer et al. 2007, 2010; Grimaldo et al. 2009) while negatively affecting phytoplankton abundance (Koseff et al. 1993; Jassby et al. 2002, 2003; Dugdale et al. 2007; Jones et al. 2009). Likewise, temperature and salinity tolerances for delta smelt and phytoplankton are vastly different.

These differences in biological response of food web organisms and delta smelt to Feyrer et al.'s abiotic characteristics cast doubt on the analytical efficacy of separating the years of analysis. The scientific literature abounds with manuscripts describing the effect of the Amur River clam *C. amurensis* on the Bay-Delta's food web post-1987 – the abundance of food web organisms, and the estuary's carrying capacity, was significantly reduced (*see* e.g., Kimmerer 2005; Jassby 2008; Grimaldo et al. 2009; Winder and Jassby 2010). Feyrer et al. (2007) admits that habitat constrictions, combined with an altered food web, may affect the health and survival of delta smelt (p. 732). In fact, the Bay-Delta's altered food web post-*C. amurensis*, by itself, explains most of the declines in delta smelt abundance (*see* e.g., Kimmerer 2005; Jassby 2008; Grimaldo et al. 2009; Winder and Jassby 2010). Therefore, it is quite possible that

Feyrer et al.'s analysis of the three abiotic characteristics' effect on delta smelt are conflated with the effect of the Amur River clam *C. amurensis* on the food web.

e. <u>*Conclusions regarding fall X2*</u>

Experiments that attempt to move location of fall X2 are unlikely to be effective at increasing delta smelt abundance. Feyrer et al. (2007, 2010) are both methodologically, biologically, and statistically flawed. Current trawls are largely missing delta smelt because they do not sample shoals and shallows during flood tides. Previous analyses done using historical trawl data cannot be considered conclusive.

- *What information is available on the effects of salinity management on terrestrial plant communities and/or tidal marsh endemic species? What indirect effect does this have on aquatic communities?*

The goal of tidal marsh restoration projects is to bring back the natural variability in the system. Marsh restoration projects affect the plant form of the Delta by changing salinity gradients, tidal excursions and by changing the tidal range. Native plant communities evolved in a dynamic ecosystem where there was greater fluctuation in the location of the salinity zone. The natural communities that we should be striving to restore need variability and are impaired by a management scheme where the location of X2 is stagnant.

- *Does the geographic location of low-salinity habitat have an effect on the quality of the habitat or its availability to species of concern? If so, what is the nature and extent of such effect? Is the distribution pattern of low salinity habitat important in determining its quality?*

Since the publication of Jassby et al. (1995), which proposed flows that placed the two parts per thousand near-bottom salinity in certain positions within the Sacramento-San Joaquin estuary might serve as a "habitat" indicator for myriad species, agency scientists and policymakers have used such flows as a surrogate to guide management of at-risk species and to allocate river flows (Jassby et al. 1995; Feyrer et al. 2007; USFWS 2008; Nobriga et al. 2008).

The assumption that X2 flows are a reliable habitat indicator for the imperiled delta smelt and other estuarine species is difficult for at least two reasons. First, it does not account for the fact that each species that resides in the Bay-Delta has its own unique habitat, which is defined as the geographic area that supports a suite of physical and biotic resources upon which the species depends for its survival and reproduction (see discussion above under Section III.B.1, question 3). While aquatic zones with unique physical conditions, like the brackish waters of estuaries, are often referred to as "habitats," they are not; they are resource areas where some or many of the essential resources necessary to support an individual species, either in part or in total. Few, if any, species have all of their resource needs met in an "ecosystem" that is defined by one or a narrow suite of ecological parameters. Fewer species occupy the full extent of a narrowly defined ecosystem or are wholly limited in their distribution to such an ecosystem. The concept of habitat as defined by one or a few parameters is not synonymous with that of an ecosystem. In light of the foregoing, the hypothesis that one physical environmental factor can, by itself, constitute a reliable surrogate for the habitat that supports a species or species with multiple resources needs and varied life histories is not supportable.

Second, the use of X2 in resource management planning as a surrogate habitat indicator is scientifically problematic, unless it has been validated that X2 correlates well in its spatial and temporal distribution with the suite of physical and biological resources required by the targeted species. Habitat frequently includes areas that are suitable for a given species but may not be occupied at a given time because the presence or abundance of the species inevitably varies dynamically during its life history and in response to habitat conditions or quality. Habitat quality is often inferred from the density of the targeted species, with areas supporting higher densities usually considered to be higher in habitat quality; however habitat quality should be inferred from data on fitness – the highest quality habitats are those that contribute to population persistence by maximizing species survival over mortality through time. The best habitat areas support stable or growing populations, not necessarily the highest densities of individuals at any given time. Because of the frequent discordance between habitat conditions and population density in an area of habitat, care must be taken when drawing conclusions regarding the resources and resource conditions that are necessary to assure the persistence of any target species.

