COMMENTS OF THE BAY/DELTA URBAN COALITION ON THE JANUARY 6, 1994 PROPOSED RULE ON BAY/DELTA STANDARDS

SUBMITTED BY:

BAY/DELTA URBAN COALITION
C/O BEST, BEST & KRIEGER
POST OFFICE BOX 1028
RIVERSIDE, CALIFORNIA 92502

SUBMITTED TO:

PATRICK WRIGHT
BAY/DELTA PROGRAM MANAGER
WATER QUALITY STANDARDS BRANCH W-3
WATER MANAGEMENT DIVISION
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
75 HAWTHORNE STREET
SAN FRANCISCO, CALIFORNIA 94105

DATED: MARCH 11, 1994

March 9, 1994

<u>**BY OVERNIGHT DELIVERY**</u>

Mr. Patrick Wright
Bay/Delta Program Manager
Water Quality Standards Branch, W-3
Water Management Division
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, California 94105

Proposed Federal Water Quality Standards for the San Francisco Bay/Sacramento-San Joaquin River Delta -- Comments of the Bay/Delta Urban Coalition

Dear Mr. Wright:

The U.S. Environmental Protection Agency ("EPA") has requested comments on its proposal to adopt federal water quality criteria for the San Francisco Bay/Sacramento-San Joaquin River Delta ("Bay/Delta").[1] In response to EPA's request, the following comments are being submitted on behalf of a group of urban water agencies known as the Bay/Delta Urban Coalition, which has been organized for the purpose of developing comments and positions on Bay/Delta protection.

The coalition is an informal group of urban water agencies that serve communities throughout the northern, southern and central coastal areas of the State of California. The individual entities that make up the coalition and which join in the enclosed comments are identified in an attachment to this letter.

---

[1]. EPA's proposal is set out in Proposed Rule, "Water Quality Standards for Surface Waters of the Sacramento River, San Joaquin River, and San Francisco Bay and Delta of the State of California," 59 Fed. Reg. 810 (1994) (to be codified at 40 C.F.R. part 131) (proposed January 6, 1994).

The coalition has a strong interest in any federal or state actions that could affect the availability of water from the Bay/Delta watershed. Members of the coalition supply water to more than two-thirds of California's population. Much of that water is obtained from the Delta or its watershed and is provided to urban water users through local, state, and federal water projects. Without this water, coalition members would be unable to meet the commercial, industrial, and domestic needs of millions of Californians throughout the State.

At the same time, the coalition is sensitive to the fact that the Bay/Delta and the estuarine habitats it provides are under considerable stress. We recognize that the decline of certain estuarine and freshwater species over the years may be associated, in part, with the diversion of water from the Bay/Delta watershed for urban and agricultural use. We agree that concrete actions must be taken as quickly as possible to prevent further decline of these important resources. We do not believe, however, that the regulatory standards proposed by EPA are the best answer to this serious problem.

While EPA's proposed standards purport to be water quality criteria intended to protect estuarine habitat and other designated uses, in effect they are water outflow requirements that would directly and substantially restrict the quantity of water available for export from the Bay/Delta watershed. We believe EPA does not have legal authority under the federal Clean Water Act ("CWA") to regulate the allocation of water quantity for water quality purposes. Among other things, Sections 101(g) and 208 of the CWA expressly reserve to the states the exclusive right to manage water allocation issues within their jurisdictions. EPA should not use its authority under other provisions of the CWA to subvert Congress' clear intent on this matter.

Moreover, the specific water quality criteria proposed by EPA have significant technical and scientific flaws. Most significantly, EPA's 2 part per thousand ("ppt") salinity criteria for the protection of estuarine habitat is based on assumptions regarding historical hydrological conditions that are not representative and are inaccurate and unduly restrictive. EPA's approach would require much higher levels of annual freshwater flow into the Bay/Delta than is necessary to protect existing beneficial uses; indeed, attainment of required flows in certain years could have significant adverse effects on two aquatic species listed under state and federal endangered species laws -- the winter-run chinook salmon and the Delta smelt.

The coalition believes there are alternatives to EPA's proposed criteria that would be more effective in protecting existing uses in the Bay/Delta and at the same time have a less direct and immediate impact on the availability of water from the Bay/Delta for other uses. In particular, we believe that both of these goals would best be achieved through the use of:

(a) narrative criteria explicitly requiring the maintenance of water quality necessary to protect estuarine habitat and other fish and wildlife uses;

(b) alternative mechanisms for measuring compliance with the criteria, including mechanisms based on the 2 ppt salinity parameter endorsed by EPA, on flow, or on other relevant parameters; and

(c) plans for prompt implementation of applicable criteria, focusing on the development of best management practices for the protection of listed species, comprehensive water management solutions, and multi-species plans for the protection of the Bay/Delta ecosystem as a whole.

The California Urban Water Agencies ("CUWA"), which includes members of the coalition, is submitting separate, technical comments that address many of the same concerns the coalition has expressed with respect to EPA's proposed rule. The coalition endorses the technical analyses and recommendations offered by CUWA and incorporates them by reference in these comments. At the same time, the coalition encourages adoption of an alternative standard along the lines described above, which we believe is more consistent than EPA's proposed criteria and is based upon the technical approaches endorsed by CUWA.

Detailed comments prepared on behalf of the coalition are attached. We appreciate the opportunity to submit these comments to EPA, and we look forward to working with all interested parties in seeking to protect the environmental health of the Bay/Delta while preserving the multiple resource values it provides.

Respectfully submitted,

Representing the Steering
Committee of the Bay\Delta
Urban Coalition

Timothy H. Quinn
The Metropolitan Water District
of Southern California

Roger James
Santa Clara Valley
Water District

Lester A. Snow
San Diego County Water Authority

JFR:mg
esa\epa

ENTITIES SUBMITTING COMMENTS TO EPA'S PROPOSED STANDARDS AS THE BAY/DELTA URBAN COALITION

Alameda County Water District

Alameda County Flood Control and W. C. District, Zone 7

Antelope Valley - East Kern Water Agency

Castaic Lake Water Agency

Casitas Municipal Water District

Central Basin Municipal Water District

Central Coast Water Authority

Coachella Valley Water District

Crestline - Lake Arrowhead Water Agency

Desert Water Agency

Los Angeles Department of Water and Power

The Metropolitan Water District of Southern California

Mojave Water Agency

The Municipal Water District of Orange County

San Bernardino Valley Municipal Water District

Santa Clara Valley Water District

San Diego County Water Authority

San Diego Water Utilities Department

San Gabriel Valley Municipal Water District

San Gorgonio Pass Water Agency

San Luis Obispo County Flood Control
and Water Conservation District

West Basin Municipal Water District

COMMENTS OF THE BAY/DELTA URBAN COALITION ON THE JANUARY 6, 1994 PROPOSED RULE ON BAY/DELTA STANDARDS

SUBMITTED BY:

BAY/DELTA URBAN COALITION
C/O BEST, BEST & KRIEGER
POST OFFICE BOX 1028
RIVERSIDE, CALIFORNIA 92502

SUBMITTED TO:

PATRICK WRIGHT
BAY/DELTA PROGRAM MANAGER
WATER QUALITY STANDARDS BRANCH W-3
WATER MANAGEMENT DIVISION
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
75 HAWTHORNE STREET
SAN FRANCISCO, CALIFORNIA 94105

DATED: MARCH 11, 1994

TABLE OF CONTENTS

I.

INTRODUCTION

The San Francisco Bay-Sacramento San Joaquin Delta Estuary (hereinafter "Bay/Delta Estuary") is the hub of California's water system. More than two-thirds of the State's population -- approximately 23 million people -- residing in the San Francisco Bay area, the Central Valley and Southern California receive all or a portion of their water supply from the Bay/Delta watershed. They use this water to run their businesses and to serve their domestic needs. In substantial numbers, they also recreate in the reservoirs built to store Delta water for later use.

The bulk of the water supplied from the Bay/Delta Estuary, and its watershed, to serve the needs of urban California is supplied by the members of the Bay/Delta urban coalition (hereinafter referred to as the "urban coalition") who join together to present these comments. The members who comprise the urban coalition are the Alameda County Water District; Alameda County Flood Control and Water Conservation District, Zone 7; Antelope Valley - East Kern Water Agency; Castaic Lake Water Agency; Casitas Municipal Water District; Central Basin Municipal Water District; Central Coast Water Authority; Coachella Valley Water District; Crestline - Lake Arrowhead Water Agency; Desert Water Agency; Los Angeles Department of Water and Power; The Metropolitan Water District of Southern California; Mojave Water Agency; The Municipal Water District of Orange County; San Bernardino Valley Municipal Water District; Santa Clara Valley

Water District; San Diego County Water Authority; San Diego Water Utilities Department; San Gabriel Valley Municipal Water District; San Gorgonio Pass Water Agency; San Luis Obispo County Flood Control and Water Conservation District; West Basin Municipal Water District.

Each of the members of the urban coalition is vitally concerned with the reliability of their water supply. In every instance, water supply reliability is one of the most fundamental underpinnings of the economies served by the members of the urban coalition. Because their water supplies are, in substantial measure, drawn from the Delta or its watershed, each of the above agencies has a fundamental interest in the Proposed Rule on Bay/Delta Standards.

The members of the urban coalition also recognize that there is a need for improvement in the condition of fish and wildlife resources reliant upon the waters of the Bay/Delta Estuary. In recent years, the numbers of some Bay/Delta species have declined. Because of a variety of factors, including the diversion of freshwater within the Estuary watershed, the Delta <u>is</u> "broken" and must be fixed. For this reason, the members of the urban coalition support EPA's goal of significantly improving conditions for Estuary fish and wildlife species. They also believe, however, that pursuit of this important goal should not be at the expense of already questionable urban water supply reliability. If California is to extricate itself from its worst recession since the 1930's, it is the State's urban sector which will lead the way. The existence of a reliable urban water supply is of critical importance to California's economic recovery process.

For these reasons, the members of the Bay/Delta urban coalition believe it is imperative to shift the focus of the proposed standards to an alternative which is not only grounded upon the best available scientific evidence, but which will also provide better protection to the Estuary's most sensitive species and do so with a reduced impact upon urban water supply reliability. These comments offer such an alternative. As will be seen, these comments also endorse the technical comments developed by the California Urban Water Agencies ("CUWA") with respect to the draft Rule.

II.

<u>OVERVIEW OF COMMENTS OF THE BAY/DELTA URBAN COALITION</u>

In their current form, the draft Bay/Delta Estuary Standards proposed by EPA will have a severe adverse effect upon urban water supply reliability throughout the State. They also could have a significant adverse impact upon both the environment and the economies of the areas served by the members of the Bay/Delta urban coalition. Estimates of water supply impact prepared by the California Department of Water Resources ("DWR") show that, in comparison with existing water rights limitations imposed by Decision

1485, the proposed standards developed by EPA would reduce water supplies from the Delta by as much as 1.7 million acre-feet, on average, over the 71 years of hydrologic record and by as much as 3.1 million acre-feet in critically dry years when urban demands are highest. (DWR Modeling Runs, Memo to EPA, Sept. 1993.) While EPA assumes that only 20% of the impact of this shortage will fall upon urban users, such an allocation is not within EPA's authority to guarantee.

Given the magnitude of the water supply reductions estimated by DWR, the proposed EPA standards are likely to generate significant environmental, social and economic impacts throughout the areas served by the members of the urban coalition. As explained in more detail in these comments and in Appendices 2 and 3 attached hereto, these impacts include:

- Curtailment of groundwater replenishment and conjunctive use programs;
- Increased groundwater overdraft;
- Conflicts with regional water quality control plans because of impaired ability to meet water quality objectives;
- The impairment of groundwater cleanup and conjunctive use efforts;
- Land subsidence;
- Reduced wastewater reclamation opportunities;
- Reduced riparian habitat enhancement resulting from decreased groundwater spreading, decreased transport of usable reclaimed water and reduced storage in surface water impoundments;

- Reduced recreational opportunities in water project reservoirs and reservoirs reliant upon water from the Bay/Delta watershed;

- Reduced water supply reliability.

In apparent recognition of the need to ameliorate the impacts of the proposed standards, the draft Rule prepared by EPA suggests a receptivity to certain technical modifications, including the use of a smoothing function to apply the proposed standards; operation of upstream reservoir releases to a flow equivalent, instead of a 2 part per thousand salinity standard to eliminate the need to operate water projects pursuant to a "confidence interval/buffer zone" having an extremely high water cost in order to assure compliance with the standards; and a 28-day moving average for determining compliance with applicable standards. The urban coalition supports these modifications along the lines proposed in the Technical Comments of the California Urban Water Agencies ("CUWA") (Enclosed as Appendix 1). The members of the urban coalition believe these modifications, and the other technical modifications proposed by CUWA, will provide more effective habitat protection to the most sensitive Bay-Delta species with a lesser impact upon water supplies and the California economy.

As also explained in these comments, however, the urban coalition believes there is a more fundamental issue to be confronted: whether EPA has an obligation to support an alternative standard, which is based upon actual hydrologic conditions and the best available scientific data, and which will provide more effective habitat protection at a substantially lower cost to other water users compared to EPA's proposal. The urban coalition believes that the provisions of the Clean Water Act, as well as EPA's own interpretation of the Act, impose such an obligation.

In the Bay/Delta Estuary, considerable data suggest that placement of the zone of saltwater/freshwater interface (hereinafter the "entrapment zone") within the shallow water areas within the Suisun Bay complex and below the confluence of Sacramento and San Joaquin rivers is beneficial to a range of estuarine species. On the other hand, the data also suggest that it is not helpful to place the entrapment zone within the confines of the Carquinez Strait, which lack shoals and shallow water habitat and may have an adverse impact on key estuarine processes such as residence time of nutrients, eggs and larvae. (See Appendix 1, CUWA Comments on "Proposed Water Quality Standards for the San Francisco Bay/Delta", pp. 13-17.) If an alternative to the EPA proposed estuarine habitat standard provides for better habitat through more appropriate placement of the entrapment zone, the members of the urban coalition believe it must be given serious consideration.

Similarly, the winter-run chinook salmon and Delta smelt are listed, respectively, as "endangered and threatened" pursuant to the Endangered Species Act. If an alternative to the proposed EPA standards provides better protection of these listed, and therefore "sensitive," species while also providing substantially equivalent protection to other species, the urban coalition believes it must be given serious consideration. If the alternative is also significantly less disruptive to the other uses of water which must be considered under Section 303(c) -- such as the "public water supply," "industrial" and "agricultural" uses supported by the water rights of other users of Bay/Delta waters -- then, again, the Clean Water Act requires that the alternative should be chosen as the final EPA standard -- assuming that Section 303, applies to efforts to control salinity intrusion.

When it amended the Clean Water Act in 1977, Congress stated the following:

> "It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Chapter. It is the further policy of Congress that nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State." (Clean Water Act, § 101(g).)

In the course of analyzing the legislative history of Section 101(g) and the cases which have dealt with its statement of policy, EPA has given its own interpretation of Congress' purpose. That interpretation includes the following statement with respect to Section 101(g):

> " . . . those authorities [the legislative history and cases] also indicate that if there is a way to reconcile water quality needs and

> water quantity allocation, such accommodation should be pursued. In other words, where there are alternative ways to meet the water quality requirements of the Act, the one with the least disruption to water quantity allocation should be chosen." (EPA, "Questions and Answers on Antidegradation," No. 30, p. 11.)

Moreover, assuming that EPA is correct in its assertion that Bay-Delta Estuary standards are appropriate for adoption pursuant to Section 303 of the Clean Water Act, the obligation to adopt an alternative which is more protective of municipal and other water supply needs also arises pursuant to Section 303(c)(2)(A):

> "Such standards shall be established <u>taking into consideration their use and value for public water supplies</u>, propagation of fish and wildlife, recreational purposes <u>and</u> <u>agricultural</u>, <u>industrial</u>, <u>and other purposes</u>, and also taking into consideration their use and value for navigation." (Emphasis added.)

Consistent with the foregoing, these comments will offer an alternative to the draft estuarine habitat standard contained in the proposed Rule. This alternative takes the form of a narrative standard intended to provide the habitat conditions identified as beneficial for aquatic species, rather than a rigid chemical measure as set forth in the current proposal. The alternative standard proposed by the urban coalition incorporates, as a measure of the achievement of those conditions, the same 2 part per thousand isohaline concept (sometimes hereinafter referred to as "X-2") which is the basis for the draft estuarine habitat standard proposed by EPA. Unlike EPA's proposed standard, however, the urban coalition alternative makes use of a sliding scale which responds to hydrologic conditions as they develop within a given year. Further, the urban coalition alternative focuses upon the important February-June regulatory period and is not driven by hydrologic conditions occurring in months far removed from the target period. Finally, the urban coalition alternative is grounded upon a more representative hydrology since it uses the period 1968-1975 for the purpose of determining the achievement of desired conditions.

(a) EPA's Proposed Sliding Scale is Inadequate and Alternatives Must Be Considered Before a Final Standard Is Developed.

As proposed by EPA, the Estuarine Habitat Standard is highly inflexible, is not consistent with its stated goals and will result in unacceptable and unnecessary economic and environmental harm. The urban coalition believes that improvements to the proposed EPA "sliding scale" must be fully considered and an approach which meets reasonable criteria, must be developed before any standard is promulgated in final form.

The proposed EPA Estuarine Habitat Standard specifies a fixed number of days that X-2 must be maintained at various monitoring points for all years within a particular water year classification. Depending upon the pattern of hydrologic events within a year, this approach could be substantially harmful to both the California economy and the Bay/Delta environment.

For example, if the early part of the water year (October-January) is unusually wet and is followed by an unusually dry spring period (February-June), the proposed EPA standard would require reservoir releases to maintain X-2 for a large number of days despite the fact that the spring months are dry and X-2 under natural weather conditions would be farther upstream. This inflexible approach could have a devastating impact on reservoir storage, imperiling the winter-run salmon and other species dependent upon the cold water releases and other habitat conditions made possible by reservoir carryover storage.

Similarly, if the early months of the water year are unusually dry, followed by wet conditions later in the year, the rigid approach incorporated into the Proposed Rule could result in a lower number of X-2 days than would result under natural weather conditions and would again not achieve EPA's objectives.

EPA recognized that its proposed regulations required significant revision to be more representative of the hydrologic cycle and requested comments on an appropriate "sliding scale" mechanism.

In order to reduce the rigidities of the Proposed Rule, the alternative estuarine habitat standard incorporates a sliding scale whose purpose is to allow greater flexibility in the regulatory approach by adjusting the required number of X-2 days in response to changing hydrologic conditions. Thus, if a year starts wet and stays wet, the sliding scale approach would require a larger number of X-2 days at required regulatory monitoring points. If, on the other hand, the year starts wet, but turns dry, the sliding scale mechanism would adjust the number of required X-2 days downward. Similarly, if the year starts dry and turns wet, the sliding scale would gradually increase the required X-2 days.

The urban coalition believes that, to be effective, a sliding scale mechanism must satisfy the following key criteria:

- **Flexibility**. The sliding scale must allow for smooth changes in the number of X-2 days (up or down) as weather patterns during the year provide additional hydrologic information.

- **Level of Protection**. EPA has declared that its objective is to provide a level of protection consistent with conditions that existed during the late 1960s and early 1970s. (59 Fed.Reg. 820) This target period was chosen in part because it was characterized by good abundance levels for key estuarine fisheries. Thus, an appropriate sliding scale should be designed to provide a level of protection consistent with the selected target period.

- **Range of Data**. An Estuarine Habitat Standard would presumably be enforced under a wide range of weather and hydrologic conditions, possibly spanning extremely wet or dry years and extended periods of drought. To better reflect environmental requirements under a wide range of hydrologic circumstances, the sliding scale should be developedbased on the full range of available hydrologic runoff data.

- <u>**Season of Concern**</u>. Finally, the sliding scale should be based on data that reflect hydrologic conditions during the months of regulatory concern, February through June. In this regard, sliding scale approaches that reflect runoff throughout the year, as proposed by EPA, establish regulatory requirements based on conditions too far removed from the natural weather conditions prevailing during the spring months, which are the months of primary regulatory concern.

(b) A Wide Variety of Sliding Scale Mechanisms Have been Identified in Response to the EPA Request for Comments and Should be Considered.

The urban coalition is aware of at least four separate approaches to the development of a sliding scale. These approaches -- suggested by EPA, CUWA, SWRCB, and DWR -- are summarized in Table 1, ("Comparison of Alternative Sliding Scales") and illustrated graphically in Figures 1 and 2.

In Table 1, the "Analysis Period" refers to the hydrologic years included in the development of each sliding scale, which either directly or indirectly affect the determination of the sliding scale equations proposed. The "Months Included" column indicates whether the approach is based solely on hydrologic runoff data from the spring months of regulatory concern (February-June) or includes hydrologic runoff data from other months of the year. The "number of data points" used in each analysis depends upon the

GKW206547

period of analysis and whether individual year or average-year classification data were utilized. The "Method of Fit" identifies the approach used by each agency to "smooth" X-2 required days, typically as a function of the estimated Sacramento Four-River Index. The final column in Table 1 indicates whether the sliding scale mechanism adjusts to the level of development consistent with the EPA target period of the late 1960s and early 1970s.

