

**Statement of  
California Urban Water Agencies  
to the  
State Water Resources Control Board  
at its  
Third Workshop to Review Standards for  
San Francisco Bay/Sacramento-San Joaquin Delta Estuary  
June 14, 1994**

California Urban Water Agencies (CUWA) is an organization of the largest urban water providers in California, who serve about two-thirds of the state's 32 million people. Through CUWA, these metropolitan water agencies join to work on water resources issues of common concern. The number one issue that occupies the large urban water providers is supply reliability. They all believe that an appropriate long-term solution to Delta problems is currently the single largest factor influencing state-wide water supply reliability.

CUWA appears before the State Board today to speak to Key Issues No.'s 1 and 4 from your workshop invitation. We have an overview comment on Issue No. 1 - "What factors, excluding diversions, contribute to the decline of fish in the estuary," and then will present a summary of a recent CUWA technical review of Issues 1 and 4.

In response to the recent proposal by the Environmental Protection Agency (EPA) to implement a salinity standard for the San Francisco and San Joaquin Estuary, CUWA conducted an intensive review of data and information that formed the basis behind the proposed standards. This included an assessment of the statistical relationships that were developed between the 2 ppt isohaline (hereinafter referred to as X2) and abundance of various estuarine aquatic organisms, as well as

the biological basis for the standard. This latter evaluation included an assessment of the habitats that would be provided in the Bay-Delta system based on salinity and for a broad spectrum of estuarine and marine species and life history stages known to inhabit the system. The collective work products that were generated as a result of this analysis have been made available to the State Board and to all parties interested in the technical work conducted by CUWA. In addition, CUWA technical specialists have conducted several technical review sessions with representatives from various state and federal resource agencies to discuss the overall results of CUWA's analysis, as well as differences of opinion and recommendations for further studies.

As a result of this analysis, CUWA is in agreement with the EPA in that a salinity standard which would be managed through outflow is an important step toward maintaining and restoring the aquatic resources of the Bay-Delta. However, part of CUWA's analysis focused on identifying all major factors in addition to salinity, which have been and are continuing to contribute toward shaping the overall ecosystem. One of CUWA's technical work products focused specifically on these "other factors" and described qualitatively how they may be influencing the aquatic ecosystem. CUWA also completed a preliminary correlation analysis of estuarine species abundance and a variety of environmental factors including food abundance, water quality, flow, salinity, nutrient loadings, and time. The results indicated that several of these factors, in particular food abundance, were highly correlated with estuarine species abundance. CUWA's statistical review and re-calculation of the abundance versus X2 series relationships indicated that the location of X2 explains substantially less of the variation in abundance than originally postulated by the San Francisco Estuary Project (SFEP); there is a correlation between abundance and X2 (as controlled by outflow), but it is not strong. This is consistent with the observations of Jassby et al. (1994) who noted that "the presence of unexplained variation is one signal that an existing model can lead to unacceptably biased management policies, and should result in a search for alternate and additional models". These findings have led CUWA to conclude that there are other factors influencing species abundance, and that these need to be identified, quantified and remedied in parallel with the implementation of any water quality standards, thereby further facilitating the recovery of the Bay-Delta system.

The CUWA Board of Directors, because of its concern about the influence of "other factors" on the health of the Bay-Delta system, has approved and is moving forward on a \$750,000 work plan to determine the importance of "other factors" in the decline of Bay-Delta species. While we support protective water quality standards, including outflow standards, we are concerned that reducing water diversions alone will not achieve desirable species recovery goals unless the reductions are accompanied by a comprehensive ecosystem approach which addresses "other factors" contributing to the decline.

We urge the State Board to include in its December draft water quality standards a specific program to aggressively regulate, or otherwise provide for control of, other factors which can be attributed to human impacts, including pollution/toxics, commercial and sportfish harvest, entrainment and impingement, nutrient loadings, exotic species, etc. The State Board and/or the Regional Boards clearly have the responsibility and authority to regulate many of these other factors. The State Board is further urged to use its influence with other state and federal agencies to regulate those factors which are beyond the authority of the Board. The early and aggressive regulation and control of other factors combined with implementation of water quality standards is needed to prevent the decline in Bay-Delta fish and wildlife resources and hopefully prevent the further erosion in the reliability of our urban water supplies.