The conservation biology literature is replete with warnings about relying on unvalidated surrogates when making resource management decisions (Landres 1988; Andelman and Fagan 2000; Caro et al. 2005). To perform as an indicator of habitat for delta smelt, X2 must be shown to co-occur with the distribution of delta smelt and the essential resources used by the species, and variation in spatial and temporal attributes of X2 must be related explicitly to the demographic status of the species in measures that are linked to fitness. To date, such a validation process has not been carried out even though it is asserted that the location of X2 in the Bay-Delta is important to the survival and recovery of the delta smelt.

- *Are spring/neap differences in tidal water quality important for aquatic species? If so, how should these habitat characteristics be evaluated?*

Drs. Bill Bennett and Jon Burau have been investigating physical processes, in particular the effect of tides and turbidity; influencing spawning migrations of delta smelt. Beach seines and Kodiak trawls were timed with tides, with hourly surveys performed.

Near Decker Island many delta smelt were consistently caught in the open during flood tides. During ebb tides, delta smelt were caught in the shallows even when midwater trawling caught few or no delta smelt. This suggests the fish are out in the open during flood tides but go to the shallows during ebb tides, possibly to get out of the current. To-date, the data shows that delta smelt surf with the tides and make pinpoint decisions on where to go, either using flows to stay in place or to leap-frog into or out of the Delta.

Initial results of the Bennett/Burau study also indicates that turbidity plays a significant role in spawning movement of delta smelt. Flooded islands in the Bay-Delta act as sources and sinks of turbidity. Franks Tract appears to mute turbidity until high winds re-suspend particulates. Turbidity events tightly track with wind events.

Besides wind, precipitation is known to influence turbidity by erosion. Phytoplankton density also influences turbidity. Various sub-regions of the Bay-Delta likely have different primary turbidity sources. Additional study is needed to determine the historical and current primary causes of turbidity in the various sub-regions of the Bay-Delta. Without an understanding of the causes of turbidity on a sub-regional basis it will difficult to assess, on a species-by-species basis, the importance of tidal water quality as measured by turbidity.

- <u>Fish Migration Corridors</u>

A role of physical or chemical constituent gradients for a San Joaquin Basin migratory salmon corridor is not supported with the information provided in the Bay-Delta ANPR. The US EPA author cited to Mesick 2001 who first, re-analyzed data collected and reported by Hallock (1970), and second performed his own analysis of coded wire tagged (CWT) San Joaquin Basin origin hatchery Chinook returning as adults to the San Joaquin and Sacramento rivers and hatcheries.

The Hallock (1970) study is not applicable to the evaluation of a physical or chemical gradient needed to improve San Joaquin Basin origin adult Chinook homing behavior to the San Joaquin River. The adult Chinook tagged by Hallock were of unknown origin. They were most likely fall run from the Central Valley, based on timing, but could have originated from anywhere in the Central Valley system. The appropriate use for the Hallock study might be an evaluation of the effect of San Joaquin River flow on upstream migration speed and/or timing, but not specific to San Joaquin Basin origin Chinook.

The CWT recovery analysis by Mesick (2001) would be the preferred style of analysis to evaluate the effect of a physical or chemical gradient to improve homing behavior of San Joaquin Basin origin adult Chinook to the San Joaquin Basin. The limitations of such an analysis were described by Mesick in the report. Inspection for CWTs in the returning adult Chinook in both the rivers and hatcheries was inconsistent and non-systematic throughout the years. Table 2 in the Mesick report is a list of the adult recovery effort by year. Many years are missing either in the rivers or at the hatcheries. Mesick made his best effort to piece the information together, but cautioned:

> The coded-wire-tag (CWT) recovery data may not have been appropriate for a straying analysis because there are no clear records of the number of fish examined for tags during the carcass surveys. Not all fish counted for the carcass survey were examined for tags. These recovery data are necessary to accurately compute the total number of adult salmon with tags in each river. (Mesick 2001).

According to Mesick:

> A casual inspection of the CWT recovery data suggests that: (1) straying rates increased as the percentage of San Joaquin flow exported by the CVP and SWP pumping facilities increased..", but later Mesick cautioned "Rather than trying to determine the exact nature of the relationship based on existing data the uncertainty regarding the true number of fish examined for tags should be resolved first. (Mesick 2001).