TABLE 1

COMPARISON OF ALTERNATIVE "SLIDING SCALES"

AGENCY	ANALYSIS PERIOD	MONTHS INCLUDED	NUMBER OF DATA POINTS	METHOD OF FIT	ADJUSTMENT FOR LATE 1960s-EARLY 70s LEVEL OF DEVELOPMENT
EPA Proposal	1940-1975	Full Year	4 'average' points, based on 36 annual observations	Step Function	No Adjustment
EPA Preamble	1940-1975	Full Year	4 'average' points, based on 36 annual observations	Quadratic OLS*	No Adjustment
CUWA	1968-1975	Feb-June	8 Annual Observations	Linear OLS*	All data from EPA target period
SWRCB	1964-1976	Full Year	13 Annual Observations	Log-Linear OLS*	Data extend somewhat beyond EPA target period
DWR	1930-1992	Feb-June	11 'average' points, based on 63 annual observations	Linear "Best Fit"	Adjusted to 1975

* Ordinary Least Squares

S:\MM\REPORT\COMPAR.THQ

FIGURE 3

CUMULATIVE CAPACITY OF SELECTED CENTRAL VALLEY RESERVOIRS (1910-1990)

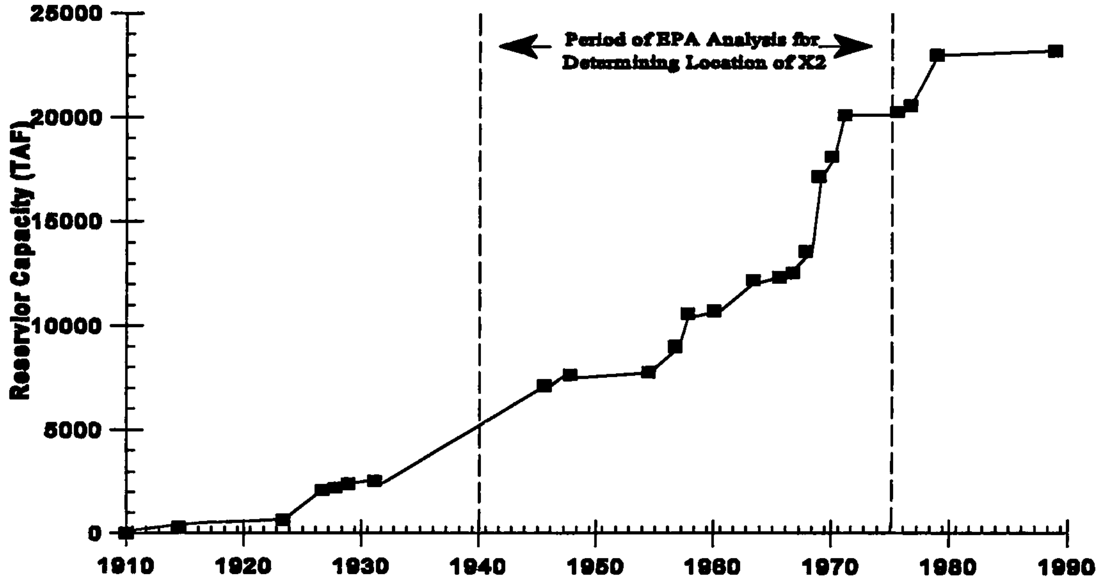


FIGURE 4

CALCULATED AGRICULTURAL AND URBAN WATER USE UPSTREAM OF DELTA, PLUS DELTA CONSUMPTIVE USE

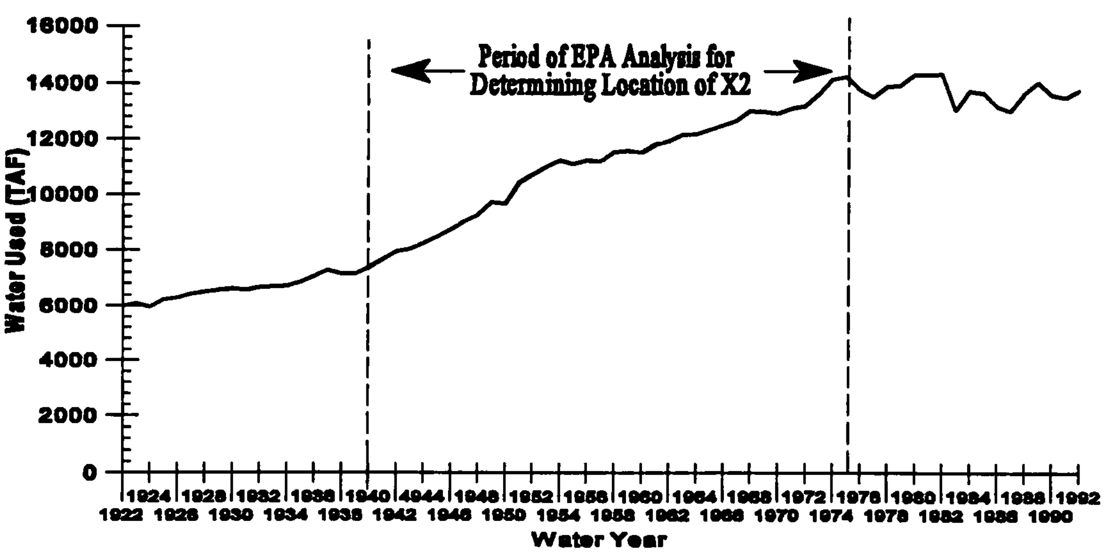


Figure 1

EPA & SWRCB Step Function & Sliding Scale

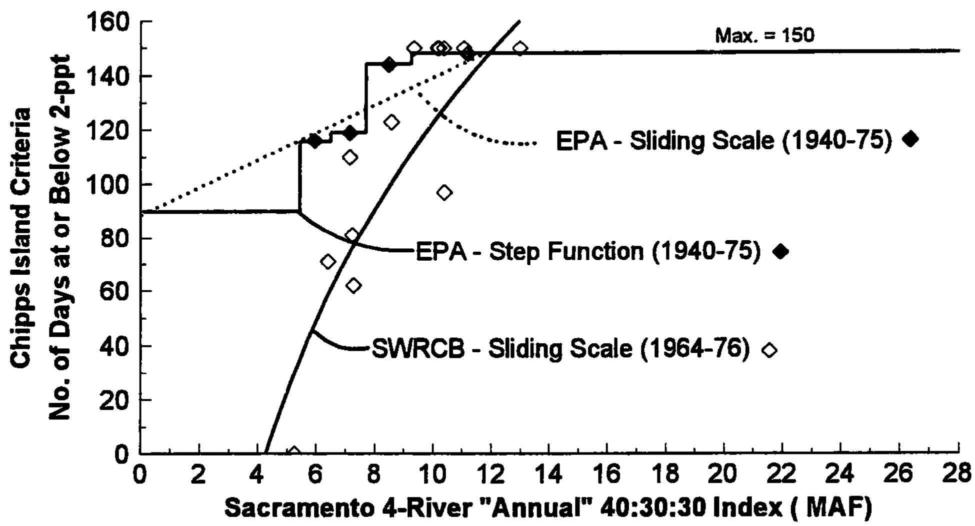
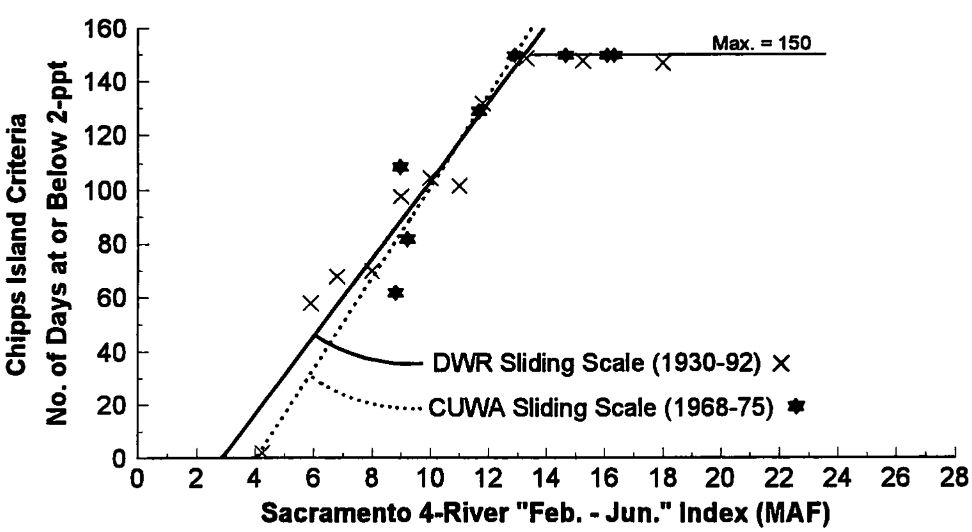


Figure 2

DWR & CUWA - Sliding Scale



The different sliding scale approaches described in Table 1 differ substantially in their assumptions and methodologies and in their results. Because the selection of an appropriate sliding scale is essential to the implementation of an effective estuarine habitat standard, the urban coalition strongly believes that EPA must, in cooperation with the State, other regulatory agencies and other affected parties, carefully consider these and other alternatives to select the most appropriate sliding scale mechanism before any standard can be finalized.

The alternative mechanisms depicted graphically in Figures 1 and 2 can be summarized in the following terms:

<u>EPA</u>. EPA's proposed Estuarine Habitat Standard includes only a rudimentary form of a sliding scale. The X-2 days requirement is a step function illustrated in Figure 1, with a fixed requirement for all years within a given water year classification. This relatively elementary approach results in identical regulatory requirements for years that may vary widely in their weather patterns and runoff conditions and, as noted, could have devastating impacts on project operations.

To respond to these problems, EPA suggests possible refined sliding scales for X-2 requirements at the Chipps Island and Roe Island monitoring points (the Chipps Island sliding scale is illustrated in Figure 1). (59 Fed. Reg. 834-38.) However, the EPA approach remains flawed for several critical reasons.

KW206547

First, the EPA sliding scale does not appropriately adjust to meet the objective of establishing conditions consistent with the late 1960s-early 1970s target period. EPA's period of analysis, 1940 through 1975, was one of rapid growth both in terms of reservoir development and agricultural and urban water use, as illustrated in Figures 3 and 4. In fact, during this period, reservoir capacity in Central Valley reservoirs increased eight fold. Furthermore, the period chosen by EPA was much wetter than either the target period or the full historic record. Because of this growing level of development, the number of X-2 days declines over time -- assuming no change in the hydrologic conditions.

By failing to adjust for the level of development consistent with the late 1960s-early 1970s target period, the EPA sliding scale substantially overstates the number of X-2 days required to meet the regulatory objective of achieving the habitat conditions prevalent during the late 1960s and early 1970s. Accordingly, as depicted in Figure 1, the EPA sliding scale function lies considerably above the sliding scale functions developed by the SWRCB and other agencies.

Second, EPA calculates its sliding scale based on hydrologic data from all months, not just the spring months of regulatory concern. As a result, weather conditions far in advance of, and after, the spring can significantly influence regulatory requirements during the spring.

Third, EPA does not utilize the full range of available hydrologic data. Ultimately, the EPA analysis is based on only four data points -- the average number of X-2 days for four types of water years: wet, above normal, below normal, and dry. As EPA concedes (59 Fed.Reg. 834) its analysis period does not include <u>any</u> critical years or any droughts, such as occurred from 1928 through 1934, in 1976 and 1977 and from 1987 through 1992. Instead, critical year X-2 requirements are extrapolated based on a quadratic function fitted to these four data points.

<u>California Urban Water Agencies</u>. The sliding scale proposed by CUWA and illustrated in Figure 2 was estimated from an ordinary least squares (OLS) regression of annual data during the target period, 1968 through 1975. This approach accounts for the level of development by only using data from the target period thereby more accurately reflecting conditions in the target period. However, because the CUWA analysis period contains no critical years, the CUWA approach also extrapolates X-2 requirements for these years through a regression method. The CUWA sliding scale is based on the February-June Sacramento Four River Index and, therefore, does not distort X-2 requirements during the spring months based on weather conditions outside this period. Although the CUWA method does not use the full range of data available, its results are very similar to the sliding scale estimated by DWR.

<u>State Water Resources Control Board</u>. SWRCB staff have developed the sliding scale illustrated in Figure 1. The SWRCB

sliding scale is estimated from an OLS regression using annual data from 1964 to 1976. Like EPA, the SWRCB sliding scale is estimated using data from all months and not just the spring months. However, unlike EPA, the SWRCB approach utilizes data nearer the target period, thereby adjusting for the level of development characteristic of the late 1960s and 1970s. For this reason, the SWRCB sliding sale requires substantially fewer X-2 days than does the EPA method, especially during drier years.

<u>Department of Water Resources</u>. The DWR method illustrated in Figure 2 is the only sliding scale that uses all available DAYFLOW data from the full period of record, 1930 to 1992. These data are then adjusted by DWR to reflect the 1975 level of development, in order to approximate conditions in the target period. The DWR methodology uses February-June runoff data, and the DWR sliding scale represents a "best fit" linear approximation to 11 average X-2 runoff points calculated from 9-year moving averages. Compared to the CUWA methodology, the DWR method results in a slightly higher requirement for X-2 days during critical years.

(c) <u>Although Additional Analysis is Strongly Recommended, Use of the CUWA Sliding Scale Consistent With the Proposed Urban Alternative is Superior to the EPA Sliding Scale.</u>

EPA's proposed step function for establishing X-2 requirements is seriously flawed. The EPA sliding scale ranks lowest with respect to the criteria discussed above for an appropriate sliding scale mechanism. The EPA approach relies on a limited period of analysis, uses hydrologic data from months outside the period of regulatory concern and does not accurately reflect conditions as they actually occurred in the target. For these reasons, the urban coalition strongly recommends that neither the EPA step function nor the EPA sliding scale be used to determine X-2 day requirements.

The use of the CUWA sliding scale, consistent with the alternative standard recommended by CUWA, is superior to the EPA approach. In the alternative narrative estuarine habitat standard prepared by these comments, the urban coalition incorporates a sliding scale equation consistent with the CUWA approach. Either the DWR or SWRCB methods would also be superior to the EPA approach. The urban coalition believes that development of a sliding scale equation similar to DWR's approach, based on an analysis of the full period for which DAYFLOW data are available (1930-1992) should be pursued. Overall, the urban coalition strongly recommends that additional analysis be conducted to identify the most appropriate sliding scale mechanism before a final estuarine standard is developed.

(d) A Chipps Island Rather than Roe Island Standard Would be More Effective

Unlike EPA's Proposed Rule, the urban coalition alternative estuarine standard does not identify Roe Island as a compliance monitoring location. The reason for this change is two-fold. First, SWP and CVP reservoirs located upstream of the Delta lack the capacity to release enough controlled outflow to regulate salinity at Roe Island on a continuous basis -- when recreational safety, flooding, travel time, and upstream riparian water rights constraints are taken into account. (Gerald Cox, Pers. Comm., March 1994) Moreover, even if sufficient release capacity did exist, the volume of controlled release required would likely increase the frequency of overtopping of downstream by-pass weirs, thus creating a situation where winter-run salmon are diverted onto agricultural fields in the Sutter and Yolo bypasses. (Id.)

Second, based upon an extensive analysis of the relevant data sets, it is apparent that locating X-2 at Chipps Island will produce a greater opportunity for higher Delta smelt abundance than if X-2 is located at Roe Island. To a considerable degree, this improvement in the opportunity for increased Delta smelt abundance occurs as a result of more appropriate placement of the entrapment zone. According to the testimony presented during the Phase I hearings conducted by the State Board in 1987, when the upper limit of the entrapment zone (X-2) is placed at Chipps Island (74 km east of the Golden Gate Bridge), the length of the entrapment zone would be about 16 km, extending downstream throughout Honker and Suisun Bays to the Carquinez Strait (km 58). (Testimony of Phil Williams, SWRCB Hearings, 1987.) However, when flows are released to meet EPA's proposed Roe Island standard, the entrapment zone is shifted downstream into a less desirable geographic location for estuarine habitat in the Carquinez Strait. (Id.) Furthermore, measurements in these shallow shoals, tidal flats and marshes show that phytoplankton growth rates are ten times as productive as deeper channel areas (Cloern et al 1983, Arthur and Ball 1978-80) and many larval and juvenile fish rapidly grow in these high food densities areas (Moyle and Cech 1988). In short, by measuring compliance through X-2 at Chipps Island, rather than Roe Island, the urban coalition provides more opportunity for improved Delta smelt abundance -- and does so at a substantially reduced water cost to competing users.

By relating X-2 to Chipps Island, the urban coalition alternative also provides more protection to the winter-run salmon -- the Estuary's other ESA-listed, fish species. As explained in Appendix 1 hereto, locating X-2 at Roe Island will, in many years, require a much larger volume of freshwater to be released from upstream reservoirs than if X-2 is located at Chipps Island. The release required by EPA during the February-June period in fact is so large, that it will significantly impair the ability of the CVP and SWP to maintain reservoir carryover storage. According to analyses developed by DWR, the average reduction in carryover storage is 900,000 acre-feet per year compared with conditions under D-1485. This impact assumes operations without a margin of safety to ensure compliance with the standards; with such a margin of safety, impacts would be substantially greater. (DWR Model Runs, Memo to EPA, Sept. 1993.) This loss of carryover storage is so substantial that it renders Shasta Reservoir incapable, in many years, of meeting the cold water release requirements mandated by the National Marine Fisheries Service ("NMFS") to avoid jeopardy to the winter-run salmon. (Appendix 1, p. 19.)

Measuring X-2 days at Chipps Island, on the other hand, as provided by the urban coalition alternative, does not produce the severe loss of carryover storage provoked by EPA's proposed rule. Instead, a sufficient cold water pool will remain more frequently in Shasta Reservoir at the end of June to meet required temperature criteria mandated by NMFS. In sum, the urban coalition alternative will provide significantly more protection to <u>both</u> of the Estuary's listed species than the rule proposed by EPA.[1/]

1/ The urban coalition alternative will provide enhanced protection to Delta smelt and winter-run chinook salmon - the estuary's most sensitive species - without a substantial loss in protection for other species. As explained in Appendix 1, data from various biological surveys are consistent in showing that, for a variety of fish and macroinvertebrate species, abundance is increased when spring flows are sufficient to locate the 2 ppt salinity gradient in the general vicinity of Chipps Island (whether the true biological mechanism is in response to outflow, salinity or other conditions occurring within Suisun Bay as an indicator of suitable habitat has not been resolved). Although the available scientific data do not support a conclusion that species abundance will always be highest when the median location of the 2 ppt isohaline is between 68 and 80 kilometers from the Golden Gate, the scientific data do show that the probability of strong year classes (high juvenile abundance) increases for many fish and macroinvertebrate species.

Providing seasonal high flow conditions through uncontrolled stormwater events, while not requiring that a Roe Island standard be maintained through releases from storage, would contribute to variable hydrologic conditions which are thought to be biologically beneficial to a variety of species; would allow for naturally occurring high outflow events that would provide benefit to estuarine dependent species such as longfin
(continued...)

(e) Alternative Measures of Compliance

Finally, the estuarine habitat alternative proposed by the urban coalition incorporates the CUWA recommendation to measure achievement of the desired habitat conditions in three alternative ways. (See Appendix 1, p. 19.) Thus, in addition to measuring X-2 days on an average daily salinity basis, the urban coalition also provides for measurement of X-2 on a 14-day average salinity basis or through the measurement of outflow calculated to maintain X-2 at the appropriate monitoring station. In addition, in order to encourage improvement in Delta habitat conditions, the urban coalition would recognize that changes in the methods for measuring achievement of desired habitat conditions may be revised as appropriate as a result of a process of triennial review.

(f) Urban Coalition Alternative Estuarine Habitat Standard.

The alternative estuarine standard thus proposed in these comments can be stated in the following terms:

> "**Bay/Delta Estuarine Habitat Standard**. The following water quality standard is applicable to waters specified in the Water Quality Control Plan for Salinity for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary ('Bay/Delta'), adopted by the California State Water Resources Control Board in State Board Resolution No. 91-34 on May 1, 1991, which is available from the Water

---

[1](...continued)
smelt, starry flounder, and Bay shrimp as occurred under recent historic conditions; would increase the likelihood of strong year classes for a variety of fish and macroinvertebrate populations inhabiting Suisun Bay; and would avoid or reduce the risk of adverse effects on winter-run chinook salmon and Delta smelt.

Resources Control Board, State of California, PO Box 100, Sacramento, CA 95812.

(a) <u>Water quality criteria</u>. The quality of waters in the Bay/Delta shall be maintained consistent with that level necessary to protect estuarine habitat, fish migration, cold habitat, and other existing beneficial uses.

(b) <u>Measurement of Compliance</u>. Compliance with the water quality criteria in paragraph (a) may be demonstrated by any one or more of the following methods:

(i) attainment of at least 2 ppt salinity (measured as either average daily salinity or 14-day moving average salinity one meter below the surface converted to salinity one meter from the bottom) during the months of February through June for at least the number of calculated days at each station identified in the following equations:

<u>CUWA SLIDING SCALE EQUATIONS</u>

(1) <u>CHIPPS ISLAND:</u>

X-2 DAYS = 16.95 X (FEBRUARY-JUNE SACRAMENTO FOUR RIVER INDEX) -68.33

(2) <u>SACRAMENTO/SAN JOAQUIN RIVER CONFLUENCE:</u>

X-2 DAYS = 11.85 X (FEBRUARY-JUNE SACRAMENTO FOUR RIVER INDEX) +10.19

* X-2 Days should never be less than zero nor greater than 150

The Chipps Island measurements shall be taken at the Mallard Slough Monitoring Site, Station D-10 (RKI RSAC-075) made at the salinity measuring station maintained by the California Department of Water Resources. The Confluence measurements shall be taken at the Collinsville Continuous Monitoring Station C-2 (RKI RSAC-081) maintained by the California Department of Water Resources.

(ii) calculation of sufficient outflow from the upstream Delta watershed to result in the placement at each station identified in the equations in paragraph (b)(i) of the freshwater/saltwater interface, as defined by the location of the 2 ppt isohaline, for at least the number of days calculated during the months of February through June.

(iii) such other methods as may be adopted by the State of California, pursuant to any plan developed in accordance with paragraph (c) or any plan otherwise designed to assure compliance with the criteria contained in paragraph (a).

(c) Implementation. Implementation of the water quality criteria contained in paragraph (a) may be achieved through development by the State of California of a water quality protection plan. In developing any such plan, the State of California shall consider:

(i) State and Federal regulatory authorities and programs necessary to achieve compliance with the plan.

(ii) the use of supplemental numeric criteria consistent with the water quality criteria contained in paragraph (a)(i), including, where appropriate, supplemental numeric criteria for salinity and flow.

(iii) allowances for temporary increases in salinity levels to the extent that control measures to offset the increases are included in the plan.

(iv) the identification of best management practices for the protection of salmon smolt survival.

(v) the development of a comprehensive multi-species monitoring program to ensure that adopted standards do not produce net adverse impacts on the overall Bay/Delta ecosystem.

(vi) the identification of specific monitoring locations and methods, including biological monitoring methods, to be used in determining compliance with the plan.

(D) Sacramento Four River Index. The Sacramento Four River Index of unimpaired flow for a current water year (October 1 through September 30) is a forecast of the sum of the following locations: Sacramento River above Bend Bridge, near Red Bluff; total inflow to

Oroville Reservoir; Yuba River at Smartville, American River, total inflow to Folsom Reservoir. The flow determinations are made and are published by the California Department of Water Resources in Bulletin 120 which is available from the California Department of Water Resources, 3251 S. Street, Sacramento, CA 95816."

(g) EPA Should Not Adopt a Salmon Smolt Survival Index Standard

The urban coalition also recommends as does CUWA, against inclusion of a Salmon Smolt Survival Index Standard to achieve the goal of protecting the survival of salmon smolts on the Sacramento and San Joaquin rivers. The Salmon Smolt Survival Index is not the appropriate method for accomplishing EPA's stated goals because (1) it is not technically valid over a wide range of conditions and operational scenarios likely to occur, (2) compliance with the standard would be impossible under some circumstances and (3) it is, in any event, not a water quality standard within the meaning of the Clean Water Act. In lieu of the proposed Salmon Smolt Survival Index, a basin-wide management plan should be developed by the appropriate federal and state agencies and implemented under their separate authorities to address the full range of variables which affect salmon smolt survival. Consideration should also be given to developing a management plan in combination with the U.S. Fish and Wildlife Service's ongoing Central Valley Project Improvement Act's Anadromous Fish Restoration Plan.