We hope that CUWA's research efforts will contribute to a more thorough understanding of the influence of other factors and further the development of the State Board's program for the regulation of these other factors.

CUWA is encouraged by the State Board's request for information regarding "other factors" in and above those associated with water diversions. A summary of the results of our technical assessments is provided below.

**Key Issue No. 1:  
Factors Contributing to the Decline of Fish and Wildlife Resources  
in the Bay-Delta Estuary**

Based on Bay-Delta work by the State Water Resources Control Board, and completion of the San Francisco Estuary Project (SFEP) in 1993, there has been broad recognition that there is a variety of environmental factors that influence the aquatic resources of the Bay-Delta. However, to date, there has been little quantitative evaluation of these factors, as to the degree they may be influencing abundance of aquatic biota. The work conducted by CUWA involved a systematic evaluation of the major factors identified by the SFEP and where possible, statistical analysis to begin to understand the relationships between such factors and abundance of different aquatic organisms. The task of completing a more comprehensive assessment was beyond the scope and time limits that were available to CUWA during the initial review of the proposed standard. As noted above, it is CUWA's intent to vigorously pursue further studies of these other effects through the systematic compilation of existing resource data and data bases, and subsequent detailed statistical analysis. The overall analysis of other factors will require active participation of state and federal agencies and other entities who have been intimately involved in conducting studies within the Bay-Delta, and we would urge the State Board to support their continued participation as CUWA proceeds with this analysis. This type of analysis will be useful for ensuring that potential benefits of required outflows are maximized, and are not offset by prevailing impacts or conditions which might otherwise prevent such benefits from occurring.

To illustrate the types of impacts that CUWA has identified, a brief summary of the major "other factors" that are influencing the ecosystem is provided below and represented in Table 1. They do not supplant the factors of outflow/inflow which are implicit within the proposed EPA standard and to which CUWA acknowledges are important "drivers" in the shaping of the Bay-Delta aquatic ecosystem, but rather are those CUWA believes are also influencing the ecosystem, but which are not addressed under the current proposed EPA standard.

- **Land Reclamation/Dredging:** Human activities have greatly changed the structure and function of the Bay-Delta ecosystem. Beginning in the 1850's and ending in the 1930's, the Delta was reclaimed by the diking and draining of wetlands. The resulting loss of about 500,000 acres of shallow, low-salinity, and riparian habitats in the estuary has had a major impact on native species. By diking land to create the Delta islands and the deep-water channels which separate them, we have created relatively deep, open-water habitats that are foreign to the species that have evolved in this estuary. This new type of habitat does not provide the variability or quality needed by these species. Only about 3 to 5 percent of the needed shallow, low-salinity, and riparian habitats available in the 1860's remain today.

The importance of this habitat loss is underscored by Dr. Bruce Herbold, who suggests that loss of shallow-water and riparian habitat may have led to the extinction of the thickettail chub and Sacramento perch. E.C. Meiorin and others further suggest in their 1991 San Francisco Estuary Project report (Meiorin et al. 1991) that habitat loss and degradation are the major reasons for the decline of a variety of animal and plant species in the Bay-Delta ecosystem.

Of particular concern is the nearly total loss of these habitat types within the Delta. As a result, the only large suitable habitat blocks for many species of fish exist in the northern portions of the Suisun Bay Complex. Using flows to transport fish to this area requires large volumes of water. Recreating shallow, low-salinity habitats within the Delta could expand the availability of suitable habitat for native species, reduce the mortality associated with downstream transport, and provide additional spawning and rearing areas for a number of native species such as Delta smelt, longfin smelt, and Sacramento splittail.

Dredging activities are conducted in the Bay-Delta system to maintain navigation

channels, and to some degree flood control channels. The disposal of this material within the estuary can result in loss of benthic production, and can alter intertidal and sub-tidal habitats. Because many pollutants which enter the estuary are incorporated into bottom sediments, the dredging of these materials may release toxic materials into the water column making them available for biological uptake. Although recent progress in controlling dredging operations and limits has occurred via actions of the State Water Resources Control Board, further actions are warranted to more fully control this problem.