III. Miscellaneous Comments

P. 2. Figure A shows the State Water Project and Central Valley Project, but does not show any of the other aqueducts that also divert from the Bay-Delta watershed, such as the Mokelumne Aqueduct. These should be shown as well.

P. 6. Figure B is unclear on which run of salmon is graphed.

P. 6. Sensitivity of salmon to poor ocean conditions is not influenced by declines in freshwater and estuarine conditions. These may affect the number of salmon reaching the ocean, but does nothing to make them more or less sensitive to poor ocean conditions.

P.9. This page indicates, without a reference, that "after 2001 approximately 6 million acre-feet (MAF) of new water storage space became available south of the Delta." In fact, the last major storage facility south of the Delta to be added south of the Delta is Diamond Valley Reservoir, with 810,000 acre-feet of storage. Diamond Valley became operational in 1999. There has been no additional storage space added since that time.

The Bay-Delta ANPR also indicates on page 9 that CVP and SWP pumping resulted in a decline in the volume of estuarine habitat. The reference cited (Feyrer 2007) actually states that the change in habitat appears to be the result of CVP and SWP operations, either a change in upstream operations or more pumping from the south Delta. Additionally, Feyrer et al. (2007) does not address the post 2001 period, focusing on the period prior to and following 1987. A summary of unimpaired inflows to the Central Valley for September-November is provided below (Figure 5). This figure shows that flows for the period prior to 1987 that was being compared by Feyrer et al. were considerably higher than the long term average – over 800 cfs, or about 150,000 acre-feet.