(h) EPA Should Not Adopt a Striped Bass Spawning Standard

The urban coalition further recommends against adoption of a Striped Bass Spawning Standard since: (1) the best available scientific evidence indicates that spawning habitat is not a limiting factor for striped bass populations, (2) actions intended to increase striped bass populations would be inconsistent with the protection of species listed under the Endangered Species Act (winter-run salmon and Delta smelt), (3) extension of the range of striped bass spawning habitat in the Delta would increase their susceptibility to entrainment at SWP and CVP diversions in the southern Delta, and (4) actions to improve salinity during dry and critical years for striped bass spawning in the lower San Joaquin River are severely limited by existing requirements to close the Delta Cross Channel gates for winter-run salmon outmigration.

Rather than promulgation of a rule with the foregoing deficiencies, the members of the urban coalition strongly believe that striped bass spawning habitat would be more effectively improved through a multi-species planning effort consistent with USFWS and NMFS recovery plans for Delta smelt and winter-run salmon, that is consistent with the State's program to regulate and control agricultural drainage.

(i) <u>The SWRCB is the Appropriate Agency to Adopt Standards for the Bay/Delta</u>

These comments also take the position that the State of California, acting through its State Water Resources Control Board ("SWRCB") is the appropriate entity to adopt standards. To this end, on December 15, 1993 the Governor of California directed the

SWRCB to work with EPA for the purpose of establishing an acceptable regulatory plan for the Bay/Delta Estuary and concluded that the basis for such a plan should be the Triennial Review Process outlined in the Clean Water Act. It is the urban coalition's understanding that the SWRCB will commence workshops for this purpose in mid-April, 1994. These comments recommend that, in order to avoid a State-Federal confrontation over the scope of EPA's jurisdiction to set standards for the Bay/Delta Estuary, EPA should work with the SWRCB to develop Bay/Delta standards which incorporate the proposals set forth herein. The State of California should then submit the results of its review to EPA, as appropriate, under Sections 208, 303 and other sections of the Clean Water Act.

It should also be understood that although the alternative estuarine habitat standard proposed by these comments will result in a smaller water cost to competing consumptive uses of Delta water compared with EPA's proposed standards, the cost, nonetheless, remains substantial. According to preliminary analyses prepared by DWR, substitution of the urban coalition alternative for EPA's proposed estuarine habitat standard will result in an annual water supply reduction to urban and agricultural water users of approximately 1.2 million acre-feet on average in critically dry years, compared with existing limitations imposed by Decision 1485.[2/] Such reductions, as applied to urban users,

---

2/ This preliminary estimate of impact does not include certain of the modifications suggested by the California Urban Water (continued...)

will continue to create significant, adverse environmental, economic and social effects within urban areas reliant upon water from the Bay/Delta watershed, unless, implementation measures are developed to minimize enviromental and economic impacts.

(j) <u>The Urban Coalition Urges Developement of Implementation Measures Which Minimize Economic and Environmental Impacts of Bay/Delta Standards</u>

Decisions about implementation can dramatically reduce the water supply cost of the urban coalition alternative. In order to provide for the mitigation of such costs, the appropriate regulatory agencies should: (1) rely more on water transfers to accomplish Bay/Delta environmental objectives; (2) appropriately spread the obligations imposed by Bay/Delta standards to <u>all</u> responsible parties within the Bay/Delta watershed; and (3) incorporate a mechanism for a phased compliance schedule for the standards.

The innovative implementation strategy which is needed for this purpose can be accomplished only if the protective measures ultimately adopted for the Bay-Delta Estuary are developed at the appropriate regulatory level and are flexible enough to accommodate the progressive solutions required. EPA must assure that it takes no action under color of its Clean Water Act

---

[2](...continued)
Agencies (see Appendix 1) including, for example, the alternative means of measuring compliance (daily salinity, 14-day average salinity or equivalent outflow). If these modifications are made, it can be expected that the impact of the Urban alternative may be further reduced.

authority that would limit the ability of the State to develop and implement those solutions. Moreover, EPA must consider the interrelationships between its proposals and parallel regulatory actions by NMFS and USFWS under the ESA and work with those agencies so that, in combination, these federal actions do not foreclose cost-effective implementation.

To this end, these comments urge EPA -- both in its Clean Water Act role and through its membership in "Club Fed" -- to ensure that implementation of the Endangered Species Act by NMFS or USFWS will not impede development of the following mitigation measures by the SWRCB:

- Assurance of access by urban and agricultural water users to cross-Delta water transfers;
- Development of a phased compliance schedule for the implementation of Bay-Delta standards which progressively involves <u>all</u> responsible Estuary water users;
- Establishment of a water supply impact threshold beyond which the standard would be met with purchased water paid for by an environmental fund established for this purpose;
- Creation of a Restoration Fund to be used for the purchase of additional water, above the "cap," required to meet Bay/Delta Standards in any year;
- Development of a multi-species approach to protect the entire Bay/Delta ecosystem in order to minimize species-by-species listings under the Endangered Species Act;
- Development of a comprehensive biological response monitoring program that fully

investigates the relative impact of all factors influencing estuarine health (e.g. outflow, point source pollution, exotic species, non-point source pollution); and

- Assurance that standards can be modified as physical habitat improvements are made in the Bay/Delta watershed.

We turn to a more complete discussion of the points summarized hereinabove.

III.

AS PROPOSED, THE EPA STANDARDS WILL HAVE A SIGNIFICANT ADVERSE IMPACT IN THE URBAN AREAS OF CALIFORNIA RELIANT UPON DELTA WATER

(a) Environmental Impacts.

The water quality standards proposed by EPA for the Bay/Delta Estuary would have far reaching effects outside the Estuary itself. In particular, reduced diversions of water from the Estuary and its watershed could trigger a wide range of impacts in urban areas which depend upon Delta water, including degradation of fish and wildlife habitat, conflicts with regional water quality control plans, curtailment of groundwater replenishment, degradation of air quality, and impacts on regional recreational use at surface storage facilities. Furthermore, there could be impacts on the amount of water available for direct use and storage, greater fluctuations in local reservoirs, and reductions in the ability to develop additional reclaimed water supplies.

As a result of the foregoing, a range of direct and potentially significant environmental effects could occur. The following is a summary of these potential effects; each of which is classified as "significant" under guidelines developed by the State of California to implement the California Environmental Quality Act (California Public Resources Code Section 21000 et seq.; CEQA Guidelines § 15064):[3/]

(i) Groundwater-Related Impacts: Groundwater replenishment in urban areas served with water diverted from the Delta is essential for maintaining the integrity of local water supplies. If water supplies from the Bay/Delta watershed are significantly reduced, groundwater resources in areas dependent upon this water would be affected. The effects upon groundwater generated by such a reduction would likely include the following:

- Conjunctive-use programs reliant upon Delta water could be curtailed and possibly abandoned. The benefits to the affected basins related to water quality and dependable supplies could be lost.
- There could be a reduction in annual groundwater replenishment, resulting in the drawdown of groundwater supplies in the affected basins. This drawdown could result in overdrafting of basins and the substantial depletion of groundwater storage in the region.
- Water quality in the basins could deteriorate due to: a) a reduction in high quality

---

[3/] See John T. Gray, "Environmental Impacts of the Proposed EPA Bay/Delta Water Quality Standards in the Service Areas of the Bay/Delta Urban Coalition", March 11, 1994, attached hereto as Appendix 2.

replenishment water; b) accelerated contaminant plume migration as drawdown of basins occurs; 3) further degradation of contaminated of basins if imported water for remediation is curtailed; and d) degradation of coastal basins if imported water for seawater intrusion barrier programs is reduced.

- Increased drawdown of groundwater due to reduced replenishment could cause a consolidation of water-bearing formations and/or changes in the chemical environment in the aquifer reducing storage and/or recharge capabilities. This condition has occurred historically in the San Jacinto, San Joaquin and Santa Clara valleys. In Santa Clara, in fact, subsidence was not corrected until 1968 with the arrival of Delta water supplies provided by the State Water Project.

- The depletion of groundwater basins could cause localized land subsidence and its resultant impacts on recharge capabilities, wells, structures, roadways, and utilities. Incidents of subsidence and major geologic hazards due to groundwater withdrawal have already been documented in San Bernardino, Riverside, and Los Angeles counties.

(ii) Increased Energy Use: Reduced deliveries of imported water from the Bay/Delta watershed could encourage activities which result in the use of large amounts of fuel, water, or electrical energy in many urban areas served by the urban coalition agencies. Presently, the majority of SWP supplies delivered to urban areas are directly consumed by the municipal and industrial sector and used to replenish groundwater basins. If the amount of groundwater replenishment supplies is decreased, groundwater levels would lower and consequently pumping lifts would increase. These increased pumping lifts would require the use of additional electrical power from existing power plants or require the construction of new plants.

(iii) Air Quality Impacts: Increased energy use for additional groundwater pumping could result in increased emissions of air pollutants and increased frequency of regional air quality violations in urban areas which receive Bay/Delta water supplies. These increased air pollutants primarily include NOx, reactive hydrocarbons and ozone.

(iv) Water Quality Impacts: The following impacts could substantially degrade water quality in urban areas which receive Bay/Delta watershed supplies.

- Increased concentration of regulated contaminants in the drinking water supply due to a reduction in Bay/Delta watershed supplies to blend with poorer-quality well water.
- Increased levels of total dissolved solids (TDS), nitrates, and other contaminants in wastewater treatment and reclamation effluent due to a reduction in Bay/Delta watershed supplies.
- Increased levels of TDS, nitrates, and other contaminants in groundwater basins because less Bay/Delta watershed supplies, which have lower TDS, would be available.

(v) Fish, Wildlife, Plant, and Endangered Species Habitat Impacts: Imported water from the Bay/Delta watershed that is stored in reservoirs or discharged into streams frequently creates or supports wetland, riparian, and fishery habitats. EPA's proposed standards would reduce deliveries of imported water from the Bay/Delta watershed, thereby diminishing local habitat. In particular, reduced imported water supplies could adversely affect wetland, riparian, and fishery habitats by: 1) reducing urban and agricultural runoff into natural and constructed water courses; and 2) reducing discharges from wastewater treatment (reclamation) plants into spreading ponds or watercourses.

In addition, these reductions could substantially affect species listed as threatened or endangered under the state and federal endangered species acts that are restricted to wetland and riparian habitats. For example, the summer base flow in the Santa Ana River at Prado Basin is due entirely to discharges from upstream wastewater treatment plants. This artificial runoff creates wetlands for a small bird, the least Bell's vireo, and other listed species. A reduction in Delta water supplies currently relied upon for water use in export areas could thus affect habitat for these, and other, threatened or endangered wetland species.

(vi) <u>Conflicts with Regional Water Quality Control and Environmental Plans</u>: A reduction in imported water that adversely affects groundwater supply and water quality could also be in conflict with adopted environmental plans and goals of the communities served with Bay/Delta watershed supplies. Many regional water quality basin plans, adopted by California regional water quality control boards, contain water quality objectives designed to reasonably protect the beneficial uses of groundwater and surface water, increase the importation of high-quality water, and increase wastewater reclamation.

(vii) <u>Negative Aesthetic Impacts</u>: A reduction in Bay/Delta watershed supplies to urban areas could have a negative aesthetic effect on the visual and landscape features of a community. A reduction in imported water supplies could result in reduced water available for irrigation or landscaping in urban areas. The degradation or loss of urban greenery, in turn, could result in substantial changes in the visual setting and landscape features of a community or an individual public facility.

(viii) <u>Reduced or Modified Recreational Opportunities at SWP Surface Storage Facilities</u>: A reduction or seasonal restriction of imported water could also result in lower reservoir levels and greater fluctuations in water surface elevations, particularly during the summer when recreational demands are the highest. Lower water levels and greater fluctuations in these reservoirs could adversely affect, and possibly preclude, recreational activities.

Because of the potentially significant environmental impacts identified above, the alternative standard hereinabove proposed in these comments should be preferred since it would result in a substantially reduced water supply impact with a consequentially reduced impact on the numerous environmental uses outside the Delta that are dependent upon imported Delta water.

(b) The Draft Regulatory Impact Analysis Significantly Understates the Economic Impacts of the Proposed Rule.

The stated purpose of EPA's Draft Regulatory Impact Analysis (Draft RIA) is to estimate the economic impact of proposed water quality standards for the Bay/Delta Estuary. An analysis of the Draft RIA prepared by Foster Associates, Inc. concludes, however, that the RIA is significantly flawed because it greatly underestimates the economic impacts of the proposed standards.

When simple corrections are made in the RIA analysis, estimated annual average urban costs increase. Under EPA's Scenario 1, urban cost estimates increase from $79 million to $117 million. In EPA Scenario 2 the cost estimates increase from $50 million to $101 million. If less optimistic assumptions are adopted, these cost estimates are increased further. Costs in critically-dry years could be as high as $700 and $900 million.

Similar underestimates appear in the RIA's discussion of agricultural impacts. Extrapolation from the RIA's estimated agricultural costs suggest that when an adequate base-case analysis is specified, agricultural cost estimates would also increase, from

GKW206547

$20 milllion to $29 million for Scenario 2, and from $8 million to $19 million for Scenario 3.

The major problems in the Draft RIA are discussed in detail in Appendix 3 and can be summarized as follows:

- An assumption was made that water diversion reductions resulting from implementation of the proposed standards could be allocated between urban and agricultural users on a 20/80 percent ratio. There is no substantiation for this assumption nor is there any analysis to consider other likely outcomes;

- Assumptions regarding the ability to mitigate water supply reductions with voluntary water transfers as a result of the proposed standards are highly questionable given "take" limitations imposed on the state and federal water projects and other water project operational constraints to protect species listed under the Endangered Species Act;

- The cost of reclaimed water as a substitute supply to mitigate impacts from the proposed standards have been significantly underestimated;

- The assumption of reliance on reclamation for alternative water supplies ignores several factors. First, these facilities will take time to construct, and other costs which will be incurred in intervening years have been ignored. Second, some regions have limited markets for non-potable water. Third, the levels of reclamation presumed are approximately 25 percent of the total potential State capacity for reclamation. This severely limits the urban agencies' ability to respond to future growth;

- The cost of water shortages to industries has been significantly underestimated;

- The cost of water shortages to residential customers has been significantly underestimated;

- The discussion of the effects of the Critical Habitat Designation for Delta smelt is insufficient and does not adequately describe the potential major economic impacts of such designation;

GKW206547

- Long-term impacts of reduced supplies due to the proposed standards are not separately identified from near-term impacts;
- The base case water supplies assumed in the study are inadequately described and appear incorrect;
- The lack of a description of base case water supplies assumed in the study leads to "double counting" of water supplies available for transfer from land fallowing.
- There is no accounting for potential water supply impacts resulting from the need to operate the water projects to provide a "margin of safety" or "buffer" to assure compliance with a salinity standard. Inclusion of this margin of safety could increase the urban economic impacts by over 3 to 4 times the estimates presented in the RIA;

As explained later in Part VII of these Comments, the above-described deficiencies in the Regulatory Impact Analysis promulgated in connection with the Proposed Rule are, collectively, so significant that they preclude compliance with EPA's obligations under the Regulatory Flexibility Act (5 U.S.C. Section 603) and Executive Order 12291.

IV.

THE TECHNICAL MODIFICATIONS PROPOSED BY THE CALIFORNIA URBAN WATER AGENCIES SHOULD BE INCORPORATED INTO STANDARDS ADOPTED FOR THE BAY-DELTA ESTUARY

The California Urban Water Agencies ("CUWA") conducted a four month review and analysis of EPA's proposed rule, the scientific basis for the proposed rule, the potential water costs associated with likely compliance scenarios, and a number of refinements to the proposed rule. The following are the key technical modifications proposed by CUWA which are presented in detail in its Technical Report appearing in Appendix 1 attached hereto:

(a) The Proper Historical Reference Period For the Standard. CUWA proposes that the period 1968 through 1975 is appropriate for determining the number of days of compliance rather than the period 1940 through 1975. CUWA states in its comment letter to EPA, dated March 1994:

> "For a given Sacramento River Index, the number of days of compliance at the Confluence and Chipps Island would be determined based on a weighted least squares regression of the hydrology during the period of 1968-75, a period for which measured salinity data are available. Extending the period to include the extreme events (such as flood alternating with drought from 1976 through 1992) is unnecessary because it does not appear to significantly alter the results of the 1968-1975 regression."

(b) February Through June Runoff Index. CUWA proposes that the February through June Sacramento runoff index should be used for determining compliance:

> "The Sacramento River Index for the period of February through June will be calculated at the beginning of the compliance period and updated at least monthly. The February-June Sacramento River Index is the appropriate index because it is the best estimate of the available water supply during the regulatory period." (CUWA, 1994.)

(c) Smoothing Function. To allow for the standard to appropriately reflect changed hydrologic conditions within a year

GKW206547

and variation in magnitude of runoff within year types, CUWA proposes a smoothing function rather than discrete year types for determining the number of days of compliance:

> "The number of days of compliance at each point would be updated at each re-calculation of the Sacramento River Index, but would not exceed the number of days remaining in the regulatory period. This approach is preferred because it will best reflect hydrology during the regulatory period, while other indices take into account other factors which may be unrelated to accomplishing the goal of providing transport and brackish water habitat during the critical winter-spring period". (CUWA, 1994.)

(d) Three Methods For Compliance. To eliminate the need for a "confidence interval (buffer zone)," CUWA proposes a three-way compliance methodology which allows for meeting an estuarine habitat standard through either salinity or flow:

> "Compliance would be based on achieving any one of the following requirements at the compliance point: 1) average daily salinity of 2 ppt at the compliance point, or 2) 14-day average salinity at the compliance point, or 3) maintenance of an outflow calculated to maintain an average X2 at steady state condition. This will prevent short-term extreme wind or tidal events from inappropriately causing non-compliance, as long as the required outflow is provided". (CUWA, 1994.)

(e) Comprehensive Monitoring And Research Program. CUWA proposes a monitoring and research program as follows:

GKW206547

"The appropriate agency(s) should develop a comprehensive monitoring and research program which would result in better understanding of how abundance and distribution of aquatic and marsh wetlands species are related to a full range of potential causative factors in the delta and upstream areas. The purpose of the monitoring program would be to measure how the estuarine standard is meeting its objectives and how other actions, such as those to restore habitat, are contributing to estuarine health. Any regulatory approach should allow for incorporation of the results of this program in the future. This is important because any standard must reflect changed conditions in the estuary to ensure that it continues to meet its goal of protecting beneficial estuarine habitat uses". (CUWA, 1994.)

(f) Compliance Schedule. CUWA proposes a compliance schedule for Bay/Delta standards as follows:

"To avoid confusion and thus ensure orderly and prompt compliance, a compliance schedule should be established which would phase in requirements dependent upon a schedule for all Delta watershed users to appropriately share water supply impacts. Also, phasing is appropriate in recognition of the need for operators to develop procedures for compliance, and the need for the State Water Resources Control Board to address water allocation issues". (CUWA, 1994.)

(g) Salmon Smolt Survival Index. CUWA proposes elimination of the Salmon Smolt Survival Index:

"The Salmon Smolt Survival Index proposed under the Fish Migration and Cold-Water Habitat Criteria was developed by USF&WS, which has often noted that there are limits to its application. Consistent with the concerns of the USF&WS, CUWA analysis of the proposed

Fish Migration and Cold-Water Habitat Criteria indicates that the proposed criteria is not the appropriate tool for accomplishing EPA's stated goals. Because the index is not valid over a wide range of conditions and operational scenarios likely to occur, compliance with the standard would be impossible under some circumstances, regardless of water project actions." (CUWA, 1994.)

(h) <u>Striped Bass Spawning Standard</u>. CUWA also proposes deletion of the suggested striped bass spawning standard for several reasons:

"A striped bass spawning standard should not be set as proposed because 1) spawning habitat is not generally considered as the limiting factor in striped bass populations, and 2) actions intended to increase striped bass populations would be inconsistent with the protection of threatened and endangered species (winter-run chinook salmon and delta smelt). The goal of the proposed rule is to increase striped bass spawning success by reducing electrical conductivity in the San Joaquin River. Implementation of any standard should be coordinated with and consistent with USF&WS and NMFS recovery plans for threatened and endangered species. Such action should also be consistent with the State's program to regulate and control agricultural drainage." (CUWA, 1994.)

Each of the above technical modifications was incorporated into the following key points submitted on behalf of CUWA:

- CUWA recommends adoption of a Suisun Estuary protection standard, to be met at the Confluence and Chipps Island, which would provide a level of protection for the Estuary as effective or more effective than the EPA proposal in protecting estuarine habitat and fishery resources and is fully consistent with EPA's stated goals, with lower water supply impacts. CUWA does not support extending the standard to include Roe Island/Port Chicago because this may result in counter-productive environmental effects.

- The goals of EPA's proposed Fish Migration and Coldwater Habitat Criteria are not met by the EPA proposal but are rather more appropriately addressed by a basin-wide management plan developed to control the full range of variables which affect salmon smolt survival.

- A striped bass spawning standard should not be set as proposed. Action to improve striped bass spawning habitat would be better managed in a multi-species planning effort and should be consistent with USFWS and NMFS recovery plans for threatened and endangered species. Such action should also be consistent with the State's program to regulate and control agricultural drainage.

- Now is the time for action on Delta protective standards. CUWA urges that appropriate standards be promulgated in 1994 through a State and Federal partnership.

The Bay/Delta urban coalition supports the foregoing technical findings and comments by CUWA (appearing in Appendix 1). It has incorporated them into its proposed alternative Bay/Delta standard appearing in Section II of these Comments. That alternative, as noted earlier, protects Bay/Delta estuarine habitat and fishery resources while minimizing water supply and economic impacts. The urban coalition strongly recommends that this approach be implemented.

V.

THERE IS NO EVIDENCE THAT STRIPED BASS SPAWNING IS LIMITED BY SALINITY; MOREOVER, DELTA CROSS CHANNEL CLOSURES REQUIRED FOR WINTER-RUN SALMON MAKE ATTAINMENT OF THE EPA PROPOSED STANDARD INFEASIBLE IN DRY AND CRITICAL YEARS

EPA is proposing to expand striped bass spawning habitat by lowering salinity requirements and adding compliance points upstream of existing regulatory locations contained in the SWRCB's Water Rights Decision 1485 and 1991 Water Quality Control Plan for Salinity. In addition to arguments presented by the California Urban Water Agencies to oppose setting a striped bass spawning standard (described immediately above in Part IV of the Comments), the urban coalition urges EPA to examine the scientific literature which indicates that striped bass spawning habitat is not a limiting factor for adult striped bass.

