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March 2, 2007

Ms. Gita Kapahi, Chief
Bay Delta/Special Projects Unit
State Water Resources Control Board
P.O. Box 2000
Sacramento, CA 95812-2000

Subject: Initial Comments on the Consideration of the Pelagic Organism Decline in the San Francisco Bay / Sacramento-San Joaquin Delta Estuary

Dear Ms. Kapahi:

Contra Costa Water District (CCWD) applauds the State Water Resources Control Board (State Board) for convening a workshop on the pelagic organism decline (POD) in the San Francisco Bay / Sacramento-San Joaquin Delta Estuary, an important and timely subject. Actions taken in connection with the POD have potential effects on long term management of the Delta, on water rights and water quality, and on future biological opinions.

CCWD appreciates this opportunity to provide relevant information for the State Board's consideration. Our intent is to ensure that the State Board broadly considers all significant factors of the POD decline which extend beyond the direct take associated with diversions in the south Delta. Our comments summarize the new understanding taking form from the emerging POD studies, present evidence of the detrimental impact of increased fall salinity on delta smelt, and suggest possible restoration measures that recognize recovery of pelagic species will require a multifaceted approach.

Best available science emphasizes many factors in decline

The scientific basis for explaining the decline of Delta fisheries is active and still evolving. Previous theories that exclusively implicated the export facilities as the primary or sole factor responsible for declining fisheries are no longer being accepted as new science reveals more complicated interactions in the Delta ecosystem. The most recently publicized work downgrades the significance of the role of the export facilities, and emphasizes additional factors.

The Bay Institute's February 7, 2007 petition[1] to the California Department of Fish and Game (DFG) to list delta smelt as endangered, which draws upon work done by U.C. Davis and other work, including CCWD's efforts, underscores the importance of water quality and the need for more fresh water in addition to reductions in entrainment by pumps in the south and western Delta. Further, the widely publicized Public Policy Institute of California's document "*Envisioning Futures for the Sacramento-San Joaquin Delta*" further dispels the old theory that export pumps are the biggest cause. Taking a current synthesis of the science, the report concludes that "the big pumps in the southern Delta are one of several causes for fish declines". Other factors discussed in the report include invasive species, entrainment of fish at the power plants, oceanic conditions, fish hatcheries, chronic toxicants, and the recognition that management actions in one part of the estuary may affect other regions.

Relationship between fall salinity in the Delta and delta smelt decline

Higher fall salinity, lower number of delta smelt

Population indices for delta smelt are calculated from two surveys performed by the DFG. The fall midwater trawl survey (FMWT), conducted September to December, samples sub-adult and adult delta smelt available to reproduce, while the summer tow net survey (STN), conducted in June and July, measures the abundance of juveniles.

Analysis by CCWD shows that the abundance of juvenile delta smelt in summer is significantly correlated with the salinity in the western Delta during the previous fall (Figure 1), a finding that has been confirmed by initial peer review[2]. As salinity in the fall months increases, the abundance of delta smelt the following summer decreases (based on the STN index).

This relationship is strengthened further when the analysis is expanded to account for the number of adult delta smelt available to reproduce (as measured by the FMWT). A multiple regression analysis of fall salinity, FMWT, and STN for the following summer yields one of the strongest predictors for delta smelt abundance.[3]

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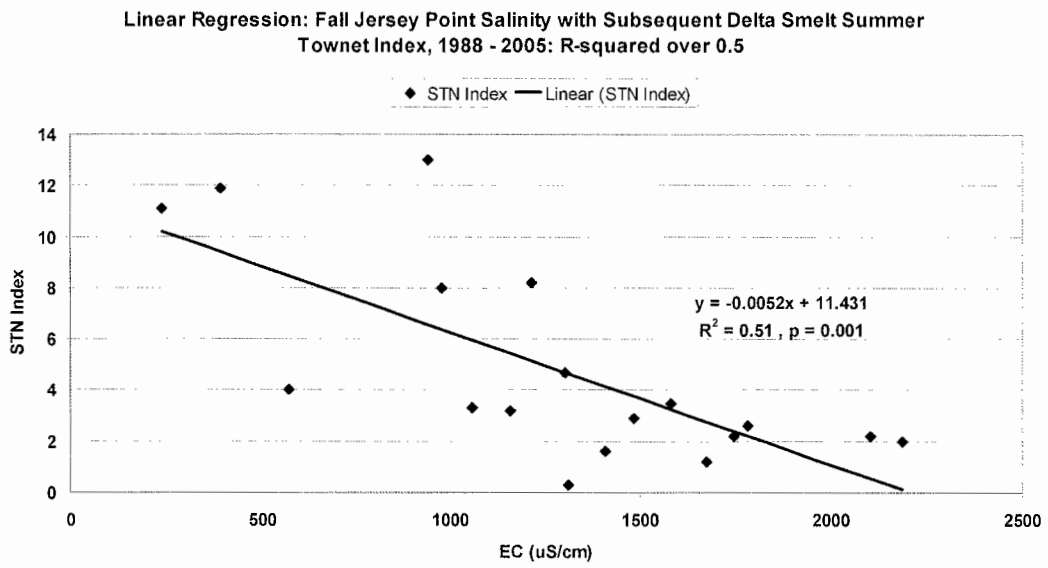
[1] The Bay Institute. 2007. Petition to the State of California Fish and Game Commission and supporting information for listing the delta smelt (*Hypomesus transpacificus*) as an endangered species under the California Endangered Species Act. Available online at: http://www.bay.org/delta.smelt.petition.pdf