- **Upstream Water Use/Flood Control:** Upstream water uses including flood control projects have had significant impacts -- from the 35 reservoirs which can store 29 million acre-feet of water to the thousands of individual agricultural and urban diversions. Reservoirs convert riverine habitat to lakes, block the movement of migratory fish, and alter the hydrologic regime downstream, affecting both the magnitude and timing of outflows. Other upstream projects, diversions for agricultural and urban uses, remove water from the system, kill fish on intake screens or in fields, and then return water of poorer quality to the rivers. Multiple use of the same water cumulatively degrades water quality for downstream uses. To protect the beneficial uses of the estuary, the State Board needs to look at upstream uses of water as well as in Delta uses.
- **Pollution:** Pollution from agricultural, urban, and industrial return flows has significant impacts on aquatic resources, both directly and indirectly. Although we have made significant progress in treating point source discharges into rivers and the Bay-Delta with mixed effects on aquatic resources, chemical pollution remains a major threat to the estuary, particularly from non-point sources and agricultural discharges. Studies of chemical pollution conducted to date indicate that pollutants such as chlordane, DDT, toxaphene, diazinon, and rice herbicides are found in fish tissues and may cause both direct and indirect mortality and lower reproductive

success. Much work remains to be done to determine the exact impacts of particular pollutants, but they undoubtedly play a significant role in the decline of some species in the Bay-Delta.

Pollution also takes the form of sediments carried into rivers and streams from lands damaged by unsound agricultural and logging practices -- clear cutting, over-grazing, and other practices. These sediments alter and reduce the habitat in tributaries, affect the quantity and quality of spawning habitat, and reduce overall stream productivity.

- **In-Delta Water Diversions:** The effects of in-Delta water diversions, water use, and discharge from agriculture are also significant. In addition to diversions at the CVP and SWP pumps and major urban and industrial diversions, there are 1800 smaller agricultural diversions in the Delta itself. These diversions, particularly unscreened diversions are a direct source of fish mortality. Recent, preliminary, data from the Department of Water Resources indicates that the effects of in-Delta diversions may be much greater than previously thought. In-Delta diversions may have particularly high impacts on egg and larval fish, which cannot be screened and which cannot swim to escape even weak flows toward the diversions.
- **Commercial and Sportfishing/Exploitation:** Commercial and sportfishing also has an impact on the health of the ecosystem. High rates of exploitation in the salmon fishery, where native stocks are mixed with more numerous hatchery-reared fish, may result in levels of impact to native stocks which are unacceptably high. In addition, ocean fishing reduces salmon returns to inland streams, where, in the past, their post-spawning death provided nutrients which increased the general productivity of the ecosystem.
- **Introduced Species/Exotics:** Finally, introduced species have the potential to

adversely affect native species. Twenty-seven of the 55 fish historically or presently residing in the Delta are non-native species, and there are significant populations of non-native invertebrates. As Moyle points out, these species can have both direct and indirect impacts on the native ecosystem. They can compete with native species for food or space. They may be direct predators of native species. They may also alter habitat -- changing a food chain for example.

- **Natural Factors/Climate/Drought:** Notwithstanding the effects of these human-induced "other effects", CUWA would also like to note that the Bay-Delta system has recently been subjected to extreme conditions of drought, intermixed with periods of flooding, both of which have occurred naturally without human influence. Such factors are largely climatic and represent the extremes of the normal ranges of certain variables. For the Bay - Delta, these have included: periods of extended low snow pack and precipitation - drought; periods of high intensity rainstorm events - floods; and alternating periods of drought and flood. The San Francisco Bay and Delta areas have been subjected to these types of conditions in a sustained fashion over the last 20 years. Depending on particular habitat affinities, these conditions would be expected to impact fish and invertebrate populations, even absent all other developments. For riverine species, drought conditions can translate into reductions in available physical habitat, elevated water temperatures, reductions in food base, increased susceptibility to predation, and alterations in general water quality characteristics. Some estuarine species (e.g., striped bass) are anadromous and would therefore be subjected to similar types of impacts as noted above, during residency in riverine habitats. For other estuarine species (e.g., delta smelt, longfin smelt), drought conditions result in reduced inflows of freshwater, which may influence location of spawning and rearing habitats and production potential. Freshwater inflow also affects primary



and secondary production of important food organisms for estuarine species (e.g., *Neomysis* sp., *Crangon* sp.).