A review of 1993 operations of the San Joaquin River and its tributaries by CUWA indicate that the proposed spawning criteria would be difficult, if not impossible, to meet even in a year classified as wet. During April and May 1993, over 100,000 acre-feet of supplemental flows were released down the San Joaquin to meet SWRCB water quality requirements and salmon smolt pulse flow requirements in the winter-run Biological Opinion. If EPA's salinity criteria of 0.44 EC was required during 1993, it would have only been met for a few days during this period. The amount of "additional supplemental" water needed to comply with EPA's proposed criteria at Vernalis during 1993 was estimated to exceed 150,000 acre-feet. (CUWA Report Reference No. 12, pg. 12)

The U.S. Bureau of Reclamation believes that it would be of little use to expand striped bass spawning habitat in the San Joaquin river. Evidence indicates that under present conditions striped bass are not spawning habitat limited (letter USBR to SWRCB August 22, 1990). An examination of the 0.44 EC data on the San Joaquin River using the same sources cited by the California Department of Fish and Game (WQCP DFG Exhibit 25) concluded that "there is no evidence that striped bass spawning is limited at the present time (Hanson HTE-73)." Until more efficient screens are constructed to isolate export pumping from the southern Delta channels, increased spawning habitat past the confluence of the San Joaquin and Old/Middle rivers could cause increased entrainment in the pumps and is unlikely to benefit striped bass numbers.

Turner and Farley in 1971 also examined the hatching rate of striped bass eggs placed in varying degrees of salinity. For electrical conductivities (EC) less than 3.0 mmhos/cm the hatching rate was 95 percent (Turner & Farley 1971; Morgan 1981; Hanson 1990). The 3.0 mmhos/cm EC is considerably higher than the 0.44 mmhos/cm proposed by EPA. Thus, it is reasonable to conclude that striped bass eggs can also tolerate a wider variety of salinities.

Dr. Charles Hanson testified without contradiction before the State Water Resources Control Board during Water Quality Control Plan Hearings that "there is no evidence that striped bass spawning is habitat limited at the present time." (SWRCB Testimony August 20, 1990) Dr. Hanson cited Farley 1966, Turner 1976, and Farley and turner 1971 to support his testimony.

Further, if striped bass spawning habitat is expanded by providing lower salinity water on the San Joaquin River between Prisoners Point and Vernalis, it is likely that increased spawning activity would occur near the head of Old River Head and would increase the susceptibility of striped bass eggs and larvae to entrainment by State, federal and local diversions. Such an outcome would be unfortunate and completely unnecessary since adequate spawning habitat presently exists.

Finally, EPA's proposed striped bass standard will be difficult if not impossible to meet with the Delta Cross Channel gates closed as required by the long-term winter-run chinook salmon Biological Opinion. Without allowing lower salinity water from the Sacramento River to be conveyed through the Delta Cross Channel and blended with higher salinity San Joaquin River inflow to the Delta, compliance with the proposed standard would be difficult, if not impossible, between Prisoners Point and Jersey Point on the lower San Joaquin during dry and critical years.

VI.

<u>ANY FEDERAL OR STATE REGULATIONS IMPOSED TO PROTECT BAY/DELTA SPECIES MUST BE SUFFICIENTLY FLEXIBLE TO ALLOW THE USE OF CROSS-DELTA WATER TRANSFERS TO AMELIORATE WATER SUPPLY IMPACTS</u>

Access to cross-Delta water transfers is essential if the urban economy of California is to minimize the economic impacts of Bay/Delta regulations intended to protect and restore the Bay/Delta environment. However, because of the location of state and federal water project diversions, constraints on operations of these projects continue to increase, resulting in greatly reduced water supply reliability and reduced cross-Delta transfer capabilities. In addition to flow requirements, severe export and "take" limits are imposed in every month of the year pursuant to biological opinions issued for the winter-run salmon and Delta smelt.

The Department of Water Resources has estimated that approximately 600 TAF will be available for transfer based on the experiences of the 1991 and 1992 Drought Water Bank (DWR Draft Bulletin 160-94, p. 305). However, such estimates do <u>not</u> account for the impact of "take" limits which could limit the ability of the water projects to transport the water made available for transfer.

Because access to a geographically diverse water market (including water transfers from north of the Delta to south of the Delta) allows existing users to mitigate water losses from regulatory actions with less adverse impacts to the economy, State and federal regulatory agencies, including EPA, must work cooperatively with the urban coalition, and others, to identify voluntary water transfer strategies. Such strategies should: 1) be consistent with environmental protection and restoration efforts; 2) provide necessary flexibility to water project operators and existing users to protect urban supply reliability and California's economy; and 3) generate upstream environmental benefits. EPA, as a member of Club FED, should work aggressively with other regulatory agencies to secure the transfer strategies described above in order to achieve environmental objectives in an economically responsible manner.

VII.

SERIOUS QUESTIONS EXIST REGARDING THE SCOPE OF EPA'S JURISDICTION, THE LEGAL VALIDITY OF THE PROPOSED STANDARDS AND THEIR APPLICABILITY. IT IS THUS IMPORTANT THAT EPA WORK WITH THE STATE TO DEVELOP BAY-DELTA STANDARDS WHICH INCORPORATE THE URBAN ALTERNATIVE

The urban coalition alternative package of protections for the Bay/Delta estuary is intended to meet the goals of EPA's proposal while reducing adverse impacts upon urban water supply reliability. The urban coalition also believes that it is the State which should play the primary role in adopting and implementing the protections they propose. Indeed, a prime goal of the Urban alternative is to define a regulatory program which not only does a better job of protecting beneficial uses of the Bay-Delta Estuary, but which also better respects the delineation of authority between the State and Federal governments established by Congress in the Clean Water Act.

(a) Only the State of California Is Fully Capable of Making the Comprehensive Water Quality/Water Resources Allocation Decisions Required to Protect the Bay/Delta Estuary.

Sections 101(b), 101(g) and 510 of the Clean Water Act expressly leave water planning, water resource allocation and the regulation of water project operation -- the type of activity directly implicated by EPA's proposed standards -- to the States. In turn, the State of California has developed a sophisticated and comprehensive mechanism for the coordinated implementation of the policies outlined in the CWA. Given the clarity of Congress' direction as well as the availability of an adequate State regulatory mechanism, EPA must be careful not to intrude on State authority.[4]

4/ Among the concerns which arise with respect to the Proposed Rule is that, by requiring the State of California to fully implement the draft standards by imposing them on the State Water Project, the Proposed rule violates the Tenth Amendment of the United States Constitution.

The SWP is the largest public works project in California. It is wholly owned and operated by the State in its sovereign capacity and has never received a federal subsidy with respect to its construction, operation or maintenance. Moreover, the SWP serves a traditional State function -- the provision of a public water supply -- and is essential to California's functioning as a State.

(continued...)

California law delegates to the State Water Resources Control Board ("SWRCB") broad authority to regulate both water quality and water resource allocation. (See United States v. State Water Resources Control Bd., (1986) 182 Cal.App.3d 82, 109, 113) Under the Porter-Cologne Water Quality Control Act, (Cal. Wat. Code §§ 13000 et. seq.) the SWRCB is the agency authorized to exercise any powers delegated to the State by the Clean Water Act (Cal. Wat. Code § 13160); to formulate and adopt State policy for water quality control (Cal. Wat. Code § 13140); and to adopt water quality control plans for waters for which water quality standards are required by the CWA (Cal. Wat. Code § 13170).

Under its separate, but related, water rights allocation authority, the SWRCB is authorized to take all appropriate proceedings or actions to prevent waste and unreasonable use of water (Cal. Wat. Code § 275); to permit and condition the appropriation of water (Cal. Wat. Code §§ 1200, et. seq.); to consider water quality control plans and fish and wildlife needs when

---

[4/](...continued)
While the Supreme Court has recently characterized its Tenth Amendment jurisprudence as following an "unsteady path" (New York v. United States (1992) ___ U.S. ___; 120 L.Ed.2d 120, 140), there is little doubt that a federal effort to regulate (1) an activity of traditional State regulation or management such as water supply; (2) carried out by a State acting in its sovereign capacity through a project which receives no federal subsidy; (3) for the purpose of serving a vital State interest; (4) where reasonable expectations regarding the State activity have been created and reliance on that activity has occurred; and (5) where there is equivalent State legislation which can be, and is, enforced by the State, would offend the Tenth Amendment. In the present situation, all of the foregoing factors are met with regard to the State Water Project.

permitting or conditioning an appropriative right (Cal. Wat. Code §§ 1243, 1258); and to condition all water rights, where appropriate, to protect the public interest and public trust. (United States v. SWRCB, supra; National Audubon Society v. Superior Court (1983) 33 Cal.3d 419, 446; Environmental Defense Fund v. East Bay Mun. Utility Dist. (1977) 20 Cal.3d 327.)

In short, the SWRCB is statutorily armed with the authority to develop, adopt and implement the types of water quality control/water resource regulatory actions proposed by EPA. Moreover, it was recently directed by the Governor to do so. On December 15, 1993 the Governor of California expressly requested the SWRCB to:

> "Work with the Environmental Protection Agency to set up a joint process for establishing an acceptable regulatory plan for the Delta. The basis should be the Triennial Review Process outlined in the federal Clean Water Act."

To that end, the Chairman of the SWRCB recently testified on January 25, 1994 at a legislative hearing in Sacramento that the SWRCB would commence hearings for such purpose in the near future. Further, on February 24, 1994 in hearings conducted by EPA with respect to the proposed standards, Douglas Wheeler, the Secretary of Resources for the State of California announced the SWRCB " will initiate a review of its water quality control plan by the end of April." The urban coalition understands that a workshop intended to commence the SWRCB process will be held in mid-April.

(b) Congress Has Specifically Left Control Of Salinity Conditions And Salinity <u>Intrusion To The States.</u>

While Section 303(c) of the Clean Water Act provides EPA with the authority to review State-proposed "water quality standards" and to adopt its own standards if a State fails to adopt appropriate standards, review of the legislative history and the relevant case law shows that such authority does not extend to the control of salinity intrusion. Instead, Congress provided that the power to regulate salinity intrusion would remain with the States to be exercised through the areawide waste treatment planning process of section 208 of the Act.

Section 208, adopted in the Clean Water Act of 1972 ("1972 Amendments"), contains the first explicit recognition of salt-water intrusion as an activity subject to the Act. It requires the States to designate management areas and an organization to develop a management plan, and specifies the requirements of the plan. The plan must "if appropriate" identify salt-water intrusion problems "resulting from reduction of freshwater flow" and set forth procedures and methods, "to the extent feasible," to control such intrusion "where such procedures and measures are otherwise a part of the waste treatment plan." (CWA § 208(b)(2)(I).) The plans must be submitted to EPA for approval, but significantly, <u>EPA has no authority to adopt its own areawide waste-treatment plan</u>.

Until section 208 was enacted, salt-water intrusion caused by upstream diversion was not included within the Act's regulatory scheme. The Senate Report discussing the need for section 208 explained that:

> "The present Federal water pollution control program does not consider degradation of water caused by reduction in fresh water flows which produce the intrusion of salt or brackish waters into estuaries and rivers." (Senate Report on S.2770, SR 92-414; A Legislative History of the Water Pollution Control Act ("Legislative History"), Vol. 2, p. 1458.)

The water pollution program in existence at the time this statement was made included section 10(c), the forerunner of section 303(c). As does the existing section 303(c), section 10(c) required the States to adopt water quality standards for submission to the Federal Government (actually, to the Secretary of the Interior, since EPA did not then exist) and authorized the Government to adopt its own standards if the State proposals were inadequate. Thus, while federal water quality standards were required before 1972, they, like the remainder of the Act, did "not consider degradation of water caused by reduction of freshwater flows which produce the intrusion of salt and brackish water." (Legislative History, Vol. 2, p. 1458.)

Congress thus added section 208(b)(2)(I) to the Act in 1972 to authorize appropriate <u>State</u> management and planning to address salt-water intrusion and other nonpoint sources of pollution. Significantly, Congress chose to add this new program through the <u>State</u>-administered Areawide Waste Treatment Management process of section 208 rather than amend section 303(c) to add salt-water intrusion as a subject of EPA control through the water quality standard setting process. Indeed, the 1972 amendment simply "continues the use of water quality standards contained in the existing law" (Conference Report No. 92-1236: Legislative History, Vol. 1, p. 305). As seen, however, the existing section 303 water quality standard process did not include regulation of salt-water intrusion. By continuing the "existing law," Congress continued to exclude salt-water intrusion as a parameter which EPA may regulate pursuant to section 303 water quality standards.

As initially proposed, section 208 simply required the States to control salt-water intrusion, without qualification. The language eventually enacted in Section 208(b)(2)(I), however, requires the States to identify salt-water intrusion only "if appropriate" and to establish procedures and methods to control salt-water intrusion only "to the extent feasible where such procedures and methods are otherwise a part of the waste treatment management plans."

An exchange between two California congressmen regarding this change in the requirements for control of salinity intrusion took place during Congress' deliberations over the 1972 Amendments, and is highly instructive. Beginning the exchange, Representative Jerome Waldie -- a Congressman representing much of the area of the Bay-Delta Estuary -- stated, first, that the original language dealing with salinity intrusion had "very, very strong provisions" requiring that "the [areawide waste treatment] plan shall include procedures to control salt-water intrusion." (Legislative History, Vol. 1, p. 484) He went on to complain that the language eventually adopted was "weakened immeasurably" by the qualifications described above -- changes that were not made with respect to other sources of nonpoint pollution. (Id.) Finally, he opined that these qualifications were added by:

> ". . . someone who does not desire to have salt-water intrusion, which is non-point pollution, controlled in the bill. Particularly I have reference to estuaries in which salt-water intrusion and reduced outflows are particularly destructive. I particularly have reference to the Delta in California. Someone did not want those sources of pollution to be controlled." (Legislative History, Vol. 1, p. 484.)

In response, Representative Bizz Johnson -- speaking for a CVP export area in the San Joaquin Valley -- did not dispute that unqualified control of salt-water intrusion was deleted from the bill. He instead explained that this had been done to answer California's fear that federal control of salt-water intrusion would cause California to lose control of its water resources system:

> "The gentleman well knows that in our State in the headwaters of the Sacramento and the San Joaquin Rivers we have developed dams and storage reservoirs up and down the Sierra Nevada Mountains and also minor diversion facilities in the coastal country. All this water flows through the Delta, and this water has been controlled under a program in which the State and Federal agencies, including the Corps of Engineers and the Bureau of Reclamation, have participated. The fear was brought to the committee's attention when our State people testified that the State was losing control of its water resources programs under the introduced bill. The State wanted assurance this would not happen . . . (Legislative History, Vol. 1, p. 485.)

GKW206547

Representative Waldie thereupon concluded that:

> "The difficulty with this provision -- and I gather that it is a California provision -- the act was amended and weakened from its initial strong provisions controlling saline intrusion and water diversions to take care of a problem that the water resources people wanted to take care of to enable them to exert control, control over the delta they had been exerting.
>
> . . .
>
> "In response I would point out that the permits involved in this bill have nothing to do with nonpoint salt-water intrusion, and there is no control within this bill for nonpoint pollution, and that control will only come about by the development and adoption of an areawide management program that controls." (Legislative History, Vol. 1, p. 486.)

Congress had an opportunity to again consider the regulation of salt-water intrusion when it amended the Act in 1977. Rather than change the 1972 amendments to make salinity intrusion a matter of federal control, however, Congress reiterated that salt-water intrusion and other nonpoint sources of pollution were not subject to federal control under the Act but instead, -- were left to the States. In commenting on section 208, the Senate Report on the 1977 amendments thus stated:

> "In 1972, the Congress made a clear and precise distinction between point sources, which would be subject to direct Federal regulation, and nonpoint sources, control of which was specifically reserved to State and local governments through the section 208 process." (SR 95-370, p. 8: Legislative History, Vol. 4, p. 642.)

The report went on to describe Congress' decision to continue this distinction in the 1977 amendments:

> "Between requiring regulatory authority for nonpoint sources, or continuing the section 208 experiment, the committee chose the latter course, judging that these

matters were appropriately left to the level of government closest to the sources of the problem."

"...

"Section 208 . . . may not be adequate. It may be that the States will be reluctant to develop [adequate] control measures . . . and it may be that some time in the future a Federal presence can be justified and afforded.

"But for the moment, it is both necessary and appropriate to make a distinction as to the kinds of activities that are to be regulated by the Federal Government and the kinds of activities which are to be subject to some measure of local control. (id., p. 643.)

In short, Congress again expressed its intent that salinity intrusion and other nonpoint-source problems would be controlled by the States under section 208, rather than by EPA under section 303. Given subsequent opportunities to modify the Act, Congress has not altered its intent regarding the control of salinity intrusion. Instead, rather than give EPA authority to control salinity through water quality standards, it gave the States supplemental authority to control such pollution.

In 1987, Congress enacted Section 319 of the CWA to supplement State regulation under section 208. Section 319 requires the States to develop management plans for nonpoint sources, including salt-water intrusion (see § 304(f)), and to develop best management practices to "reduce" nonpoint-source pollution. (§ 319(b)(2)). Section 319 plans must be submitted to EPA for approval, but section 319 does not authorize EPA to develop its own plans or in any other way exercise authority over salinity intrusion. Again, Congress continued the "clear and precise distinction" between EPA authority over traditional point-source pollution and State authority over salinity intrusion. The latter is to be regulated by the States under sections 208 and 319.

Confronted with the foregoing legislative history, the court of appeals in National Wildlife Federation v. Gorsuch 693 F.2d 156 (D.C. Cir. 1982) agreed with EPA that dams do not require NPDES permits, citing, in part, EPA's policy argument that Congress purposely limited the federal NPDES program to certain well-recognized pollutants and left control of other water-altering substances or conditions to the States under Section 208. (693 F.2d at p. 172.) The court found "specific indication in the Act that Congress did not want to interfere any more than necessary with State water management, of which dams are an important component." (693 F.2d at p. 178.) The court observed that Congress had not considered all aspects of regulation of dam-caused pollution, but that "in light of its intent to minimize federal control over State decisions on water quantity, Congress might also, if confronted with the issue, have decided to leave control of dams insofar as they affect water quality to the States." (693 F.2d at p. 178-179; emphasis in original.) The court then went on to specifically hold that "with respect to one area where quality and quantity are in conflict -- salt-water intrusion caused by water diversion for drinking water or irrigation -- Congress explicitly declined to require the States to control water quality," citing the legislative history described above. (693 F.2d at p. 179, fn. 67.)

A number of other cases, though not specifically dealing with water quality standards, agree that salinity intrusion and other nonpoint sources of pollution are to be dealt with under sections 208 and 319. In U.S. ex rel. TVA v. Tenn. Water Quality Control Bd., (6th Cir. 1983) 717 F.2d 992, for example, the Sixth Circuit cited Gorsuch for the proposition that "water pollution arising from nonpoint sources is to be dealt with differently, specifically through the device of areawide waste treatment management by the States." (717 F.2d, at p. 999) EPA had agreed with the TVA that the State of Tennessee must deal with dam-induced nonpoint pollution under section 208 (717 F.2d, at p. 998), and could not require TVA to obtain an NPDES permit to operate a dam, which was not a point source.

In Shanty Town Associates LTD. Partnership v. EPA (4th Cir. 1988) 843 F.2d. 782, the court held that the Clean Water Act "contains no mechanism for direct federal regulation of nonpoint source pollution". (843 F.2d, at p. 791; emphasis in original.) It went on to point out that such pollution is to be regulated under the areawide waste treatment planning process of section 208 and that EPA's influence over that process is limited to withholding grants where the State failed to adequately regulate nonpoint-source pollution. It explained further that the Act also authorizes EPA to "assist" the States in regulating nonpoint sources by issuing guidelines under section 304(f), but that "the Act provides no direct mechanism by which EPA can force the States to adopt adequate nonpoint source pollution programs." (Id.;

emphasis in original.) This lack of direct federal regulatory authority over nonpoint-source pollution confirms EPA's lack of authority to impose standards -- such as the proposed estuarine habitat standard -- intended to control salinity intrusion.[5]

(c) Assuming Arguendo that EPA Generally Has Authority to Adopt The Types of Standards Proposed, The Exercise Of That Authority Is Prohibited Where It Would Have Impermissible, Direct Impacts On State-Established Water Rights.

Even if it is assumed, despite the above legislative history and case law, that the Clean Water Act generally contemplates direct federal regulation of salinity intrusion, Section 101(g) of the Act nevertheless precludes EPA adoption of the estuarine salinity standard contained in the Proposed Rule.

Section 101(g), also known as the "Wallop amendment" states, in part, as follows:

> "It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this chapter. It is the further policy of Congress that nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State."

5/ Shanty Town also recognized that, while EPA is entitled to "special deference" when interpreting the general provisions of the Act, the court remained the final authority on issues of statutory construction and must not "rubberstamp" administrative decisions that are "inconsistent with a statutory mandate or that frustrate the congressional policy underlying a statute." (843 Fed 782 at 790.)

The foregoing statement establishes limits upon EPA's authority to directly reallocate State water or impair water rights. Such reallocation is nonetheless exactly what the EPA estuarine standard is intended to do. Indeed, EPA has admitted as much:

> "Achieving compliance with the proposed standards will require increased freshwater flows through the Delta and, thus, a reallocation of water from agriculture and urban uses to instream use for fish and wildlife enhancement." (Draft Regulatory Impact Assessment of the Proposed Water Quality Standards for the San Francisco Bay-Delta and Critical Habitat Requirements for the Delta Smelt, at pp. 4-1).

EPA, in fact, has conceded that its proposed standards will reallocate more than a million acre feet from consumptive uses to environmental uses during each year of a critical drought period.[6] (59 Fed.Reg. 832

) Thus, EPA is mandating a "reallocation of water" irrespective of the water rights allocations that have already been established by the State of California acting under its water resource allocation and water rights laws.

6/ The amount of the proposed reallocation, according to California's Department of Water Resources, is substantively larger that the already large estimate given by EPA. On average, according to DWR, the re-allocation resulting from adoption of the standards as proposed with a buffer could be as much as 1.7 million acre feet; while in critically dry years (during a time of drought) the re-allocation may be as much as 3.1 million acre feet. By way of comparison, the yield of the entire State Water Project is 2.3 million acre feet.

GKW206547

The addition of Section 101(g) to the Clean Water Act in 1977 made explicit the existing Congressional policy of deferring to the States with respect to water rights allocation decisions. Since 1866, Congress has adopted numerous statutes establishing a consistent and well-defined policy of recognizing State water right laws, and of deferring to those laws in all respects not directly inconsistent with clear congressional directives. Section 101(g) explicitly incorporates that century-old policy.

The Conference Report on the 1977 amendments to the Clean Water Act states with respect to Section 101(g) that "This provision is intended to clarify existing law to assure its effective implementation. It is not intended to change existing law." (Conf. Rept. 95-830, p. 52; Legislative History, Vol. 3, p. 236.) Senator Wallop, the sponsor of the provision, also explained that his amendment was intended:

> " . . . to recognize the historic allocation rights contained in the State constitutions.
>
> "It is designed to protect historic rights from mischievous abrogation by those who would use an act, designed solely to protect water quality and wetlands, for other purposes. It does not interfere with the legitimate purposes for which the act was designed.
>
> "The amendment speaks only -- but significantly -- to the rights of the States to allocate quantities of their water and to determine priority uses. It recognizes the differences in types of water law across the Nation. It recognizes patterns of use.
>
> "Water quality and interstate movement is an acceptable Federal role and influence. But the States' historic rights to allocate quantity, and establish priority of usage remains inviolate because of this amendment.