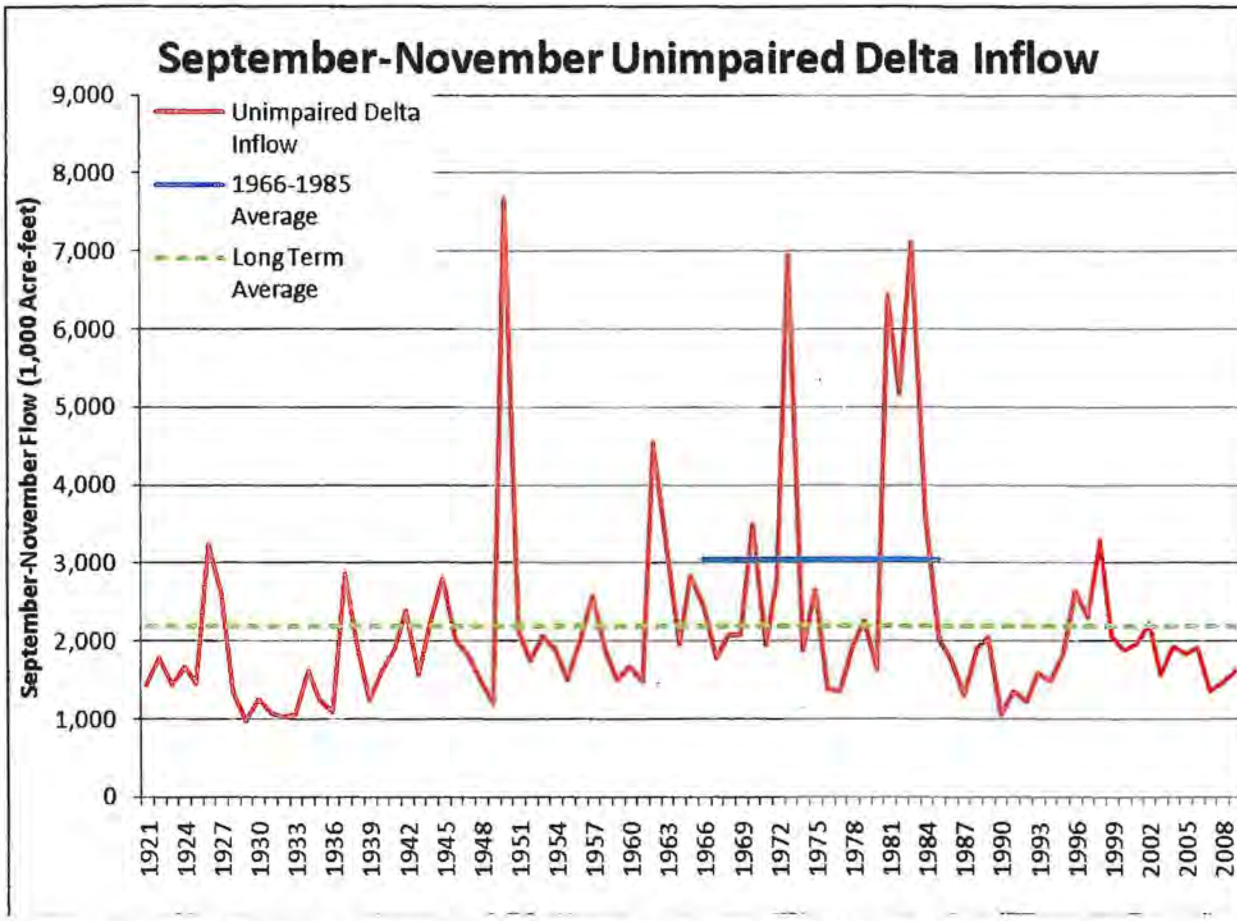

Figure 5. Summary of unimpaired inflows to the Central Valley for September-November.

P. 9. It is stated that upstream and migratory conditions made the Chinook salmon population less resilient to oceanic stressors. This is simply not true. If migratory conditions include the effects of predation on smolts, then the Water Agencies are in agreement, since ~98% of the smolts are eaten during their outmigration. A report on the decline in Chinook salmon returns in 2005-2006 found that smolts entering the ocean were not deficient in health; they starved to death while in the ocean.

P. 9. The statement "Ocean conditions alone appear to have little effect on the declining resident Delta fishes" is not supported by endnote 40 (Cloern et al. 2010).

Cloern et al. states that the data available for estuarine species is too short to make valid comparisons with large-scale climate patterns such as the PDO or NPGO.

P. 39. The Bay-Delta ANPR states: "it is unclear whether pelagic fish populations have declined due to food limitation." We disagree with this assessment and believe the evidence is clear that food limitation has been shown to be one of, if not the proximate, cause of the decline in fish populations. For example, there is evidence that Delta smelt are food-limited based on analyses of their liver glycogen levels (Bennett *et al.,* 2008). Longfin smelt also show evidence of food limitation (Rosenfield and Baxter 2007; CDFG 2009). Additional information to support the finding for delta smelt is currently in review and will be forwarded to US EPA once it is accepted for publication (Maunder and Deriso, in review; and Miller et al., submitted).

IV. <u>Additional Considerations</u>

The scope of actions identified in the Bay-Delta ANPR, particularly those aspects that could result in rulemaking that impacts the flow of water, if pursued, could require the US EPA to perform comprehensive analyses and reporting, prior to adopting any final rule. Among the federal guidelines:

- *Adherence To Standard Scientific Process And Use Of Best Available Science*

Through the Bay-Delta ANPR, US EPA is clearly seeking to identify areas where it can assist in addressing the crisis facing the Bay-Delta. However, that effort will only succeed if US EPA approaches rulemaking using standard scientific process and the best available science. US EPA must also adhere to the Data Quality Act. Pub. L. No. 106-554, § 515 Appendix C, 114 Stat. 2763A-153 (2000). As a result, US EPA will need to identify all available and relevant scientific information and evaluate its soundness, applicability or utilities, clarity and completeness, and uncertainty or variability. US EPA's decision making process will also need to be inclusive, objective, transparent and open. The Bay-Delta ANPR falls short of doing that. The comments presented herein demonstrate some of the Bay-Delta ANPR's shortcomings. The Authority and SWC are hopeful that, as the US EPA moves through its rulemaking, it will seek all available, relevant information and ensure it is presented in a manner more objective and more balanced than that presented in the Bay-Delta ANPR.

- *Comprehensive Economic Impact Analysis*

When a federal agency proposes "significant regulatory action" it must first prepare a comprehensive impact analysis prior to adopting any such rule. Exec. Order No. 12866f. Executive Order 12866 mandates that federal agencies only promulgate "such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling public need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being of the American people." Exec. Order No. 12866. Significant regulatory action includes actions that may have an annual effect on the economy of $100 million, may adversely affect in a material way the economy or a sector of the economy, or may raise novel legal or policy issues arising out of legal mandates. Exec. Order No. 12866f.