In short, we believe that there are many factors responsible for the cumulative decline in Bay-Delta resources, a decline which began in California's early history and continues today.

These other factors call for additional action by the Board, which needs to look at proposed water quality standards within the context of these other factors. While it is clear to CUWA that additional outflows are a necessary component of a Bay-Delta protection plan, it is also clear to us that the effects of additional outflows and improved water quality may be offset or confounded by these other factors. Will increased outflow more favor delta smelt or its non-native cohort the inland silversides? Will more outflow and better water quality increase the populations of important native food organisms such as *Neomysis* or recently-introduced non-native competitors? Will the effects of increased flows be offset by the introduction of a new pesticide or pollutant? How, then, do we measure the response of the Bay-Delta ecosystem to improved water quality?

CUWA believes that unless these "other factors" are successfully addressed, simultaneously with implementation of water quality standards, there is no certainty at all that the estuary will respond as desired or as some have predicted. Actions to improve water quality and outflow regimes for aquatic resources should not be substituted for other needed actions. More water should not be viewed as a substitute for pollution control, for habitat restoration, for screening unscreened diversions.

Our concerns for addressing these many other factors responsible for the decline in Bay-Delta resources should not be misinterpreted as arguments against Board action. We urge the Board to act proactively and in a timely manner, as we recommended in our comments regarding the EPA's proposed standards. But we urge the Board, and all others involved in protecting Bay-Delta environmental resources to recognize that Board action is an initial step. We believe that it is essential to begin the effort to address these other factors at the same time we are considering and

implementing water quality standards for the Bay-Delta. It is only through this combined effort of addressing all of the major factors influencing the Bay-Delta that the goal of restoring its ecosystem health can be achieved.

#### **Key Issue No. 4 Status and Trends of Biological Resources in the Bay-Delta Estuary**

The San Francisco Estuary Project (SFEP) has prepared a number of generally excellent reviews of the status of the Bay-Delta and trends affecting that status, including that prepared by Herbold et al (1992), and others on the status and trends of aquatic resources. It is not our intent in this statement to address this issue in detail. Rather, we would like to try to draw the State Board's attention to some major points about the status and trends in the estuary.

Regarding the status of the estuary, the map of the Sacramento-San Joaquin Delta reveals that what we call a delta-estuary is predominantly a system of islands and interconnected channels. Most of the historic delta-estuary is no longer estuarine. It does not function like a natural delta; flow velocities are higher, depths are greater, there is little vegetative substrate in the channels for fish to hide in or feed in, and little riparian vegetation to shade the streams. In addition, what we call rivers and streams are often mere diked channels, which have replaced the meandering streams and wetlands which characterized the natural ecosystem. There are several promising programs and proposals for programs to reverse this trend, including recent acquisition of 3,000 acres of habitat in the Yolo Bypass for wetlands restoration and a plan to restore shallow-water habitat at Prospect Island. But there is no evidence that the long-term trend towards loss of wetlands has been reversed in any significant way.

Regarding the status of aquatic communities within this largely degraded habitat, CUWA generally concurs that there have been long-term declines in the populations of many native species, as well as some introduced species such as striped bass which are considered of economic value. There is little doubt that native runs of salmon and steelhead are in serious

decline, and that some stocks have been lost. Likewise, sturgeon and starry flounder populations are down. And there are strong indications that other native species are also in serious decline, although the causal mechanisms for these declines are not as well understood as those for the salmonids.