This act remains an act to protect the quality of water and to protect critical wetlands in concert with the various States. In short, a responsible Federal role." (Legislative History, Vol. 4, p. 1030.)

During the House debate over the Conference Report on the bill, Senator Wallop repeated the above statements and expanded them:

"The conferees accepted an amendment which will reassure the State that it is the policy of Congress that the Clean Water Act will not be used for the purpose of interfering with State water rights systems . . . This amendment came immediately after the release of the Issue and Option Papers for the Water Resource Policy Study now being conducted by the Water Resources Council. Several of the options contained in that paper called for the use of Federal water quality legislation to effect Federal purposes that were not strictly related to water quality. Those other purposes might include, but were not limited to Federal land use planning, plant siting and production planning purposes. This 'State's jurisdiction' amendment reaffirms that it is the policy of Congress that this act is to be used for water quality purposes only.

"This amendment is not intended to create a new cause of action. It is not intended to change present law, for a similar prohibition is contained in section 510 of the act. This amendment does seek to clarify the policy of Congress concerning the proper role of Federal water quality legislation in relation to State water law. Legitimate water quality measures authorized by this act may at times have some effect on the method of water usage. Water quality standards and their upgrading are legitimate and necessary under this act. The requirements of section 402 and 404 permits may incidentally affect individual water rights. Management practices developed through State or local 208 planning units may also incidentally effect the use of water under an individual water right. It is not the purpose of this amendment to prohibit those incidental effects. It is the purpose of this amendment to insure that State allocation systems are not subverted, and that

> effects on individual rights, if any, are prompted by legitimate and necessary water quality considerations." (Legislative History, Vol. 3, pp. 531-532.)

Thus, section 101(g) is intended to prohibit the federal government, acting through EPA, from interfering with State allocations of water and determinations of priority among different uses, including instream and consumptive uses. It recognizes the historic role of the States in allocating water according to State constitutional and statutory systems and is designed to protect those rights from "mischievous abrogation" by those who would stretch their authority under the Act to interfere with such rights.

On the other hand, Section 101(g) also contemplates that "legitimate water quality measures" under the Act may "incidently" affect water use. (Legislative History, Vol 3, p. 532) The issue, then, appears to be whether an action contemplated by EPA would abrogate or otherwise interfere with State water rights allocations, or whether it will merely "incidently affect individual water rights." If the former is true, the proposed action is prohibited by section 101(g).

In the <u>Gorsuch</u> case discussed above, the D.C. Circuit considered whether EPA regulation of salt-water intrusion caused by upstream diversions was an invalid interference with State water allocations or merely had an incidental effect on water use. The Court found, in section 101(g), "specific indication that Congress

GKW206547

did not want to interfere any more than necessary with State water management." (693 F.2d at p. 178.) It also recognized that the section was not intended to take precedence over "legitimate and necessary water quality considerations", citing Senator Wallop's statements. (Id. p. 179 fn. 67) It concluded, nonetheless, that federal regulation of salt-water intrusion, which otherwise might be a "legitimate" consideration, was specifically precluded:

> "However, with respect to one area where quality and quantity are in conflict -- salt-water intrusion caused by water diversion for drinking or irrigation -- Congress explicitly declined to require the States to control water quality." (Id.)

Under the unambiguous holding of Gorsuch, the salinity standard proposed by EPA as an "estuarine habitat" standard, is prohibited by section 101(g). The standard is intended to control salinity intrusion through increased releases of freshwater outflow. (Regulatory Impact Analysis p. 4-1) Given the hydrology of the Bay-Delta Estuary, this can only be done by reducing the amount of water consumptively used by competing water uses in accordance with water rights previously granted by the SWRCB. The unavoidable result is a reallocation of water from consumptive uses. EPA's standards would directly "supersede or abrogate rights to quantities of water" which have been established by California under its constitutional and statutory water allocation system. This result is not the "incidental" effect on water usage contemplated by section 101(g), but rather is a direct reduction in State allocated water rights for consumptive use, prohibited by Section 101(g).

EPA's own interpretation of Section 101(g) casts considerable doubt upon the propriety of the standards set forth in the Proposed Rule. In a document entitled "Questions and Answer on Antidegradation," published by EPA in August 1985, EPA specifically addressed the relationship between regulating to protect water quality under section 303 and protecting State water allocation rights under section 101(g):

> "The exact limitations imposed by section 101(g) are unclear; however, the legislative history and the courts interpreting it do indicate that it does not nullify water quality measures authorized by CWA (such as water quality standards and their upgrading, and NPDES and 402 permits) even if such measures incidentally affect individual water rights; those authorities also indicate that if there is a way to reconcile water quality needs and water quantity allocations, such accommodation should be [sic] pursued. <u>In other words, where there are alternate ways to meet the water quality requirements of the Act, the one with least disruption to water quantity allocations should be chosen</u>. (<u>Id</u>., emphasis added.)

In short, where there are alternate approaches to meeting the Act's water quality requirements, EPA has interpreted section 101(g) to require that the least-cost alternative be chosen. Thus, if there is an alternative that will provide protection for Delta species as effective as the Proposed Rule, with less disruption to state water quantity allocations and better protection for the Delta's most sensitive species, it would amount to arbitrary and capricious conduct for EPA to fail to adopt the alternative. (See also <u>Westlands Water Dist., et al. v. United States, et al.</u> No. CF-F-93-5327 OWW, U.S.D.C. E.D. Cal. Memorandum Opinion and Order, filed Feb. 11, 1994, pp. 84-85.) Here, the estuarine salinity standard proposed by the urban coalition amounts to such an alternative.

The alternative estuarine standard proposed by the urban coalition will provide better protection to the two species -- winter-run salmon and Delta smelt -- listed under the Endangered Species Act, than the estuarine standard proposed by EPA. It will provide such protection, moreover, without a reduction in protection for other, less sensitive, Bay-Delta species. Further, it will provide improved protection to the Estuary's listed species with substantially less disruption to water quantity allocations previously made by the State of California. Given these circumstances, adoption of the estuarine standards proposed by EPA would violate the Clean Water Act -- as the Act has been previously interpreted by EPA itself.

The cases of Riverside Irr. Dist. v. Andrews (10th Cir. 1985) 758 F.2d 508, and United States v. Akers (9th Cir. 1986) 785 F.2d 814, recited in the Proposed Rule, are examples of the type of incidental action that is not precluded by section 101(g). In Andrews the plaintiff district was denied a nationwide Corps permit to deposit in a navigable waterway material dredged in construction of a reservoir, and was required instead to make an individual permit application.

Responding to the plaintiff's subsequent allegation that denial of the nationwide permit was a violation of section 101(g), the court held that application of the general policy of section 101(g) in the case before it would not nullify the clear statutory requirement that a permit must be obtained to deposit dredged material in a navigable waterway. (758 F.2d at p. 513.) Requiring plaintiff to participate in the individual permit process, rather than rely on the nationwide permit, would best accommodate the State's interest in allocating water and the federal interest in regulating dredge and fill actions.

In Akers, the plaintiff simply refused to apply for a section 404 permit before leveling, grading and draining land he wished to farm. Later, he asserted an "irrigation" exemption from the permit requirement and urged that it had to be applied so as not to violate section 101(g). The court determined that "any incidental effect" the permit process might have on his water rights was justified because the dredge and fill permit was a legitimate purpose of the Act. (785 F.2d at p. 821.)

The result in both of the foregoing cases is distinguishable from Gorsuch and the present situation. Nothing in the section 404 permit process at issue in Andrews and Akers had a direct impact on plaintiff's water rights. In each case the water user was required merely to apply for the permit necessary to develop facilities or land. The users' water supply, in short, was not an issue.

(d) EPA Does Not Have the Authority to Promulgate the Salmon Smolt Survival Index as a Water Quality Standard.

(i) A Survival Number is Not Within the Definition of Water Quality Criteria.

The salmon smolt survival index proposed by EPA is not a water quality standard; instead, it is a survival number based primarily on water diversions, export and flow. In its proposed rule, EPA admits that it is proposing the index as water quality criteria because it lacks sufficient information to promulgate true water quality criteria:

> "Because at this time EPA has not developed an adequate scientific basis for precise temperature criteria, EPA is proposing 'smolt survival criteria' to protect Fish Migration and Cold Fresh-Water Habitat designated uses in the Bay-Delta estuary." (59 Fed.Reg. 823)

Rather than propose criteria that relate to water quality, EPA instead, proposes an index that attempts to quantify and predict the survival of salmon migrating through the Delta. There is no basis for promulgating a survival number as a water quality criterion. Smolt survival is dependent on numerous non-water quality factors, many of which are controlled under other sections of the Act, and EPA does not have the authority under Section 303 to adopt criteria that would regulate non-water quality factors.

EPA's authority to promulgate water quality standards, as noted previously, is found in Section 303 of the Act.

The regulations governing the promulgation of water quality standards define such standards as:

> " . . . 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))

Water quality standards thus have two components: (1) a designated use or uses for water in an area; and (2) the water quality criteria necessary to meet the designated use. (33 U.S.C. 1313(c)(2)(A); 40 C.F.R. 131.3(i).) The propagation of fish and wildlife may be an appropriate designated use. However, a quantified survival number for a species is not an appropriate water quality criterion to meet that designated use:

> "Criteria are elements of State water quality standards, expressed as constituent concentrations, levels or narrative statements, representing a <u>quality of water</u> that supports a particular use. When criteria are met, water quality will generally protect the designated use. (40 C.F.R. 131.3(b), emphasis added)

A survival number does not fit within the foregoing definition. It is not a constituent concentration, a level or a narrative statement that represents a <u>quality of water</u> supporting a particular use. There is also no evidence that the proposed survival index will lead to water quality that will protect the designated use. Indeed, in its proposed rule EPA makes no connection between water quality and its chosen salmon survival number:

> ". . . the proposed salmon smolt survival criteria are based on the most recent model . . . for predicting migration success for the Sacramento River fall run population . . . ."
>
> . . .
>
> "In developing the goals or target index values for its proposal, EPA is relying primarily on the goal of restoring habitat conditions to those existing in the late 1960's and early 1970's, as recommended in the Interagency Statement of Principles. Strict adherence to this recommendation would suggest using the index values associated with that historical period as the target index values. These values are included in Table 2, which provides estimated index values for different historical periods." (59 Fed. Reg. 823-24)

The survival number thus sets a goal for salmon survival based on an historic period. It bears no evident relationship to water quality. Indeed, numerous habitat conditions unrelated to water quality have changed since the historic period selected by EPA. Water quality standards cannot regulate these non-water quality factors. Because the salmon smolt survival index does not fall within the definition of water quality criteria and bears no relationship to water quality, it is beyond EPA's authority to promulgate.

(ii) The Case Law Defining "Water Quality Standards" Demonstrates that a Salmon Smolt Survival Index is not a <u>Proper Water Quality Criterion.</u>

Water quality standards are designed to regulate the discharge of pollutants and pollutant levels in waters, not to regulate population levels of species. The reason for this distinction is readily apparent: water quality standards only extend to the protection of the quality of water, while the population of a species may be affected by many factors completely unrelated to water quality, including factors left to State control under Section 101(b) and (g), 208, 319 and 510. EPA itself concludes, for example, that smolt survival is dependent inter alia, on the diversion of water out of the mainstream Sacramento River and export rates, and the salmon smolt survival index criterion is based on the control of these factors. (59 Fed.Reg. 823) EPA is thus proposing a water quality criterion based on two factors -- water diversions and export rates -- that have no connection to water quality. While temperature, a component in the Sacramento River smolt survival index is a water quality factor, EPA admits that it does not have an adequate scientific basis upon which to erect a temperature criterion. (59 Fed.Reg. 823) The San Joaquin River index is based solely on exports and flow (59 Fed.Reg. 823). Thus, the San Joaquin River index is not based on any water quality components.

The definition of water quality criteria was discussed in Mississippi Commn. on Natural Resources v. Costle, 625 F.2d 1269 (5th Cir. 1980), where the Court of Appeals reviewed the definition of criteria in the context of deciding whether EPA's disapproval of a State water quality standard was proper:

> "For most pollutants, [water quality] criteria are expressed as specific numerical concentration limits. For example, a State might set the water quality standard for a certain creek by designating it as a fishing area and requiring that the chloride concentration be

> no greater than 250 milligrams per liter of water." (625 F.2d at 1271-1272)

The definition of what constitutes a water quality standard was also addressed by a State court in Niagara of Wisconsin Paper Corporation v. Department of Natural Resources (1978) 84 Wis. 2d 32. Citing Bethlehem Steel v. Environmental Protection Agency 538 F.2d 513 (2nd Cir. 1976), the Wisconsin Supreme Court stated:

> "Effluent limitations and water quality standards are related, however significant differences exist between them. An effluent limitation is a measurement of pollutant discharge. It is measured at the source. A water quality standard is a measurement of the water itself and it does not focus on any single polluter but necessarily comprehends all discharges into a given body of water. (Footnote omitted.) (84 Wis. 2d. at 54, emphasis added)

Consistent with this reasoning, one federal court of appeals has described water quality standards as defining a "desirable ambient water quality." (State of Alabama ex. rel. Baxley v. EPA 557 F.2d. 1101, 1112-1113 (5th Cir. 1977))

These decisions lead to the conclusion that the proposed survival number is simply not an appropriate water quality criterion. It is not a measurement of water quality and it provides no basis to measure discharges or pollution levels. It simply does not regulate water quality.

(e) EPA Has Failed to Designate Uses as Required by Section 303 of the Clean Water Act.

In its Proposed Rule, EPA discusses the background of Bay-Delta water quality regulation, including the past application of the Clean Water Act to protect the Delta's water quality. (59 Fed.Reg. 810-812) At page 811 of its Rule, EPA addresses the water quality standards contained in the 1978 Delta Plan submitted by the State Board to EPA. In its discussion of these standards, the Proposed Rule raises three categories of designated uses included in the 1978 Delta Plan followed by a footnote, which states:

> "The CWA and implementing regulations describe the two components of water quality standards as "designated uses" and "water quality criteria" (40 CFR § 131.3(i)), whereas California uses the terms "beneficial uses" and "objectives." It has been EPA's and California's longstanding practice to interpret these terms synonymously. To avoid confusion, this proposal will use the federal terms "designated uses" and criteria." (59 Fed.Reg 811)

EPA, however, cites no authority for its statement that the "designated uses" described by the Clean Water Act and the "beneficial uses" provided for by California's Porter-Cologne Act (Water Code §§ 13000 et. seq.) are to be interpreted synonymously. In fact, no such authority exists to support EPA's conclusion. Moreover, EPA's attempt to rely upon the State of California's "beneficial uses" as an excuse to avoid the development of the "designated uses" required by the Clean Water Act violates the requirements of both statutes since it ignores the balancing obligations imposed by both Acts to protect the interests of competing water users.

When a State adopts water quality standards pursuant to Section 303(c) of the Clean Water Act, it must specify "appropriate water uses to be achieved and protected." (40 CFR § 131.10(a)) The uses so specified are termed "designated uses" under the CWA. As required by section 303 and as recognized by the EPA regulations interpreting the Act, (Id.) the classification of State waters for the purpose of designating uses must take into consideration:

> " . . . the use and value of water for public water supplies, protection and propagation of fish, shellfish and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation." (303(c)(2)(A); 40 CFR § 131.10(a), emphasis added.)

Thus, when "designated uses" are developed pursuant to Section 303, competing water uses, including the need for public water supplies and the need for water for industrial and agricultural purposes, must be taken into account.

Water quality standards developed pursuant to Section 303 are composed, of course, not only of "designated uses" but also the "water quality criteria" based upon such uses. (§ 303(c)(2)(A)) "Criteria" are defined by regulations developed by EPA as "elements" of water quality standards, expressed as "constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use." (40 CFR

GKW206547

§ 131.3(b)) Logically, the Section 303(c) language quoted above, requiring consideration of other uses, should also apply to the adoption of criteria under that section. EPA has taken the position, however, that no consideration of impacts on other uses is required when adopting criteria. According to the EPA regulations, criteria "must be based upon sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use." (40 CFR § 131.11) In short, under EPA's view of § 303, while the development of "designated uses" accommodates a consideration of competing water uses, the development of "criteria" includes no such flexibility and, instead, is driven only by the need to fully protect uses which are designated.

The California water quality law which EPA seeks to equate to the federal process of developing water quality standards, takes a different approach. Under California's Porter-Cologne Act (California Water Code Sections 13000 et seq.), a two-step process is also followed for the purpose of developing water quality control plans. Unlike the federal process, however, no consideration of competing water uses occurs during the first step. Instead, a detailed balancing process occurs only <u>after</u> "beneficial uses" have been developed.

Thus, pursuant to the provisions of the Porter-Cologne Act, "beneficial uses" are simply defined as including:

> " . . . domestic, municipal, agricultural and industrial supply; power generation; recrea-

> tion; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves." (Water Code § 13050(f).)

Once such "beneficial uses" have been identified, the Porter-Cologne Act then obliges the State to undertake a balancing process in the course of developing water quality "objectives." Water Code Section 13241 thus provides:

> "Each regional board shall establish such water quality objectives in water quality control plans as in its judgment will ensure the <u>reasonable</u> protection of beneficial uses . . . ." (Emphasis added.)

As described by the California Court of Appeal in <u>United States v. State Water Resources Control Bd.</u> (1986) 182 Cal.App.3d 82:

> "We think this statutory charge ["reasonable protection of beneficial uses"] grants the Board broad discretion to establish reasonable standards consistent with overall statewide interest. The Board's obligation is to attain the highest reasonable water quality '<u>considering all demands being made and to be made on those waters</u> and the total values involved, beneficial and detrimental, economic and social, tangible and intangible.'" (182 Cal.App.3d 82 at 116, emphasis in original.)

In order to effectuate the balancing required by the Porter-Cologne Act, California's regional water quality control boards are thus required to consider the following issues when they establish water quality "objectives:"

> "(a) Past, present, and probable future beneficial uses of water.
>
> . . .

GKW206547

(b) Environmental characteristics of the hydrographic unit under conssideration, including the quality of water available thereto.

(c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.

(d) Economic considerations.

(e) The need for developing housing within the region.

(f) The need to develop and use recycled water." (Water Code § 13241.)

The crucial difference in the development of "water quality standards" pursuant to the Clean Water Act and the development of "water quality plans" under California's Porter-Cologne Act, is thus one of timing. While both processes incorporate a balancing process that takes competing water uses into consideration, the balancing occurs at a different time depending upon whether it is EPA's process or the California process which is followed. Thus, if it is EPA's process of developing "water quality standards" which is used, the consideration of competing water uses occurs up-front, when uses are designated. Under California's Porter-Cologne Act, on the other hand, the balancing of competing water uses occurs at the end, when the State decides how to "reasonably protect" previously developed "beneficial uses."

By reaching the conclusion that California's previously designated "beneficial uses" are identical to the "designated uses" provided for by the Clean Water Act, EPA's proposed Rule dispenses with any consideration of competing water uses, even though such consideration is required by <u>both</u> State and federal law. In sum, such a procedure is in violation of both State and federal law. Instead, the proposed rule combines State developed "beneficial uses" (which involve no consideration of competing water uses) with federal "criteria" (which EPA holds involve no consideration of competing water uses) to produce water quality "standards" which completely fail to "take into consideration the use and value of water for public water supplies . . . recreation in and on the water, agricultural, industrial, and other purposes . . . ." (§ 303(c)(2)(A); 40 CFR § 131.10)

(f) The Proposed Rule Fails to Conform to the Requirements of the Regulatory <u>Flexibility Act or Executive Order 12291.</u>

(i) <u>The Regulatory Flexibility Act</u>

Section 603 of the Regulatory Flexibility Act ("RFA") (5 U.S.C. § 603) provides that:

> "Whenever an agency is required by section 553 of this title, or any other law, to publish general notice of proposed rule-making or any proposed rule the agency shall prepare and make available for public comment an <u>initial regulatory flexibility analysis</u>. Such analysis shall describe the <u>impact of the proposed rule on small entities</u>." (Emphasis added.)

The requirement for an analysis can be eliminated if the agency's director certifies that the rule "will not . . . have a significant economic impact on a substantial number of small entities." The certifying agency, however, must publish the certification in its notice of proposed rule-making and include a "succinct statement explaining the reasons for such certification." (5 U.s.c. § 605(b).)

Although Section 611(b) of the RFA expressly provides that "(1) any determination by an agency concerning the applicability of the Act; and (2) any flexibility analysis prepared pursuant to the Act "shall not be subject to judicial review," the D.C. Circuit has concluded that the contents of the analysis should be considered in determining whether a rule is reasonable or arbitrary. (See Thompson v. Clark (D.C. Cir. 1984) 741 F.2d 401, 405; Small Refiner Lead phase-Down Task Force v. EPA (D.C. Cir. (1983) 705 F.2d 506, 539.)

Here, while the Proposed Rule contains at least a passing reference to impacts on small farms (59 Fed.Reg. 834), it contains no analysis whatsoever of the impacts of the Rule on small urban businesses. Further, the Regulatory Impact Analysis ("RIA") which accompanies the Proposed Rule contains only an abbreviated regulatory flexibility analysis which concludes with the following statement:

> ". . . the USEPA action is not an implementation plan and thus has no mechanism for affecting or mitigating impacts on small entities." (RIA at S-10)

This statement is disingenuous at best. The State of California has submitted water quality standards to EPA that were disapproved. EPA's proposed water quality standards will likely have a significant impact on the standards ultimately implemented by the State Water Resources Control Board. A number of implementation alternatives are available, and EPA's failure to review the economic impacts of those alternatives is unreasonable. (Michigan v. Thomas (6th Cir. 1986) 805 F.2d 176, 187-188.)

(ii) Executive Order 12291

Parallel to the RFA is Executive Order 12291. Pursuant to the Executive Order, all agencies, when promulgating new regulations, shall "maximize the aggregate net benefits to society, taking into account the conditions of the particular industries affected by regulations . . ." More specifically, each agency must ". . . in connection with every major rule, prepare, and to the extent permitted by law consider a Regulatory Impact Analysis." (See 5 U.S.C.A. § 601 p. 356.) Such an analysis must describe the potential benefits and costs of the rule as well as determine potential net benefits. The analysis must also be submitted to the Office of Management and Budget along with all notices of proposed rulemaking and final rules.

A "major rule" is defined for these purposes as one that is likely to result in: (1) an annual effect on the economy of $100 million or more; or (2) a major increase in costs or prices for consumers, individual industries, federal, state, or local government agencies, or geographic regions. (Order, § 1(b)(1) and

1(b)(2); see 5 U.S.C.A. § 601, p. 355.) Here, the RIA developed in concert with the Proposed Rule concedes an impact on urban areas alone that is more than three-quarters of the amount ($78.9 million) required to trigger the requirements of the Executive Order. (See RIA, p. 4-23; Appendix 3, p. 2)[7/]

However, as discussed at some length in the report of Foster Associates, Inc., attached hereto, when even the most obvious corrections are made to the impact estimates for the urban sector alone, the expected impact exceeds the amount which will trigger Executive Order 12291's requirement of a Regulatory Impact Analysis. (See Appendix 3, p. 2) When the estimated impacts upon the agricultural sector are also incorporated, the resulting impact leaves no doubt that the Proposed Rule is a "major rule" for impact-analysis purposes.