- *Federalism Summary Impact Statement*

Executive Order 13132 directs federal agencies formulating and implementing policies that have federalism implications, to be guided by "fundamental federalism principles." Exec. Order No. 13132, Sec. 2. One such example of fundamental federalism principles is that: "[p]olicies of the national government should recognize the responsibility of--and should encourage opportunities for--individuals, families, neighborhoods, local governments, and private associations to achieve their personal, social, and economic objectives through cooperative effort." Exec. Order No. 13132, Sec. 2(g). Order 13132 also requires federal agencies to be "deferential to the States when taking action that affects the policymaking discretion of the States and should act only with the greatest caution where State or local governments have identified uncertainties regarding the constitutional or statutory authority of the national government." *Id.* at Sec.2(i). That is why Order 13132 requires that "to the extent practicable and permitted by law, no agency shall promulgate any regulation that has federalism implications, that imposes substantial direct compliance costs on State and local governments, and that is not required by statute. . ." Exec. Order No. 13132, Sec. 6(b).

- *Regulatory Flexibility Analysis*

For decades it has been the policy of the federal government to balance the social goals of federal regulations with the needs and capabilities of small businesses and other small entities in American society. *See* 5 U.S.C. 601 *et seq.* the Regulatory Flexibility Act ("RFA"). The RFA mandates that the small business sector play an important role in the development of a regulatory environment that is more conducive to starting and growing small businesses. *Id.* To ensure this goal, federal agencies are required to prepare an economic impact analysis when a proposed regulatory action is shown to have potential impacts to small businesses. 5 U.S.C. § 603.

- *Takings Analysis*

Executive Order 12630 stresses the importance of property rights as enshrined by the Fifth Amendment to the Constitution. Exec. Order No. 12630 Section 1. Order 12630 makes clear that "responsible fiscal management and fundamental principles of good government require that government decision-makers evaluate carefully the effect of their administrative, regulatory, and legislative actions on constitutionally protected property rights." *Id.*

- *Statement of Energy Effects*

Recognizing the tremendous burden regulatory action can have on energy supplies, Executive Order 13211 requires agencies to "prepare a Statement of Energy Effects" when undertaking certain agency regulations that impact the supply, distribution, and use of energy. Exec. Order No. 13211 Sec. 1.

- *NEPA Compliance*

The National Environmental Protection Act ("NEPA") sets forth the procedures by which federal agencies must consider the environmental impacts of their decisions. (*Vermont Yankee Nuclear Power Corp. v. NRDC* (1978) 435 US 519.) The central product of the NEPA process is an Environmental Assessment ("EA") or an Environment Impact Report ("EIS"). An EIS is required for major federal actions that have significant environmental effects.

V. Conclusion

Thank you in advance for your consideration of these comments, analyses, and data. The Authority and the SWC look forward to continuing to work with US EPA and other regulatory agencies and stakeholders in the ongoing, collaborative efforts to protect water quality within the Bay-Delta.

Daniel Nelson, Executive Director
San Luis & Delta Mendota Water Authority

Terry Erlewine, General Manager
State Water Contractors

Attachment 1

San Luis & Delta-Mendota Water Authority Member Agencies

Banta-Carbona Irrigation District; Broadview Water District; Byron-Bethany Irrigation District; Central California Irrigation District; Centinella Water District; City of Tracy; Del Puerto Water District; Eagle Field Water District; Firebaugh Canal Water District; Fresno Slough Water District; Grassland Water District; James Irrigation District; Laguna Water District; Mercy Springs Water District; Oro Loma Water District; Pacheco Water District; Pajaro Valley Water Management Agency; Panoche Water District; Patterson Water District; Pleasant Valley Water District; Reclamation District 1606; San Benito County Water District; San Luis Water District; Santa Clara Valley Water District; Tranquillity Irrigation District; Turner Island Water District; West Side Irrigation District; West Stanislaus Irrigation District; Westlands Water District; and Widren Water District. Columbia Canal Company receives water delivered by the Authority and participates in the Authority under a non-member Friend status.

State Water Contractor Member Agencies

Alameda County Flood Control and Water Conservation District Zone 7, Alameda County Water District, Antelope Valley-East Kern Water Agency, Casitas Municipal Water District, Castaic Lake Water Agency, Central Coast Water Authority, City of Yuba City, Coachella Valley Water District, County of Kings, Crestline-Lake Arrowhead Water Agency, Desert Water Agency, Dudley Ridge Water District, Empire-West Side Irrigation District, Kern County Water Agency, Littlerock Creek Irrigation District, Metropolitan Water District of Southern California, Mojave Water Agency, Napa County Flood Control and Water Conservation District, Oak Flat Water District, Palmdale Water District, San Bernardino Valley Municipal Water District, San Gabriel Valley Municipal Water District, San Gorgonio Pass Water Agency, San Luis Obispo County Flood Control and Water Conservation District, Santa Clara Valley Water District, Solano County Water Agency, Tulare Lake Basin Water Storage District.

Attachment 2

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