[2] Manly, Bryan F. J. 2006. Review of Analyses Presented at the Environmental Water Account Meeting, December 7-8, 2005.

[3] The Bay Institute, 2007. Equation 3 ($p = 0.004$; $p<0.05$ is significant). Note that the Bay Institute petition uses the abbreviation "TNS" to refer to the summer tow net survey, while CCWD uses the more common "STN."

Figure 1 – Summer delta smelt abundance as a function of the western Delta salinity during the previous fall



Fall salinity has increased in recent years

With this relationship established, changes in fall salinity become critical to predict and understand trends in delta smelt populations. Salinity in the Delta varies naturally seasonally and annually, based on the amount of precipitation and runoff in the basin. As runoff increases, the freshwater flow of the Sacramento and San Joaquin Rivers is able to repel the ocean waters further west, resulting in lower salinity in the western Delta. However, the relationship between upstream runoff and downstream salinity is complicated by diversions and return flows, upstream storage operations, exports, and other factors.

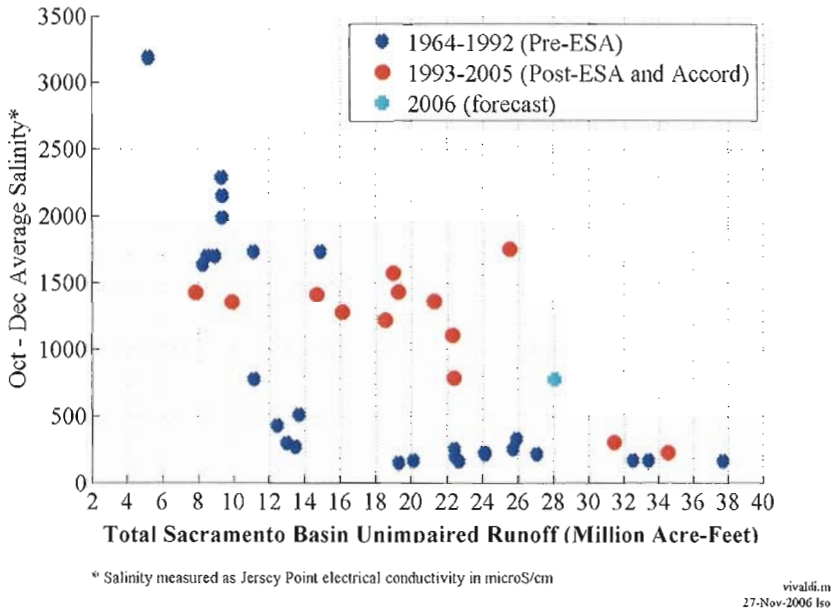
Despite the complexity of the system, a clear shift in the relationship between upstream runoff and downstream salinity occurred in the early 1990s. Fall salinity in the western Delta, represented by the October-December average electrical conductivity at Jersey Point, has increased in recent years for the same unimpaired runoff (Figure 2) as the Delta has been managed in large part reduce the "take" of anadromous species. The salinity data are plotted in Figure 2 as a function of the total annual unimpaired runoff from the Sacramento Valley so that the resulting Delta salinity can be examined without influence of project operations and upstream diversions and drainages.

In critical years, represented by the lower Sacramento runoff values, there is very limited water available for export in the fall and the relationship is consistent, independent of the historical period. Similarly, in very wet years, represented by the

highest runoff values, Delta outflows remain high in the fall and fall salinities follow the historical trend. However, in the intermediate years, the Delta is clearly saltier during the post-1993 period.

These findings are consistent with analysis of habitat decline in the fall during the POD years by the Department of Water Resources. The Department's research[4] found increased salinity to be the dominant factor reducing the suitable fall habitat for delta smelt and striped bass during the POD years.

Figure 2 – Fall western Delta salinity as a function of hydrology



Possible causal mechanisms

The relationship between increased fall salinity and decreased smelt abundance may be due to a combination of factors. The increased fall salinity has decreased the amount of habitat available to delta smelt by shifting the habitat range eastward into the lower San Joaquin River. This region is poor habitat due to substantial growth of invasive waterweeds (such as *egeria densa*) and increased pressure from predation. In addition, delta smelt may be subject to entrapment in Franks Tract by the same tidal trapping mechanism transporting salt into the central Delta. Once in the central Delta, delta smelt are more likely to be entrained at the export facilities in the southern Delta.