Unfortunately, the RIA offered in connection with the Proposed rule fails to measure up to the expectations of the Executive Order. In this regard, while the numerous inadequacies of the RIA are described at some length in Appendix 3 attached hereto, a few are worth mentioning here.

First, a major flaw in the RIA is its complete failure to address the effects of the Central Valley Project Improvement Act

---

7/ Adding the economic impacts presented in the RIA for the agricultural sector of the California economy brings the total impact to $99 million -- a combined impact number which falls just short of the $100 million trigger.

("CVPIA") on the availability of water supplies. The impacts of the additional water needed for the CVPIA are apparently included in the base case presented in the RIA, since the base case assumes that 130,000 acre feet of CVPIA water will be used to meet Delta water quality standards. (Appendix 3, p.6) However, the RIA does not discuss <u>any</u> of the changes in agricultural production that will be caused by a reduction in CVP deliveries as a result of the CVPIA.

Water to meet the environmental purposes of the CVPIA will be obtained largely from conjunctive use, transfers, conservation and land-fallowing programs. Thus, since these methods are already being used to provide water for CVPIA purposes, they will <u>not</u> be readily available to help meet the proposed standards. Assuming that the least cost conservation, conjunctive use, transfer and land-fallowing programs already have been used to meet CVPIA requirements, this will increase the cost of the use of these methods to meet the proposed standards. The RIA thus "double counts" by allowing the same water to be removed from agriculture twice -- once to meet CVPIA requirements and again to meet the water quality requirements. (Appendix 3, pp. 3 and 7) Such an obvious flaw in the RIA must be corrected.

The availability of water transfers to ameliorate the effects of the proposed rule is also extremely important to any consideration of economic impacts. Indeed, the draft RIA states:

> "For urban users, the availability of water transfers and degree of water conservation or

reclamation potential are key factors in determining costs." (RIA at 4-1.)

Nevertheless, the draft RIA goes on to admit the following:

"Analysis of costs to the urban sector was based on the potential for urban areas to compensate for reductions in water supply with other potential water sources. There is a higher level of uncertainty in the analysis of impacts on urban users than in the analysis of impacts on agricultural users because of the lack of previous studies and significant data uncertainties." (RIA at S-6.)

Throughout the entire "Club Fed" process, the true availability of transfers has never been examined. The impact of the listing of the Delta smelt and winter run salmon on transfers was not examined because, pursuant to the ESA, costs cannot be considered in the listing of a species. (RIA at 4-25.) The impact of the designation of critical habitat for the Delta smelt, also mentioned in the RIA, fails to analyze its potential impact on diversions of water from the Delta or on water transfers. (RIA at 4-25.) Incredibly, despite this virtually complete failure to analyze whether sufficient water transfers will be available, the comparison of costs and benefits in the RIA is predicated on the availability of sufficient water transfers. (RIA at 6-2.) These obvious defects hardly amount to compliance with either the letter or even the spirit of the Executive Order.

(g) Given the Legal and Technical Deficiencies in EPA's Proposed Standards, A Narrative Standard Would Better Meet the Goals of the Clean Water Act.

As discussed above, Congress intended by enacting Section 101(g) that regulation for water quality purposes under the CWA "should not interfere any more than necessary with State water management" considerations. See National Wildlife Federation v. Gorsuch, 693 F.2d at 178; Riverside Irr. Dist. v. Andrews, 728 F.2d at 513. See also 59 Fed. Reg. at 813 (quoting a November 7, 1978 internal memorandum by the EPA General Counsel indicating that Section 101(g) allows EPA to "impose requirements which affect water usage only where they are clearly necessary" to meet requirements under other provisions of the CWA).

As also noted above, EPA interprets this requirement to mean that "where there are alternate ways to meet the water quality requirements of the Act, the one with the least disruption to water quantity allocations should be chosen." EPA Office of Water Regulations and Standards, Criteria and Standards Division (WH-585), Questions and Answers on: Antidegradation, (August 1985).

There is nothing in the preamble to EPA's proposed rule to support a conclusion that its numeric salinity criteria offer "the least disruption to water quantity allocations" relative to possible alternative approaches, even though EPA has recognized that possible alternatives may exist. (See 59 Fed. Reg. at 814-

816) In fact, alternative criteria are available that not only would be less disruptive of the State's water allocation authority, but would also be at least as protective of estuarine habitat and other uses in the Bay-Delta Estuary.

In proposing numeric water quality criteria for salinity in the Bay-Delta Estuary, EPA assumes that only numeric criteria can fully protect the beneficial uses with which it is concerned; i.e., estuarian habitat, fish migration, and cold freshwater habitat. Other than specific provisions relating to listed toxic pollutants, however, CWA Section 303 does not require (or even express a preference for) numeric standards for the protection of designated uses.

The use of non-numeric (or narrative) water quality standards for salinity elsewhere has been specifically approved by EPA and endorsed by the courts. (See Environmental defense Fund, Inc. v. Costle, 657 F.2d 275 (D.C. Cir. 1981) (approving State water quality standards for salinity that included narrative criteria, a plan of implementation, and other factual information on salinity in the Colorado River). See also EDF v. Costle, 13 Env't Rep. Cas. (BNA) 1867, 1871 (D.D.C. 1979) (the CWA "nowhere requires the establishment of criteria in numerical form; criteria may be entirely narrative").

EPA regulations only authorize the use of numeric criteria when they can be established based either on specific

GKW206547

guidance issued under CWA Section 304(a) or on "other scientifically defensible methods." (40 C.F.R. § 131.11(b)(1).) If a sufficient basis for establishing numeric standards cannot be established, either narrative criteria or criteria based on biomonitoring methods must be used. (40 C.F.R. § 131.11(b)(2).) In the present case, serious questions exist as to the scientific defensibility of the numeric criteria proposed by EPA.

In establishing the level of protection to be achieved with its proposed salinity standard, EPA has used an historical approach that does not accurately characterize the existing instream uses that may require protection. According to EPA, "The proposed salinity criteria reflect estuarine habitat conditions that existed prior to 1976." 59 Fed. Reg. at 819. EPA suggests that the determination of pre-1976 conditions would ideally be based on conditions actually existing during the late 1960's through early 1970's. Because of what it believes are insufficiently representative meteorological conditions during this period, however, EPA proposes to use the historical period of 1940-1975 for that purpose. (59 Fed. Reg. at 820)

EPA's reliance on the 1940-1975 historical period as the measure of water quality conditions existing in the Bay-Delta on and after 1976 is highly questionable. While the basis of selecting 1975 as the reference point for establishing estuarine conditions is not explained in the preamble to EPA's proposed rule, it presumably derives from EPA's antidegradation policy.

The federal antidegradation policy requires states to develop their own policies and implementation methods to protect "existing instream water uses and the level of water quality necessary to protect the existing uses . . . ." 40 C.F.R. § 131.12(a)(1). "Existing uses" in this context are uses that actually have occurred during or after 1975 (more precisely, after November 28, 1975). (40 C.F.F. § 131.3(f)) The levels of water quality necessary to protect those uses establish a baseline below which water quality may not be allowed to deteriorate. (_See generally_ EPA Region 9, _Guidance on Implementing the Antidegradation Provisions of 40 C.F.R. § 131.12_ (June 3, 1987))

The federal policy does not prohibit the degradation of water quality under all circumstances. States may allow a lower quality of water if warranted to "accommodate important economic or social development," so long as the water quality allowed remains sufficient to protect existing uses. (40 C.F.R. § 131.12(a)(2)) Moreover, while states ordinarily are required to set water quality criteria necessary to protect uses of the water that are designated by them, states may remove or modify designated uses that are not existing uses.

Removal or modification of designated uses is specifically authorized where attainment of the use is prevented by naturally occurring pollutant concentrations, low flow conditions or hydrologic modifications (including dams and diversions). (_See_

40 C.F.R. § 131.10(g)) Some or all of these circumstances arguably exist in the Bay-Delta Estuary today.

EPA's approach in the proposed rule does not attempt to establish and protect existing uses within the meaning of the regulations. Rather, it is an attempt to establish baseline hydrologic conditions as they existed prior to 1976. EPA makes no showing that those conditions are required to achieve the minimum levels of water quality necessary for the protection of existing uses since 1976. Without such a showing, EPA's approach is inconsistent with its own regulations and not justified under the CWA.

The alternative narrative standard proposed in these comments does not suffer from the same legal and technical deficiencies as EPA's proposed numeric criteria. A narrative standard does not raise issues of scientific defensibility, because the assessment of defensibility would focus on the State Board's implementation plan, not the standard itself. Moreover, the narrative criteria proposed by the urban coalition necessarily would provide the same or greater level of water quality protection in the Bay-Delta as any numeric standard by expressly requiring the maintenance of the habitat conditions to protect existing beneficial uses.

Finally, and perhaps most importantly, a narrative standard would not force the kind of water allocation determinations that would be required in implementing EPA's proposed narrative standard. For that reason, a narrative criteria would be more consistent with Congressional intent to reserve the determination of water allocation issues to the states, as reflected in CWA Section 101(g).

VIII.

CONCLUSION

Urban water supply reliability is essential to the protection of the California economy. If adopted, the Bay/Delta standards proposed by EPA will severely impair the reliability of water supplies depended upon by more than two-thirds of California's urban population.

The comments presented hereinabove, offer an alternative to EPA's proposed Bay/Delta standards which has been endorsed by the water suppliers who provide the bulk of the water to urban California. The alternative will provide protection to the Bay/Delta's estuarine species as effective, if not more effective, than the alternative offered by EPA. Moreover, it will do so at a water cost that is substantially less than the cost associated with EPA's Proposed Rule. The members of the Bay/Delta urban coalition, and the other urban water suppliers who have endorsed these comments, respectfully request that their recommended alternative -- and the other comments they have raised herein -- be given serious consideration as EPA reflects upon the promulgation of a final rule.

APPENDIX 1

CALIFORNIA URBAN WATER AGENCIES

March 9, 1994

Mr. Patrick Wright
Bay/Delta Program Manager
Water Quality Standards Branch, W-3
Water Management Division
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105

California Urban Water Agencies (CUWA) represents California's eleven largest urban water agencies, serving over 20 million consumers and three-fourths of the state's economic activity. CUWA is concerned with the decline of aquatic resources in the Sacramento-San Joaquin Delta and San Francisco Bay ecosystem (hereafter Delta).

The CUWA Board of Representatives strongly supports development of a standard that protects Delta estuarine habitat. CUWA members have in the past supported efforts to address the causes of this decline and will continue to do so in the future. It is from this positive perspective that the CUWA Board submits its comments regarding the U.S. Environmental Protection Agency's (EPA) proposed rule: "Water Quality Standards for Surface Waters of the Sacramento River, San Joaquin River, and San Francisco Bay and Delta of the State of California," dated January 6, 1994 (40 CFR part 131 [OL-FRL-4783-6]).

In EPA's January 6, 1994 proposed rule, EPA recognized the need for changes to the proposed standards. Both before and since the proposed rule was released, EPA has recognized the need for innovative approaches to Delta protection that will minimize water supply and economic impacts, while achieving the desired environmental benefits. Because CUWA member agencies are collectively responsible for most of the water supply infrastructure that supports the State's $800 billion economy, we share EPA's expressed interest in finding ways to protect both the environment and the State's economy. Accordingly, CUWA members have agreed on a common set of recommendations to the EPA in support of efforts to protect the Delta.

455 CAPITOL MALL, #705, SACRAMENTO, CA 95814 916•552•2929 FAX 916•552•2931

This letter does not address issues of State/Federal jurisdiction. Rather, this letter focuses on an approach that CUWA believes would be as effective or more effective than the EPA proposal in protecting estuarine habitat and fishery resources, balanced with reduced water supply and economic impacts. CUWA strongly recommends that its approach be implemented as expeditiously as possible.

This letter transmits to EPA the results of a 4-month CUWA review of the proposed rule, the scientific basis for the rule, the potential water costs associated with likely compliance scenarios, and a number of proposed refinements to the rule. This review was conducted by a team of independent experts and technical representatives from several CUWA member agencies. Their findings and conclusions are summarized in Attachment 1 and explained in more detail in a "Technical Comments" report (Attachment 2). The findings presented in the Technical Comments form the basis of the CUWA Board's position regarding the proposed rule, which is summarized in this letter. The key points of CUWA comments are:

1. CUWA recommends adoption of a Suisun Estuary Protection Standard, to be met at the Confluence and Chipps Island, which would provide a level of protection for the estuary which is as effective or more effective than the EPA proposal in protecting estuarine habitat and fishery resources and is fully consistent with EPA's stated goals, with lower water supply impacts. CUWA does not support extending the standard to include Roe Island/Port Chicago because this may result in counterproductive environmental effects.

2. The goals of EPA's proposed Fish Migration and Cold-Water Habitat Criteria are not met by the EPA proposal but are rather more appropriately addressed by a basin-wide management plan developed to control the full range of variables which affect salmon smolt survival.

3. A striped bass spawning standard should not be set as proposed. Action to improve striped bass spawning habitat would be better managed in a multi-species planning effort and should be consistent with USF&WS and NMFS recovery plans for threatened and endangered species. Such action should also be consistent with the State's program to regulate and control agricultural drainage.

4. Now is the time for action on Delta protective standards. CUWA urges that appropriate standards be promulgated in 1994 through a State and Federal partnership.

<u>A Look to the Future</u>

CUWA appreciates EPA's open communication in the development and analysis of the proposed standards. Our comments are made in the spirit of cooperation and in the hope that EPA and the SWRCB can jointly support protective Delta water quality standards and their implementation. The approach we have proposed in these comments, along with a long-term habitat conservation effort, will meet the goals of the EPA and others concerned about the decline of Delta resources.

We look forward to working with EPA, SWRCB, and others to implement an appropriate standard and a long-term program to address the full range of issues in the Bay/Delta ecosystem. CUWA believes that the long-term outlook for environmental resources in the Delta and Central Valley watershed can be improved substantially through a cooperative, multi-agency process leading to implementation of a general recovery plan for these environmental resources. It is in the interests of CUWA member agencies, their customers, and California in general to bring many of these issues to resolution in the near future.

Sincerely,

California Urban Water Agencies
By its Board of Representatives

James Beard, General Manager
Alameda County Water District

Walter J. Bishop, General Manager
Contra Costa Water District

Jorge Carrasco, General Manager
East Bay Municipal Utility District

James Wickser, Assistant
General Manager-Water
Los Angeles Department of
Water and Power

John Wodraska, General Manager
Metropolitan Water District of Southern California

Stanley E. Sprague, General Manager
Municipal Water District of Orange County

Lester A. Snow, General Manager
San Diego County Water Authority

Milon Mills, Jr., Director
San Diego Water Utilities Department

Anson Moran, General Manager
San Francisco Public Utilities
Commission

Ronald R. Esau, General Manager
Santa Clara Valley Water District

William R. Mills, Jr., General Manager
Orange County Water District

Attachment 1.

SUPPLEMENTARY CUWA COMMENTS

In addition to its basic comments, CUWA herewith transmits an abstract of its review of the EPA's proposed standards, along with a list of suggestions for implementation of the CUWA-recommended plan. More detailed comments upon which this abstract is based are attached (Attachment 2).

Review of the Estuarine Habitat Criteria

The Scientific Basis for the CUWA Recommendation for a Suisun Estuary Standard

1. The CUWA review of the scientific basis for the estuarine habitat standard resulted in general concurrence that there has, indeed, been a serious decline in Delta aquatic resources and that reduction of spring outflow and resulting alteration of estuarine processes is one of the many causes of that decline.

CUWA further concurs with EPA that there is a relationship between the position of the 2 ppt isohaline, and therefore the freshwater outflow from the Sacramento-San Joaquin rivers, and the processes necessary for a healthy estuary. Therefore, there is a need for a water quality standard as a feature of a program for recovery of the Delta ecosystem. However, CUWA believes that some of the relationships are more complex and much less certain than those proposed by the San Francisco Estuary Project and used as the basis for the EPA proposed rule. Based on an extensive literature review and independent analysis of the available data, CUWA determined:

- When the average location of the 2 ppt isohaline (hereafter termed "X2" and measured in kilometers upstream from the Golden Gate Bridge) is upstream of the confluence of the Sacramento and San Joaquin rivers, the relationships between X2 and abundance are reliable. The prediction of low abundance under such conditions is substantiated by both the abundance versus X2 relationships and the preponderance of the scientific literature.

- When X2 is located at or near Chipps Island, the X2 versus abundance relationships show that abundance increases. Although there is less certainty in the relationships for this reach of the estuary, CUWA performed a number of other analyses which suggest that estuarine processes in Suisun Bay are enhanced by this condition. CUWA found that the habitat of a majority of estuarine species has its greatest extent under this condition.

  The benefits of locating X2 at or near Chipps Island include the following: 1) placement of the 2 ppt to 10 ppt brackish water zone in the Suisun Bay Region; 2) placement of the turbidity maxima in Suisun Bay; 3) helping to ensure transport of eggs, larvae, and nutrients into the shallow-water areas of the Suisun Bay complex; 4) allowing mixing of freshwater and saltwater in the Suisun Bay region and the dispersal of eggs, larvae, and nutrients; 5) reducing predation and competition which is affected by the density of fish; and 6) promotion of increased phytoplankton and zooplankton by increasing the residence time of nutrients in shallow-water habitat in the estuary.

This finding is consistent with the preponderance of the scientific literature cited by EPA in the references to its proposed rule.

- However, when the average X2 is located at or downstream of Roe Island in the western end of Suisun Bay, CUWA found that the uncertainty in the X2 versus abundance relationships increased dramatically, and the location of X2 explains less of the variance in the data. Based on analysis of: 1) X2 versus abundance indices for estuarine species not considered by SFEP or EPA, 2) an analysis of habitat conditions in the estuary, and 3) on an analysis of coabundance, CUWA also found many indications that locating X2 at or downstream of Roe Island reduces habitat for many species and places the entrapment zone downstream of the Suisun estuary. This may have adverse impacts on some estuarine species such as threadfin shad (through loss of habitat) and the endangered delta smelt (through promotion of competing species).

- Further, to adjust abundance indices to account for factors identified by CDF&G and to account for calculation problems such as those recently identified by Jassby, *et. al* (1994), CUWA re-calculated a number of the abundance indices used by EPA. Based on these corrected abundance versus X2 relationships, CUWA concurs with Jassby *et.al.* (1994) that the abundance versus X2 relationships are less certain and less robust than indicated in the preliminary analysis done by SFEP. The average position of X2 therefore explains substantially less of the variation in abundance than that postulated by SFEP. This suggests that 1) other factors are important constraints on ecosystem health and 2) factors such as loss of habitat, pollution, and exotic species are more important than suggested by the preliminary SFEP analysis.

CUWA's Proposed Alternative

To address the need for transport and to place key estuarine processes in the Suisun Estuary, CUWA believes that the focus of any regulation should be to assure that the brackish water zone (2 ppt to 10 ppt salinity) downstream of the Confluence and at or beyond Chipps Island will be maintained for a specified number of days during the period from February through June, the number of days to be determined as follows:

- The Sacramento River Index for the period February through June will be calculated at the beginning of the compliance period and updated at least monthly. The February-June Sacramento River Index is the appropriate index because it is the best estimate of the available water supply during the regulatory period.

- For a given Sacramento River Index, the number of days of compliance at the Confluence and Chipps Island would be determined based on a weighted least squares regression of the hydrology during the period 1968-1975, a period for which measured salinity data are available. Extending the period to include the extreme events (such as flood alternating with drought from 1976 through 1992) is unnecessary because it does not appear to significantly alter the results of the 1968-1975 regression.

- The number of days of compliance at each point would be updated at each re-calculation of the Sacramento River Index, but would not exceed the number of days remaining in the February through June regulatory period. This approach is preferred because it will best reflect hydrology during the regulatory period, while other indices take into account other factors which may be unrelated to accomplishing the goal of providing transport and brackish water habitat during the critical winter-spring period.

- Compliance would be based on achieving any one of the following requirements at the compliance point: 1) average daily salinity of 2 ppt at the compliance point, or 2) 14-day average salinity at the compliance point, or 3) maintenance of an outflow calculated to maintain average X2 at a steady state condition. This will prevent short-term extreme wind or tidal events from inappropriately causing non-compliance, as long as the required outflow is provided.

The proposed Suisun Estuary Standard would have significant benefits. It would protect the beneficial uses of the estuary by maximizing suitable habitat in Suisun Bay. The proposed standard would meet the needs of the estuary without extending management beyond the limits of our confidence in the data and data relationships.

To address issues which will arise in implementing its recommended Suisun Estuary Standard, CUWA also recommends the following:

1. All parties involved in promulgation and implementation of the CUWA-recommended Suisun Estuary Standard, including EPA, SWRCB, NMFS, USF&WS, USBR, DWR, CDF&G and others should consult to ensure that implementation of the proposed standard does not have adverse impacts on threatened or endangered species. Of particular concern is the impact of the standard on carryover storage needed to ensure low-temperature releases to the upper Sacramento River for winter-run chinook salmon.

2. Salinity measurement should be allowed near the surface, rather than at the bottom, because that is the standard measurement technique to reduce measurement difficulties. Surface electrical conductivity (EC) would be measured and these measurements would be converted to bottom salinity using well-established conversions. This is not intended to affect the position of the 2 ppt isohaline.

3. The appropriate agency(s) should develop a comprehensive monitoring and research program which would result in better understanding of how abundance and distribution of aquatic and marsh wetlands species are related to a full range of potential causative factors in the Delta and upstream areas. The purpose of the monitoring program would be to measure how the

estuarine standard is meeting its objectives and how other actions, such as those to restore habitat, are contributing to estuarine health. Any regulatory approach should allow for incorporation of the results of this program in the future. This is important because any standard must reflect changed conditions in the estuary to ensure that it continues to meet its goal of protecting beneficial estuarine habitat uses.

4. A water supply impact threshold (cap) should be established, beyond which a standard would be met with purchased water paid for by an environmental fund established for this purpose and supported by payments by the basin water users. This will ensure that the goals of the Suisun Estuary Standard are met in an economically viable manner.

5. All parties involved in promulgation and implementation of the CUWA-recommended Suisun Estuary Standard, including EPA, SWRCB, NMFS, USF&WS, USBR, DWR, CDF&G and others should coordinate with USF&WS and NMFS to address issues such as QWEST and take limits to ensure that cross delta transfers are feasible. As EPA notes in the Regulatory Impacts Analysis, transfers are a critical element of reducing the water supply impacts of a standard.