In order to provide protection and recovery programs for these declining aquatic resources, we need data which will help us understand the response of native species populations to changes in conditions in the Delta. Do changes in outflow, for example, result in changes in actual abundance of species, or do the populations respond to these changes by moving upstream or downstream to favorable habitat? "Are the changes we see in some native populations the result of changes in outflow, or from other factors such as non-native species which may have displaced native species and caused the declines we see in current population indices?"

While we recognize the value of current sampling programs in the Bay-Delta, current survey programs are not entirely adequate to address such questions. For example, estimates of declines in delta smelt populations are based on a monitoring program which was not designed to sample this species. We encourage those engaged in the study of Bay-Delta resources to develop survey programs which will ensure that the entire range of a population is sampled, that sampling methods are appropriate to the species sampled, and that the potential for sampling error is addressed. We also need data about the causes for observed changes in population abundance and distribution and the relative importance of these causes; without these data, as noted above, we cannot design effective programs for the protection and recovery of the Bay-Delta's resources.

Finally, we would like to point out some hopeful signs in the response of the native fish of Suisun Bay to the end of the drought in 1993-1994. For example, the delta smelt index would suggest that this species is either rebounding from drought-year lows or returning to Bay-Delta habitat now that conditions have improved. There are also indications that Sacramento splittail are more widely distributed throughout the Delta and its tributaries than generally thought.

Regarding trends of importance to the health of the ecosystem, we want to point out that the Bay-Delta ecosystem and its water resources are intensely used, and this use is increasing as California grows. Water reaching the Delta may have been used many times on its journey from upstream watersheds -- by power producers to provide electric power, by farmers for irrigation, by cities for drinking water, by industry for processing and cooling, by boaters for recreation. The cumulative effects of these many uses has been, and continues to be, water quality which is significantly altered from what it must have been historically. Each time water is diverted for use, the process of diversion, use, and return discharge has the potential to adversely impact aquatic resources. A significant cause of trends in species abundance may be the constantly *changing* load of chemicals put into the water -- fertilizers, pesticides, herbicides, industrial pollutants, and the byproducts of modern life from air pollutants to household chemicals. We have made significant progress towards reversing this trend in some areas, such as municipal and industrial wastewater treatment, control of thermal pollution from power plants, and control of runoff from livestock operations. We look forward to similar progress in control of other pollutants, such as pesticides from agricultural dischargers and selenium from six local refineries.

Another trend of concern for us is continued human exploitation of an often declining aquatic resource base. Although salmon runs, striped bass populations, sturgeon populations, and starry flounder populations appear to be down, we continue to fish -- using traditional methods which may not adequately protect those sensitive native species that we are concerned about. There are methods for reducing these impacts which have been proven in other areas. We hope to see these methods, such as terminal fisheries and changes in gear types, considered in California. We understand that exploitation of some of these species occurs in the ocean and therefore urge the State Board to support efforts to control/regulate these fisheries.

A third trend we see is continued urban/suburban development -- in the Bay-Delta itself and in tributary watersheds. Documented by the State Lands Commission in its 1991 report entitled "Delta-Estuary, California's Inland Coast," this development fragments and isolates habitats and increases direct human impact on aquatic resources. It also constrains our opportunities to correct

some of the land-use problems of the past. These impacts can to some extent be addressed through better regional land management and planning efforts, coordinated with resource agencies. Consideration of these issues is within the legal charge of the relatively new Delta Protection Commission. Its' formation is a hopeful sign for progress in Delta land-use issues.

A fourth trend we see is an accelerating change in the composition of species in the estuary -- at all trophic levels. Non-native species now appear to dominate the estuary in many instances. Of particular concern are species such as the Asian clam, which has the potential to alter the food chain by filtering large portions of the water column, and several copepods, which appear to be displacing native planktonic species and affecting food availability for some native fish species. As Dr. Herbold suggests, this trend "contributes greatly to the instability of the Estuary's biotic communities and increases the difficulty of managing it to favor desired species." Since the task before the State Board is to institute a water quality program to, in effect, manage estuarine habitat in the estuary, it is important to note Dr. Herbold's concern over the uncertainty whether any particular management action will, indeed, favor the native species. Despite a growing awareness of this issue, we do not yet see significant progress being made in prevention and control of non-native introductions.