[4] Feyrer, F., Nobriga, M.L. and T.R. Sommer, Can. J. of Fisheries and Aquatic Science. *In Press.*

Additionally, the increase in fall salinity has improved the habitat for the introduced overbite clam, *Corbula*, (NIMPIS, 2002), [5] and allowed this exotic species to extend its range eastward into the Delta in the fall and winter. *Corbula* has tremendous capacity to filter food out of the water column, greatly reducing the food supply for Delta fish species (Feyer et al, 2003; Alpine and Cloern, 1992). [6] Delta smelt develop their reproductive organs in the fall (Bennett, 2005), [7] so decreases in food supply during this critical period in their life cycle could result in fewer delta smelt larvae the next spring. Studies indicate that delta smelt fecundity has indeed decreased in recent years (Bennett, 2005), although recent analyses of delta smelt stomach contents show that the majority have a supply of zooplankton available as food. [8]

Restoration Actions

Given the recent precipitous decline of pelagic species, many stakeholders are calling for action. Recognizing that numerous factors have contributed to the POD, CCWD believes that a multifaceted restoration strategy would be appropriate. Examples of approaches that CCWD believes should be implemented into such a strategy include:

- Franks Tract Project, which would improve water quality (lower salinity intrusion), help keep delta smelt out of the central Delta, and could decrease entrainment in the south Delta;
- Delta and Suisun Bay habitat restoration which improves food supply, rearing conditions, and other habitat benefits;
- Pilot screens at or near Clifton Court Forebay and Tracy Pumping Plant that connect to the export facilities. CCWD completed a 250 cfs pumping plant on Old River in 1997 for $22 M and has diverted about 900 TAF of water through this plant while entraining one (1) delta smelt larva and no salmon. Although much smaller than the export facilities, some scalability in performance and cost can be assumed. Such screens could immediately reduce the staggering losses of fish by predation in Clifton Court Forebay and through salvage operations.
- Use of Environmental Water Account (EWA) water to improve habitat conditions in the fall. During years where water costs would be minimal, EWA

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[5] NIMPIS (2002). *Potamocorbula amurensis* reproduction & life cycle. National Introduced Marine Pest Information System (Eds: Hewitt C.L., Martin R.B., Sliwa C., McEnnulty, F.R., Murphy, N.E., Jones T. & Cooper, S.). Web publication <http://crimp.marine.csiro.au/nimpis>, Date of access: 7/19/2006

[6] Feyer F., B. Herbold, S.A. Matern, P.B. Moyle. 2003. Dietary shifts in a stressed fish assemblage: Consequences of a bivalve invasion in the San Francisco Estuary. Environmental Biology of Fishes. Vol. 67: 277-288.

Alpine, A.E. and J.E. Cloern. 1992. Trophic interactions and direct physical effects control phytoplankton biomass and production in an estuary. Limnol. Oceanogr. Vol 37:No.5: 946-955.

[7] Bennett, W.A.. 2005. Critical assessment of the Delta smelt population in the San Francisco Estuary, California. San Francisco Estuary and Watershed Science. Vol. 3, Issue 2 (September 2005), Article 1.

[8] Interagency Ecological Program 2007 Annual Conference. Presentation by J. Budrick, Department of Fish and Game.

water could be used as an experimental measure to increase Delta outflow and lower salinity to determine the benefits of improved water quality on delta smelt populations.

These measures would improve water quality, reduce take of fish, or in some cases both. None would result in degraded water quality or increased salinity. Because water quality remains a key factor, all restoration actions, including a possible alternative conveyance facility around the Delta, must be evaluated for their impact on Delta water quality. Water quality impacts to be evaluated should include salinity from seawater intrusion, as well as the effects of discharges, turbidity and other factors that have been shown to be related to habitat conditions.

Summary

CCWD commends the State Board in its efforts to obtain the latest scientific findings regarding the fisheries decline. The recognition in recent published works (The Bay Institute, 2007; Public Policy Institute, 2007) that the export pumps are not the sole cause of the decline represents a shift in earlier thought and has key implications for the formulation of a successful restoration strategy. Emerging science clearly indicates that measures beyond the mere limiting of exports – including a close look at fall salinities and how to reduce them – will be necessary to restore the pelagic organisms native to the Delta in the face of aggressive exotic species.

As the POD studies are made available for peer review and synthesis, the interaction and relative importance of each factor may be addressed. The State Board workshop on this topic is a critical first step to obtaining a better understanding of the decline, which will later guide the State Board in the proper exercise of its water rights and water quality responsibilities.

We look forward to working with the State Board in an effort to improve water quality in the Delta and recover the ecosystem.

Sincerely,

David A. Briggs
Water Resources Manager