6. To avoid confusion and thus ensure orderly and prompt compliance, a compliance schedule should be established which would phase in requirements relative to a schedule for all Delta watershed users to appropriately share water supply impacts. Phasing is also appropriate in recognition of the need for operators to develop procedures for compliance, the need for the State Water Resources Control Board to address water allocation issues.

7. All parties involved in promulgation and implementation of the CUWA-recommended Suisun Estuary Standard, including EPA, SWRCB, NMFS, DWR, USF&WS, USBR, CDF&G and others should develop and implement a long-term multi-species plan for the Delta.

8. Habitat enhancement efforts in the Delta should be coordinated with similar efforts in upstream areas to concurrently meet both objectives.

9. A multi-species ecosystem approach to long-term Delta protections should be developed along with commencement of a joint State/Federal process, guided by the requirements of the California Environmental Quality Act and the National Environmental Policy Act, to develop a comprehensive water resources management plan for the estuary, addressing the many factors responsible for the decline in Delta resources including consideration of a full range of alternatives.

Review of the Fish Migration and Cold-Water Habitat Criteria

The Salmon Smolt Survival Index proposed under the Fish Migration and Cold-Water Habitat Criteria was developed by USF&WS, which has often noted that there are limits to its application. Consistent with the concerns of the USF&WS, CUWA analysis of the proposed Fish Migration and Cold-Water Habitat Criteria indicates that the proposed criteria is not the appropriate tool for accomplishing EPA's stated goals. Because the index is not valid over a wide range of conditions and operational scenarios likely to occur, compliance with the standard would be impossible under some circumstances, regardless of water project actions.

CUWA believes that the appropriate tool should be used to address salmon smolt survival issues and that, in lieu of the Fish Migration and Cold-Water Habitat Criteria, water management and other management provisions for ensuring salmon smolt survival should be developed by the appropriate federal and state agencies.

Review of the Fish Spawning Criteria

A striped bass spawning standard should not be set as proposed because 1) spawning habitat is not generally considered as the limiting factor in striped bass populations, and 2) actions intended to increase striped bass populations would be inconsistent with the protection of threatened and endangered species (winter-run chinook salmon and delta smelt). The goal of the proposed rule is to increase striped bass spawning success by reducing electrical conductivity in the San Joaquin River. Implementation of any standard should be coordinated with and consistent with USF&WS and NMFS recovery plans for threatened and endangered species. Such action should also be consistent with the State's program to regulate and control agricultural drainage.

Reference:

Jassby, Alan, *et. al.* 1994. *Isohaline Position as a Habitat Indicator for Estuarine Population.* Journal of Environmental Management (in press).

Attachment 2

Comments on

"Proposed Water Quality Standards for the San Francisco Bay/Delta"

prepared by

California Urban Water Agencies

Lyle Hoag, Executive Director

March 9, 1994

1. CALIFORNIA URBAN WATER AGENCIES TECHNICAL ANALYSIS OF THE PROPOSED EPA STANDARDS

1. PURPOSE AND SCOPE

California Urban Water Agencies (CUWA) represents California's eleven largest urban water agencies, serving over 20 million consumers and a large majority of the state's economic activity. CUWA is concerned with the decline of aquatic resources in the Sacramento-San Joaquin Bay/Delta and San Francisco Bay ecosystem (hereafter Delta). CUWA strongly supports development of a standard that protects Delta estuarine habitat. CUWA members have in the past supported efforts to address the causes of this decline and will continue to do so in the future. It is from this positive perspective that the CUWA Board submits these comments regarding the U.S. Environmental Protection Agency's (EPA) proposed rule: "Water Quality Standards for Surface Waters of the Sacramento River, San Joaquin River, and San Francisco Bay and Delta of the State of California," dated January 6, 1994 (40 CFR part 131 [OL-FRL-4783-6]).

California Urban Water Agencies has conducted a technical evaluation of the Environmental Protection Agency's proposed water quality standards for the San Francisco Bay/Delta (hereafter Bay/Delta). The objectives of this evaluation were:

a) To explain the proposed standards to the CUWA Board;

b) To investigate the scientific basis for the standards, including analysis of the scientific background to the standard and comparison of this background with the provisions of the standard itself. It was assumed that the science behind the standards was valid unless contradictory evidence was identified;

c) To evaluate the potential biological and water supply impacts associated with implementation of the standards, considering both direct and indirect impacts; and

d) To determine if these proposed standards were an appropriate response to the environmental problems in the Bay/Delta, and, to the extent they are not, to propose alternatives or refinements which would be as effective or more effective at meeting the goal of protecting estuarine habitat in Suisun, Honker, and Grizzly bays (hereafter Suisun Bay).

e) To specifically address the issues raised by the EPA in its Request for Comments.

CUWA assembled a technical team composed of CUWA member agency staff and consultants along with several independent consultants. Working under the general direction of Lyle Hoag, CUWA Executive Director, the team consisted of:

CUWA Staff and Consultants

Dr. Jud Monroe, Project Manager
Dr. Dudley Reiser, R2 Resource Consultants
Dr. Phyllis Fox, Analyst
Dr. John Rice, Statistics, UC Berkeley
Ms. Alison Britton, Analyst
Dr. John List, Consultant
Dr. Wim Kimmerer, Biosystems Analysis
Mr. Ed Conner, R2 Resource Consultants

CUWA Member Agency Staff and Consultants

Mr. Steve Arakawa, Metropolitan Water District
Mr. Randall Neudeck, Metropolitan Water District
Mr. Dan Steiner, Consultant to San Francisco Public Utilities Commission
Mr. Randy Bailey, Consultant to Metropolitan Water District
Dr. Jim Buell, Consultant to Metropolitan Water District
Mr. Jerry Cox, Consultant to Metropolitan Water District
Dr. B.J. Miller, Consultant to Santa Clara Valley Water District
Dr. Thomas Mongan, Consultant to Santa Clara Valley Water District

The San Luis and Delta-Mendota Water Authority cooperated in this technical study, with the following members of their team participating:

Dr. B.J. Miller, Consultant and Project Manager for SLDMWA
Dr. Thomas Mongan, Consultant
Dr. Carl Chen, Systek Engineering
Mr. Dan Nelson, SLDMWA
Mr. Lance Johnson, SLDMWA
Mr. Tom Boardman, SLDMWA
Ms. Francis Mizuno, SLDMWA

CUWA conducted a technical evaluation of the standards and the science behind the standards. Work products of the two organizations were exchanged for review and discussion The evaluation effort was a proactive response to the proposed standards: 1) an effort to understand them, 2) an effort to determine if they are based on the best available science and the most cogent analysis of this science, and 3) an effort to ensure that any standard, whether promulgated by EPA or by the State Water Resources Control Board (SWRCB), would be an appropriate response to the problems identified. The comments which follow, based on the advice of the technical team, are the consensus of the CUWA Board. Neither the work products, the representatives, or the comments of CUWA and SLDMWA should be assumed to represent the views of the other organization.

The comments below address each of the three elements of the proposed EPA standard separately:

- The Estuarine Habitat Criteria
- The Fish Migration and Cold-Water Habitat Criteria
- The Fish Spawning Criteria

These comments are focused on a series of specific issues that which form the basis of a CUWA recommendation regarding each of the three elements of the EPA-proposed standard. For each element, the summary conclusions are presented, followed by a discussion of the key findings which support the conclusion. Findings related to CUWA independent analysis of the data (not to literature review) are cross-referenced to brief appendices which present summary data and analysis in tabular and graphic form which support the findings, based on the technical findings of the technical team. The questions addressed are outlined below and answered, in sequence, in the analysis which follows.

The Estuarine Habitat Standard

1) Is there a sound scientific basis for an estuarine habitat standard with compliance based on measurement of average salinity at various locations in the Suisun Bay?

   a) Has there been a decline in estuarine habitat and aquatic resources?

   b) Is calculated average X2 a valid indicator of estuarine conditions?

2) What is an appropriate standard and how would it function to sustain the ecological health of the estuary?

   a) What physical and hydrologic conditions would implementation of a salinity-based standard create in the estuary and what water resources would be required?

   b) What would be the environmental benefits and impacts to the estuary of creating these physical conditions?

   c) Would these benefits and impacts result in a *net* environmental benefit to the estuary ecosystem?

d) What impacts to other species in the Bay/Delta could be reasonably expected from promulgation and implementation of the standard?

e) What is the probable net impact of implementation on Bay/Delta species?

3) What other actions need to be taken to ensure the health of the Bay/Delta ecosystem?

a) What other factors appear to affect estuarine health?

b) What is the response required to address these factors?

4) What are the potential water supply impacts associated with the proposed standard? How do they differ from those of the CUWA proposed alternative?

The Fish Migration and Cold-Water Habitat Criteria

1) Is there a sound scientific basis for the proposed Fish Migration and Cold-Water Habitat Criteria?

2) What is the appropriate approach to meeting the goals of the Fish Migration and Cold-Water Habitat Criteria?

The Fish Spawning Criteria

1) Is there a sound scientific basis for the Fish Spawning Criteria?

2) What is the appropriate approach to meeting the goals of the Fish Spawning Criteria?

2. THE EPA ESTUARINE HABITAT CRITERIA

2.1 Introduction

The proposed estuarine habitat criteria, involving a requirement for the number of days that the 14-day moving average bottom salinity of 2 ppt must be downstream of three locations in Suisun Bay, is primarily based on an analysis of the relationship of the abundance of 8 indicators of estuarine habitat and the calculated position of the 2-ppt isohaline (hereafter X2, measured in kilometers upstream from the Golden Gate Bridge)). The assumption behind EPA's analysis is that the average position of X2 is an appropriate indicator or index of estuarine habitat because it integrates a number of estuarine properties and processes (EPA Proposed Rule, Section C(1)(b and c). EPA cites Moyle (1992):

> ". . .while the exact mechanisms that account for the importance of having the [entrapment] zone in Suisun Bay (increased food supplies, physical concentration of organisms, association with higher flows, etc.) are being debated, there seems little doubt that many fish species depend on this location [of the entrapment zone] for their long-term survival."

EPA further states:

> "EPA is selecting the 2 ppt isohaline as the basis for its proposed criteria in part because that isohaline incorporates a whole range of factors relevant to the estuary's health, even though the operation of some of these factors is not fully understood."

Jassby (San Francisco Estuary Project (SFEP) 1993) developed a series of abundance vs X2 regression curves (hereafter the X2 series) which indicated that abundance levels increase as the average position of X2 is located further downstream. The motivation for the EPA salinity standard was the statistical relationship between abundance and the calculated average position of X2 for a specified period of time for each indicator. The standard was established for the period from February through June because EPA determined that this was a biologically important period for most of the 8 indicators.

Assuming that X2 is the appropriate regulatory parameter, EPA then established the number of days of required compliance at each of three locations based on an objective of achieving biologic conditions similar to those during the late 1960's and early 1970's.

To understand and evaluate the scientific basis for the proposed estuarine habitat criteria, CUWA first addressed the need for a standard. Second, CUWA evaluated the appropriateness of the proposed standard from the point of view of whether its various provisions would contribute to accomplishment of its stated purpose: to protect "water quality necessary to sustain the ecological health of the estuary." CUWA's conclusions and the findings in support of these conclusions are presented below.

2.2 Conclusions and Findings in Support of Conclusions

2.2.1 Is there a sound scientific basis for an estuarine habitat standard with compliance based on measurement of average salinity at various locations in the Suisun Bay?

First, CUWA review of the scientific basis for the estuarine habitat standard resulted in general concurrence that there has, indeed, been a serious decline in Bay/Delta aquatic resources and that reduction of spring outflow and resulting alteration of estuarine processes is one cause of that decline. To address this issue CUWA both reviewed pertinent literature and obtained the data bases used to develop the abundance indices and evaluated their method of calculation. Not all data bases were readily available to CUWA, and CUWA findings related to this question are primarily based on review of the indices calculated from California Department of Fish and Game (CDF&G) Fall Midwater Trawl surveys, Summer Townet Surveys, and a partial analysis of the CDF&G Bay Study data base.

Second, CUWA concurs with EPA that there is a relationship between the average position of the 2 ppt isohaline (which is a function of freshwater outflow from the Sacramento-San Joaquin rivers) and the processes necessary for a estuarine function. An estuarine habitat standard which provides for additional outflows to Suisun Bay is therefore justified. As EPA notes in its proposed rule, measurement of compliance with such a standard may be accomplished by measurement of salinity, as an indicator of estuarine function. This standard should be a feature of a program for recovery of the Bay/Delta ecosystem. However, CUWA believes that some of the relationships between the location of the X2 and estuarine functioning are more complicated and less certain than those proposed by the San Francisco Estuary Project (SFEP) and used as the basis for the EPA proposed rule. The uncertainties in the relationship between X2 and indicators of estuarine conditions are greatest for calculated average locations of X2 downstream of Chipps Island. The basis for these conclusions is outlined below.

A preponderance of the literature indicates that native aquatic resources of the Bay/Delta ecosystem, including anadromous species which traverse the Bay/Delta, have experienced declines in abundance or changes in distribution.

A. The March 1992 SFEP "Status and Trends Report on Aquatic Resources in the San Francisco Estuary" documents: 1) changes in the abundance and composition of primary producer communities; 2) long-term declines in some zooplankton such as *Eurytemora affinis* in San Pablo and Suisun Bays; 3) changes in abundance and community composition of benthic organisms; 4) significant declines in chinook salmon runs; 5) a continuous decline in striped bass populations; 6) a probable decline in sturgeon populations; 7) a general decline of planktivorous fishes in Suisun Bay and the Delta; 8) declines in numerous native fish species; 9) increases in populations of exotic species such as the chameleon goby and the Asian clam.

B. The SFEP "Status and Trends Report on Aquatic Resources in the San Francisco Estuary" further documents many fluctuations in the relative abundance of various species at all trophic levels, and suggests that 1) there is significant variation in the ecosystem and 2) there may be long-term changes in the ecosystem.

C. Similar findings by California Department of Fish and game (CDF&G), United States Fish and Wildlife Service (USF&WS), National Marine Fisheries Service (NMFS), and other resource agencies suggest that there have been significant changes in the Bay/Delta ecosystem's communities, and that some of these changes involve declines in native species.

D. CUWA (Appendix 1) recalculated several of the abundance vs X2 relationships used by EPA as a biological basis for the standard for several species, correcting for a number of statistical problems in the original calculations. CUWA determined that there is a significant relationship between the calculated average location of X2 during the proposed regulatory period and subsequent increases in many of the indicators of estuarine health used by EPA. Based on CUWA's adjustments, this relationship is not as strong as reported by EPA, and the statistics indicate that the calculated average location of X2 downstream of Chipps Island explains much less of the variability in the indices of estuarine health than suggested in previous work. Nevertheless, this analysis supports a general conclusion that there has been a continuing decline in Bay/Delta estuarine resources.

The relationships between estuarine conditions and X2 are more complicated and less certain than those proposed by the SFEP and used as the basis for the EPA proposed rule. As the calculated average location of X2 moves downstream from Chipps Island, uncertainties in the relationship increase. When outflows are higher, and the average X2 is therefore pushed to the western end of Suisun Bay, CUWA found that the uncertainty in the X2 vs abundance relationships increased dramatically, and the location of X2 explains less of the variability in the data. The basis for this conclusion is outlined in detail below.

A. The X2 vs abundance relationship is reliable for low outflow conditions.

When outflow is consistently low, and therefore the average location of X2 is consistently upstream of the confluence of the Sacramento and San Joaquin rivers, the relationships between X2 and abundance are reliable. The prediction of low abundance under low outflow conditions (or when X2 is above the confluence) is also substantiated by the X2 series as corrected by CUWA (Appendix 1).

CUWA (Appendix 2) found that measures of estuarine primary productivity such as concentration of particulate organic carbon (POC) increase with outflow, and that these measures are positively correlated with various indices of estuarine health. Specifically, when outflows are low and the average calculated position of X2 is above Chipps Island, the index of riverine POC is low. To the extent that riverine POC increases as a result of overland runoff, and therefore with outflow, the position of X2 (which is related to outflow) may therefore be an indicator of the condition of the base of the food chain in the estuary

B. Nevertheless, there is significant uncertainty in the abundance indices themselves (Appendix 4). CUWA found a *systematic* bias evident in the sampling upon which the abundance indices are based, in that the sampling effort may not sample the entire population of each species. However, it is not possible to correct for these potential problems and not possible to address the influence of this bias on the X2 series. CUWA notes, however, that the potential for sampling problems to influence the data, and therefore the abundance indices, increases the level of uncertainty regarding their usefulness as predictors of estuarine conditions.

CUWA re-calculated several of the abundance indices (primarily from Fall Midwater Trawl Data) to correct for potential biases in abundance indices recently identified by CDF&G and calculation problems such as those recently identified by Jassby, *et. al* (1994). Based on these corrected X2 series relationships (Appendix 1), CUWA concurs with Jassby *et.al.* (1994) that the abundance vs X2 relationships are less certain and less robust than indicated in the preliminary analysis done by SFEP. The average location of X2 therefore explains substantially less of the variation in abundance than postulated by SFEP. This suggests that 1) other factors have constrained the ecosystem health and 2) these other factors are more important than suggested by the preliminary SFEP analysis. Specific findings related to the uncertainties identified in the calculation of abundance indices themselves were:

1) The data from the Fall Midwater Trawl (FMWT) show some sampling biases (Appendix 4) which could potentially distort or confound the abundance indices, but (1) not all potential biases were investigated (including turbidity, tidal phase, and tidal velocity) and (2) the biases identified and evaluated by CUWA were not generally found to invalidate year-to-year trends in young-of-year calculated abundance and the relationships of the X2 series.

2) CUWA found considerable temporal and spatial variability in the data used to derive annual abundance indices for the species used to support the X2 standard. Therefore, there is a degree of uncertainty regarding how well the abundance indices reflect actual species populations. This level of uncertainty increases for species with moderate but widely dispersed populations including delta smelt, and (especially) Sacramento splittail.

3) CUWA found several sources of sampling bias for delta smelt, including time of sampling during the day, time of sampling during the year, depth, turbidity, and population dispersion. These biases appear to be strongest in drought years. These sources of bias may lead to population underestimation or overestimation, depending on conditions.

4) As an example of sampling bias, CUWA found that sampling results for delta smelt were influenced by the time of day when sampling occurs. Based on the analysis of this influence, delta smelt populations may be underestimated during a portion of the recent drought (1989-1990) due to decreasing catch efficiency related to time of day of sampling during drought conditions.

5) CUWA notes that there was obvious variation in delta smelt catch for a given salinity, suggesting there is a wide range of tolerance for the calculated location of X2.

6) CUWA also found that abundance indices for many species, including *Crangon franciscorum* (bay shrimp), delta smelt, longfin smelt, and starry flounder decrease when populations attain a wider spatial distribution, possibly reflecting movement of the fish out of the FMWT study area (for example, longfin smelt migrating into the central bay). This is indirect evidence that there may be sampling differences in the FMWT and Bay Study surveys and that the abundance indices may be influenced by distribution.

7) Certain species, notably Sacramento splittail, are so rare in the surveys that few conclusions can be reached regarding their relationship to salinity or the calculated position of X2.

8) Based on evaluation of species distribution in the FMWT catch, most of the species sampled in the FMWT are distributed over a wide range of salinity conditions both above and below the calculated X2 position.

9) CUWA notes that the FMWT abundance indices used by SFEP (Jassby 1993) to determine the relationship between X2 and indicators of estuarine condition have recently been corrected by CDF&G.

C. The methods used to calculate some of the indices and to relate them to average location of X2 lead to significant uncertainty about the predictive ability of the X2 series for values of X2 downstream of Chipps Island.

Regarding the methods used to calculate abundance indices themselves, and the calculation of X2 series relationships, CUWA found that, abundance index issues aside, Jassby's (SFEP 1993) analysis of the X2 series contained no obvious computational errors, but there were a number of other mathematical problems related to the calculated relationship of the X2 to abundance indicators of estuarine condition).

1) First, the biologically critical period used in the X2 series does not correspond to the proposed regulatory period.

2) Second, as noted above, CDF&G has discovered and since corrected an error in the FMWT indices that Jassby (SFEP 1993) used.

3) Third, SFEP (Jassby 1993) omitted 1967 and 1983 in their analyses. CUWA reanalyzed the X2 series with these two years added and found that including these two years in the analysis did not have the result anticipated by SFEP.

4) Fourth, SFEP (Jassby 1993) assumed the variance was constant for striped bass and was proportional to the mean for longfin smelt.

5) Fifth, SFEP (Jassby 1993) did not report a calculated uncertainty associated with the fitted equations.

6) Finally, SFEP used the total index for FMWT indicators, which, if abundance indices are used as measures of real population and trends in a population as they are in the X2 series, may alter the strength predicted increase in abundance achieved for a given X2 location.

7) Jassby *et. al.* (1994) indicate that, when they addressed the issue of other factors which may be influencing abundance, the uncertainty in the X2 regressions increased. They concluded 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."

D. Re-calculating the average indices, correcting for various calculation problems, and calculating in a manner more consistent with that used by the Bay Study, suggests that changes in abundance may be less dramatic than have previously been reported (Appendix 1). The analysis suggests that longfin smelt populations have not declined, and splittail populations may have increased. Further, delta smelt and striped bass populations may have declined at a lower rate than had previously been reported.

1) CUWA found that when the revised average indices for longfin smelt and striped bass are regressed against the location of X2, using Jassby's methods including the first five adjustments mentioned above, the percent of variability in abundance index explained by the location of X2 was significantly smaller than originally calculated by SFEP (Jassby 1993):

Species	Squared Correlation Coefficient (r^2)	
	SFEP	CUWA
Striped Bass	0.71	0.50
Longfin smelt (1)	0.74	0.27

2) CUWA (Appendix 5) found that the reported relationship between delta smelt abundance and the number of days that X2 is in Suisun Bay from February to June is not statistically valid because it fails to account for the nonuniform variance in the data. When this variance is corrected, the relationship is no longer statistically significant and X2 accounts for very little of the variability in abundance: the squared correlation coefficient for the X2 vs delta smelt abundance index relationship is only 0.13.

E. CUWA examined the abundance data to determine whether a non-continuous function could be fitted to the data. Although there are statistically significant differences in mean abundance and variability upstream and downstream of roughly 68-80 km, CUWA could not fit a discontinuous function to the data. However, there are biological reasons to indicate that there may be a discontinuity in the data, discussed in later comments.

F. CUWA found a positive relationship between salvage of Sacramento splittail at the SWP and CVP facilities and the abundance index for this species, suggesting that salvage may be a good indicator of splittail abundance within the Delta.

When outflow is 8,000 to 15,000 cfs, which places the calculated average location of X2 near Chipps Island, the X2 series shows that abundance increases. Although there is less certainty in the relationships between X2 and various indicators of estuarine condition, the uncertainties are not large (Appendix 1) for this reach of the estuary. CUWA performed a number of other analyses which suggest that estuarine processes in Suisun Bay are enhanced by outflows of this magnitude. CUWA found that habitat of a majority of estuarine species is greatest under these flow conditions.