We also, as a means to gauge the recovery of the Bay-Delta, urge the development of a comprehensive and coordinated, and statistically rigorous monitoring program focused on defining long term trends in biological, chemical and physical resources of the system. Only then can we begin to determine whether the water quality and quantity measures and land restoration activities that have and will be implemented in the Bay-Delta are achieving their goals.

Despite some promising initiatives to address these trends, and substantial progress made in addressing some of them, the net impact of the above trends is to complicate the process of resource protection and recovery. Increased and changing use of water and aquatic resources, combined with changes brought on by non-native species, will make managing the Bay-Delta Ecosystem increasingly difficult, particularly if that management is not coordinated, ecosystem-

wide, and broad in scope. CUWA therefore supports and is actively pursuing the development of a multi-species, ecosystem type of management program for the Bay-Delta Ecosystem, to ensure that the complexities of the ecosystem are recognized and interrelated problems are addressed.

## REFERENCES

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**TABLE 1 - FACTORS INFLUENCING HEALTH OF AQUATIC RESOURCES IN THE BAY/DELTA**

<b>FACTOR</b>	<b>POTENTIAL DIRECT IMPACTS</b>	<b>POTENTIAL INDIRECT IMPACTS</b>
<b>COMMERCIAL/SPORT FISHING</b>	<ul style="list-style-type: none"> <li>• Take of sensitive species in mixed stock fisheries at levels that may reduce population viability</li> </ul>	<ul style="list-style-type: none"> <li>• Disruption of food chain</li> </ul>
<b>FLOOD CONTROL</b>	<ul style="list-style-type: none"> <li>• Loss of habitat</li> <li>• Interference w/migration routes</li> </ul>	<ul style="list-style-type: none"> <li>• Changes in water quality and temperature</li> </ul>
<b>IN-DELTA DIVERSIONS</b>	<ul style="list-style-type: none"> <li>• Entrainment of fish, eggs, and larvae in sloughs and fields</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction in instream flows</li> <li>• Increase in concentration of pollutants</li> <li>• Change in in-Delta flows</li> <li>• Change in temperature</li> <li>• Upstream/downstream passage problems</li> </ul>
<b>INTRODUCED SPECIES/EXOTICS</b>	<ul style="list-style-type: none"> <li>• Direct predation on native species</li> <li>• Introduction of disease/parasites</li> </ul>	<ul style="list-style-type: none"> <li>• Displacement of native species from their preferred habitat</li> <li>• Competition with native species for food</li> <li>• Disruption of food chain</li> </ul>
<b>LAND RECLAMATION/DREDGING</b>	<ul style="list-style-type: none"> <li>• Loss of habitat and restriction of species range</li> <li>• Sedimentation of sensitive habitats</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction in food supply</li> <li>• Increase in stream temperatures</li> <li>• Increases in salinity</li> </ul>
<b>POLLUTION</b>	<ul style="list-style-type: none"> <li>• Acute and chronic toxicity, and reduced reproduction</li> </ul>	<ul style="list-style-type: none"> <li>• Bioaccumulation in food chain w/potential human health impacts</li> </ul>
<b>UPSTREAM WATER USE/CHANGES IN OUTFLOW</b>	<ul style="list-style-type: none"> <li>• Changes in transport of eggs/larvae</li> </ul>	<ul style="list-style-type: none"> <li>• Changes in: <ul style="list-style-type: none"> <li>- habitat availability</li> <li>- temperature regime</li> <li>- instream flows</li> <li>- food supply</li> <li>- salinity</li> </ul> </li> </ul>
<b>UPSTREAM WATER DIVERSIONS</b>	<ul style="list-style-type: none"> <li>• Entrainment of fish, eggs, and larvae in sloughs and fields</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction in instream flows</li> <li>• Increase in concentration of pollutants</li> <li>• Discharge of sediments</li> <li>• Reduced nutrient loadings</li> <li>• Change in temperature</li> <li>• Upstream/downstream passage problems</li> </ul>