The benefits of locating X2 at or near Chipps Island include: 1) placement of the 2 ppt to 10 ppt brackish water zone in the Suisun Bay region, 2) placement of the turbidity maxima in Suisun Bay, 3) helping to ensure transport of eggs, larvae, and nutrients into the shallow-water areas of Suisun Bay, 4) allowing for mixing of freshwater and saltwater in the estuary and dispersal of eggs, larvae, and nutrients, 5) reducing predation and competition which is affected by the density of fish, and 6) promotion of increased phytoplankton and zooplankton production by increasing the residence time of nutrients in the shallow-water estuary.

This finding is consistent with the preponderance of the scientific literature cited by EPA in the references to its proposed rule.

A. CUWA analysis of riverine productivity (Appendix 2) indicates that indicators of primary productivity increase when the calculated average location of X2 is near river kilometer 72, just downstream of Chipps Island. However, the supposition that primary productivity, the base of the food web, is *controlled* by the location of X2 is unfounded. Primary productivity in Suisun Bay, as represented by the POC series, is primarily influenced by upstream factors as represented by Delta outflow, not X2 (Appendix 3). Locally-derived POC declines marginally as flows increase and X2 moves downstream.

In short, riverine sources of organic carbon and other nutrients are the most important factor in establishing the base of the food chain. The origin of POC in riverine flows is related to unregulated flows over the watershed. To the extent that outflow and the location of X2 are indicators of these unregulated inflows carrying nutrients from the watershed not controlled by reservoirs, the location of X2, which is clearly related to such flow, may be a reasonable measure of riverine productivity input to the Suisun Bay.

B. A review of the literature upon which the SFEP based its conclusions indicates a preponderance of opinion that processes such as mixing of fresh and salt water; transport and distribution of eggs, larvae, and juveniles; transport and distribution of food supplies; and other processes necessary for estuarine function should be located in Suisun Bays, not in the narrow confines of main channels (Sacramento River, San Joaquin River, and Carquinez Strait). Maintaining this "entrapment zone" in Suisun Bay enhances the opportunity for shallow water euryhaline species to thrive, although the mechanisms which account for this are not fully understood.

C. CUWA, in its review of literature cited in the SFEP report, notes that Fullerton (1991) concluded that placement of the entrapment zone in Suisun Bay increases the residence time of phytoplankton in this favorable habitat. Fullerton indicates that this requires minimum flows, but that high flows decrease residence time and push phytoplankton out of Suisun Bay. Fullerton notes that the conjunction of the entrapment zone with the shoals of Suisun Bay is the dominant factor leading to high productivity of Suisun Bay.

D. Given that X2 correlates well with these estuarine processes (SFEP 1993), then X2 is a reasonable indicator of estuarine condition at low and moderate outflows.

However, when outflows are high enough to locate the average X2 at to the western end of Suisun Bay, CUWA found that the uncertainty in the X2 series increased dramatically, and the location of X2 explains less of the variability in the data.

A. CUWA (Appendix 1) found that the variance in abundance indices for some species increases exponentially as the index increases. This suggests that high indices are less reliable predictors of actual abundance than low indices.

B. CUWA (Appendix 1) found that the uncertainty in predicted abundance indices based on FMWT data increases significantly for values of X2 less than 70-75. Given that other factors are eliminated from consideration, this suggests that predictions of abundance indices may be reliably made from X2 for average locations of X2 upstream of Chipps Island, but that the predictive value of X2 declines rapidly when X2 is located downstream of Chipps Island.

C. Comparing the abundance indices vs X2 for Chipps Island and Roe Island, CUWA (Appendix 6) found that the amount of variability in abundance explained by X2 increases with downstream movement of X2 for some indicators (*Crangon franciscorum*, striped bass, starry flounder, and longfin smelt) but decreases for other indicators (*Neomysis mercedes*, POC, striped bass survival, and Sacramento splittail). Both the r^2 values and the upstream and downstream slopes of the regressions are statistically equal, except for longfin, suggesting that these species gain no benefit from locating X2 at Roe Island. In an additional comparison, there was no significant difference in variability for delta smelt. This suggests that X2 becomes a less reliable predictor of overall estuarine habitat conditions at the high outflows needed to place X2 at or downstream of Roe Island than for the moderate outflows needed to place X2 downstream of Chipps Island.

D. Comparing abundance indices of other estuarine species to the location of X2 (Appendix 5) also suggests that X2 does not universally predict abundance. No statistically significant model relating abundance indices and X2 could be fitted for delta smelt, threadfin shad, topsmelt, white croaker, and white sturgeon, suggesting that other factors control the abundance of these fish. X2 thus predicts less than 45% of the variance in abundance for chinook salmon ($r^2 = 0.36$), inland silversides ($r^2 = 0.16$), northern anchovy ($r^2 = 0.43$), and Pacific herring ($r^2 = 0.27$). For topsmelt and threadfin shad, the relationship between X2 and abundance appears to be negative; that is, downstream location of X2 is associated with a decline in abundance index.

The increasing uncertainty in the X2 series as the average location of X2 moves downstream of Chipps Island does *not* argue against use of salinity as an indicator of estuarine condition. Rather, it suggests 1) that the proposed standard should be based on those portions of the X2 series for which there is reasonable predictive certainty and 2) that the mechanisms potentially responsible for estuarine conditions need to be explored in order to determine the appropriate standard. In short, the X2 series is probably valid for a certain range of conditions. It is necessary to understand those conditions in order to develop an appropriate standard to protect beneficial uses in the Suisun Bay.

2.2.2 What is the appropriate standard and how would it function to sustain the ecological health of the estuary?

It is CUWA's view that there is a relationship between the location of X2, outflow, estuarine processes, and abundance of estuarine species and that this relationship varies with the location of X2.

The physical and biological mechanisms responsible for the X2 vs abundance relationships, and for the variation in this relationship, would appear to be related to transport; nutrient residence time in shallow-water habitat; mixing phenomena; reduced predation related to turbidity and other factors; dispersal of eggs, larvae and nutrients into shallow-water habitat; the presence of brackish water in the estuary; and within-year variability in conditions. The evidence for this conclusion is summarized below.

A. Transport of eggs and larvae out of the inhospitable river/delta channel complex into the Honker, Suisun, and Grizzly bays complex appears to be important to estuarine function. The evidence supporting this is:

1) Kimmerer, in a summary of 20 years of research (IESP Report 33, September 1992), suggests that transport of eggs and larvae downstream from spawning areas to the entrapment zone is necessary for striped bass.

2) USF&WS Designation of Critical Habitat for delta smelt concludes that flows are necessary to transport larval and juvenile fish downstream to rearing habitat in Suisun Bay.

3) In the USF&WS Delta Smelt Biological Opinion, during the spawning and rearing interval, from February 1 to June 30, adequate outflows of sufficient magnitude are necessary. These flows provide transport away from the CVP/SWP pumps, but also provide the necessary habitat rearing areas within Suisun Bay and Marsh. The entrapment zone needs to be downstream of the confluence.

4) Under current average water year conditions, survival is enhanced when eggs and larvae are transported out of the Delta, away from areas of entrainment in the Delta, downstream to nursery areas (IESP Annual Report, 1991).

5) Based on our statistical analysis of abundance vs X2 (Appendix 6), it appears that abundance of some species increases when outflows are adequate to move the entrapment zone out of the confluence and into Suisun Bay, but do not obtain significant benefit from a movement of X2 further downstream. For these species, transport beyond the confluence would appear to be important to egg and larval survival and subsequent recruitment.

   * Larval striped bass are most numerous in the western Delta and Suisun Bay (CDF&G 1985).

   * Moyle (1992) suggests that maintenance of net seaward flows in the lower San Joaquin River during the period when delta smelt larvae are present is related to maintenance of delta smelt populations.

B. Transport of nutrients, and nutrient residence time in the estuary appears to be important to estuarine function. The evidence supporting this is:

1) Both the 1990 and 1991 IESP Annual Reports discuss the importance of transport of nutrients and particulates into Suisun Bay, and residence time of nutrients in shallow-water estuary habitat.

2) In the Status and Trends Report on Aquatic Resources (SFEP 1992), Jassby states that the position of the entrapment zone relative to large expanses of shoal areas was the most critical factor regulating accumulation of phytoplankton in the zone.

3) In his "Synopsis of Evidence Presented to the State Water Resources Control Board in the Bay Delta Hearings on the Functioning and Benefits of the Entrapment Zone," Fullerton (1991) concurs that outflows necessary to place the entrapment zone in Suisun Bay increases the concentration of phytoplankton.

4) Abundance of entrapment zone species are highest at the location of highest concentration of chlorophyll.

5) High flows bring higher inflows of phytoplankton and nutrients to shallow-water habitat.

6) The U.S.G.S. two-dimensional model suggests that brackish-water habitat in Suisun Bay has a relatively long residence time under moderate flow conditions, due to tidal trapping in Grizzly Bay and Suisun Bay. Under higher flow conditions, nutrients, eggs, and larvae are transported out of the system into Carquinez Strait and San Pablo Bay.

7) In the Status and Trends Report (SFEP 1992), Moyle *et.al.* conclude that moderate flow levels are necessary to maximize biological productivity and that they increase the residence time and concentration of POC and the concentration of nutrients.

8) The SFEP 1992 Status and Trends Report indicates that riverine loading is the dominant source of organic carbon in Suisun Bay. Because reservoir releases are not nutrient-rich, overland runoff is probably the primary source of organic carbon.

9) Turner and Chadwick (1972) note that nutrients in the estuary increase with flow; CUWA notes that this may be a function of unregulated flows which bring nutrients from runoff, rather than reservoir releases.

10) Concentrations of chlorophyll are highest in the entrapment zone, for all outflows. Placement of the entrapment zone adjacent to shallow-water habitat therefore provides nutrients in this zone.

C. Mixing of salt and freshwater in the estuary, resulting in dispersal of nutrients, eggs, and larvae to shallow-water habitat is important to estuarine function. The evidence in support of this is:

1) Kimmerer (IESP Technical Report 33, 1992) states that the combined energy of tidal and stream flows is balanced at some intermediate point. This balance results in settlement of particles during slack water, and subsequent resuspension during tidal flows causing a turbidity maximum near the area of minimum kinetic energy. This area should be adjacent to the shallow-water habitat of the estuary.

2) The bathymetry of the SF Bay/Delta estuary is complex, and therefore circulation is complex (Kimmerer, 1991). In Suisun Bay, the topography interacts with tidal flows to produce a net counter clockwise flow that is strongest during the tides of the spring. This results in lateral dispersion. This counter clockwise circulation depends on a balance of outflow and tide. Very high outflows diminish the tidal influence. In addition, high outflows increase surface velocity and carry nutrients, eggs, and larvae of some species out of the estuary and out of the influence of this tidal circulation (except striped bass, where eggs are on the bottom).

3) According to Stevens (1985), when buoyant larvae of delta smelt and other estuarine fish species are carried by downstream flows into the upper end of the mixing zone of the estuary, the mixing currents at the upper end of the mixing zone keep larvae circulating with abundant zooplankton also found in this area.

4) Adult delta smelt are most abundant in low-salinity water associated with the mixing zone in the estuary, except when they are spawning. When the mixing zone is in Suisun Bay, a majority of fish are captured in shallow-water habitat, and there is more of this habitat available when the mixing zone is in Suisun Bay.

D. Reduced predation on juveniles and reduced competition due to more available habitat (dispersal) and more cover (turbid conditions) are important to estuarine function. The evidence in support of this is:

1) The preponderance of scientific evidence suggests that there is reduced predation when turbidity is higher.

2) Based on CUWA analysis of turbidity data (Appendix 7), there is maximum turbidity in Suisun Bay when outflows are from 10,000 to 20,000 cfs (CUWA). This is consistent with Arthur and Ball (1979), who found that flows of 9,000 to 13,000 cfs are required to maximize turbidity in Suisun Bay.

3) Midwater trawl catches are greater when turbidity is high; if the fish cannot see the net, then predators cannot see prey.

4) According to Stevens and Miller (1985), dispersal of young increases with increasing flow, which probably results in lower density-dependent mortality.

E. The presence of brackish water in the estuary is important. Evidence in support of this is:

1) In a recent Interagency Ecological Studies Program Newsletter, Herbold (1993) and the U.S. F&WS (Biological Opinion) show that delta smelt abundance is greatest when X2 is adjacent to Suisun Bay (not at the confluence or downstream in Carquinez Strait).

2) U.S. F&WS (1993) indicates that Sacramento splittail do best when X2 is located adjacent to Suisun Bay.

3) CUWA's analysis of the data suggests that adults of some species have preferences for brackish water; available habitat for these species may be greatest when the 2 ppt to 10 ppt zone is in Suisun Bay (Appendix 8).

F. Year-to-year, and within-year variation in outflow patterns. Evidence that variation in outflow patterns is important. Evidence in support of this includes:

1) CUWA analysis of abundance indices which shows that conditions which benefit one species may not benefit another (lack of coabundance, Appendix 9).

2) CUWA analysis of abundance of species other than those which were used to justify the proposed EPA rule that indicates that the habitat of 14 species (based on salinity preferences) may be reduced when the average calculated position of X2 is at or downstream of Roe Island (Appendix 8).

CUWA believes that the functions of 1) transport, 2) nutrient residence time in shallow-water habitat, 3) mixing phenomena, 4) reduced predation related to turbidity and dispersal, 5) the presence of brackish water in the estuary, and 6) within-year variability in conditions tend to be generally most favorable for the full range of aquatic biota in Suisun Bay when the upstream boundary of the 2 ppt to 10 ppt zone is, on average, located at or near Chipps Island during the proposed regulatory period. This is an appropriate basis for management provided that this condition is not imposed on a consistent basis from year-to-year; too much consistency in estuarine conditions, in an estuary which has historically had widely varying year-to-year conditions, could favor one suite of species over another. The exception to this caveat is that flows adequate to provide transport of eggs, larvae, and nutrients would appear to be required relatively more consistently to ensure that they are transported through the Delta and beyond the confluence. The evidence in support of this conclusion is outlined below.

A. It is clear that consistently low outflows do not deliver high volumes of nutrient rich flow to the estuary. Also the apparent decline in concentrations of locally-derived POC

(Appendix 3) as X2 moves downstream suggests that high outflows from reservoir releases (and therefore not carrying nutrients from unregulated watershed areas) may decrease nutrient residence time in the estuary by flushing locally-derived nutrients without supplying riverine-derived nutrients. Consistently high or low outflows might therefore have an adverse impact on nutrient loading in the estuary.

B. CUWA (Appendix 10) evaluated patterns of historic hydrology. From Appendix 10, it is clear that there is increasing year-to-year variation in the number of days that X2 is maintained at a given location during the proposed regulatory period (from February through June) as X2 is located further downstream. That is, X2 has historically been at or downstream of the confluence for extended periods of time during the regulatory period, except in drought conditions; from 1930 to 1992, X2 was at or downstream of the confluence more than 120 days during February through June in 52 out of 63 years. There is less consistency in year-to-year X2 location at Chipps Island (40 out of 63 years), and even less at Roe Island (17 out of 63 years). This trend is evident in pre-CVP and pre-SWP periods.

C. CUWA (Appendix 10) found that implementation of the standard, as proposed or as modified by EPA's proposed sliding scale, would result in a significantly greater number of days of average location of X2 at the given compliance points for a given water year type than would have occurred either during the EPA target period of 1968-1975 or during the period of record from 1968 to 1992.

D. Based on an analysis of habitat availability considerations as a function of salinity, CUWA evaluated the habitat preferences of 41 species, compared them to changing locations of X2, and found that total number of species with potential habitat impacts (either positive or negative) related to position of X2 was greatest when the calculated X2 would be at Roe Island as opposed to Chipps Island or the confluence (Appendix 8). Maintaining variation in habitat in downstream reaches of the estuary would therefore appear to be important to a variety of species.

Therefore, to address the need for transport and to place key estuarine processes in the Suisun Bay, CUWA recommends a "Suisun Estuary Standard" that provides for outflow which will place the brackish water zone (2 ppt to 10 ppt) downstream of the Confluence and Chipps Island for a specified number of days during the period from February through June, the number of days to be determined as follows:

- The Sacramento River Index for the period February through June will be updated at least monthly, or more frequently if desirable.
- For a given Sacramento River Index, the number of days of compliance at the Confluence and Chipps Island would be determined based on a weighted least squares regression of the hydrology during the period 1968-1975, a period for which salinity data are available. Extending the period to include the extreme

events (such as flood alternating with drought from 1976 through 1992) is unnecessary because it does not appear to significantly alter the results of the 1968-1975 regression.

- The number of days of compliance at each point would be adjusted at each re-calculation of the Sacramento River Index, but would not exceed the number of days remaining in the February through June regulatory period. This approach is preferred because it will best reflect hydrology during the regulatory period, while other indices take into account other factors which may be unrelated to accomplishing the goal of providing transport and brackish water habitat during the critical winter-spring period.

- Compliance would be based on achieving any one of the following requirements at the compliance point: 1) average daily salinity of 2 ppt at the compliance point, or 2) 14-day average salinity at the compliance point, or 3) maintenance of an outflow calculated to maintain average X2 at a steady state condition. This will prevent short-term extreme wind or tide events from causing non-compliance, as long as the required outflow is provided.

CUWA does not recommend a Roe Island Standard because 1) the uncertainty in the relationships between X2 and indicators of estuarine increases significantly downstream of Chipps Island, suggesting that there are uncertain benefits from the standard and 2) there are potential adverse environmental impacts associated with the standard. The evidence for this conclusion is outlined below.

A. DWR has found that implementation of the standard could have significant impacts on carryover storage in the Sacramento River Basin. The Roe standard would account for a large portion of the loss of carryover storage. Of particular concern is the impact of the standard on carryover storage needed to ensure low-temperature releases to the upper Sacramento River for winter-run chinook salmon. Endangered Species Act consultation documents have not been available to address this issue. CUWA's analysis indicated that the incremental requirements of the Roe standard, as proposed by EPA, would be 800 thousand acre-feet (TAF) in wet years, 500 TAF in above normal and below-normal years, and 200 TAF in dry years; this water supply impact would probably affect carryover storage.

B. CUWA (Appendix 10) noted that the historical record shows only a few (very wet) years (such as 1969 and 1983) when there were sustained high outflows; the hydrologic record more frequently shows high variation in outflow, particularly following March. The result of implementation of the Roe Island portions of estuarine habitat criteria, as proposed, may reduce somewhat the within-year variability in hydrology in Suisun Bay which may have an impact on the biology of the estuary.

C. CUWA's coabundance analysis (Appendix 9) suggests that conditions which benefit some species do not benefit others. CUWA analyzed the relationship between abundance of several key estuarine species and found that when delta smelt and Sacramento splittail have high abundances, they do not occur in the same year; that is, when delta smelt abundance is high, splittail abundance tends to be low and vice versa. This lack of coabundance further suggests that conditions which favor one species may not favor the other. This analysis suggests that conditions which benefit Neomysis also benefit Crangon franciscorum but do not benefit longfin smelt, Sacramento splittail, and striped bass.

D. CUWA further found that several species not evaluated by EPA showed declines in abundance indices in response to increased outflow (and therefore to location of X2 further downstream from the confluence), including inland silversides and threadfin shad, while several other species showed virtually no response to the location of X2 (white sturgeon, white croaker, delta smelt and topsmelt).

E. As noted above, CUWA believes that analysis of habitat change is an effective approach for evaluation of potential impacts. Based on an analysis of habitat considerations and an analysis of all life history stages, CUWA (Appendix 8) found that the habitat of a number of species may be reduced when X2 is located at or downstream of Roe Island. Fourteen species were identified which could be adversely affected at one life history stage or another, due to changes in habitat. For delta smelt, the amount of habitat gained from a Roe Island standard is minimal. Based on an analysis of habitat requirements, CUWA (Appendix 8) found that the species which most benefit from extending X2 downstream from the confluence to Roe Island are the Sacramento splittail, inland silverside, and threadfin shad, even though the abundance indices for threadfin shad suggest otherwise. The inconsistency between the result of a habitat-based analysis and the X2 vs abundance based analysis suggests that the relationships may not have high predictive certainty.

F. CUWA further notes that EPA will close its comment period on the proposed regulations prior to publication of the results of its Section 7 Consultation with the U.S. F&WS regarding the potential for impacts to threatened and endangered species. It is difficult to evaluate the net environmental benefit of the proposed standards without the results of this consultation. Species which could be adversely impacted by changes in salinity, and therefore changes in marsh habitat, include Suisun song sparrow, Delta tule pea, black rail, clapper rail, and soft-haired bird's beak. However, a Confluence/Chipps Island standard would not have as much potential for adverse impacts to tidal marsh habitat.

Based on these considerations, CUWA believes its proposed Suisun Estuary Standard would have significant benefits, without the uncertainties and potential risks associated with a Roe Island standard. Implementation of a standard which benefits habitat in Suisun Bay would protect the beneficial uses of the estuary, by maximizing suitable habitat in the Suisun Bay. The proposed standard is an ecologically safe standard; it meets the needs of the estuary without extending management beyond the limits of our confidence in the data and data relationships. Finally, there will be lower water costs associated with the proposed approach.

2.2.3 What other actions need to be taken to protect the beneficial uses of the Bay/Delta ecosystem?

As corrected, the X2 series indicates that the location of X2 accounts for less of the variability in estuarine conditions than initially postulated by SFEP and EPA, suggesting that other factors may be more important to protecting beneficial uses of estuarine habitat in Suisun Bay and its aquatic, wetland, and upland species than initially thought by EPA and others. CUWA believes that there is substantial evidence that other factors must be addressed, concurrent with promulgation and implementation of an estuarine habitat standard, to ensure that these resources have an opportunity to recover.

CUWA is particularly concerned that adverse impacts caused by other factors could offset or mask the beneficial effects of its proposed Suisun Estuary Standard. If, for example, the Asian clam alters the basic food chain significantly, species abundance may be affected in spite of our best efforts to provide for better estuarine habitat conditions. Other factors, such as changes in pesticide and herbicide use, could have similar effects.

The literature cited by EPA in support of the proposed standard identifies some other factors which may have an influence on estuarine habitat and on the abundance and distribution of species in the Bay Delta. Monroe and Kelly (1992) noted that the Estuary Project recognized that no single factor was controlling existing populations of aquatic biota or was singly responsible for apparent declines in historic populations. The SFEP participants identified five broad issues which they believed the program should address:

1) Intensified land use
2) Decline in biological resources
3) Freshwater diversion and altered flow regimes
4) Increased pollutants
5) Increased dredging and waterways modification

The EPA Draft Proposed Standard addresses only one of these potential causative factors.

While CUWA concurs that water diversions and altered flow regimes have an impact on the aquatic biota of the Bay/Delta, it is useful to examine the *relative* impact of this factor, with respect to other potential causative factors, as a basis for evaluating the relative benefits and costs of the proposed standard. Given the potential water supply impacts of the proposed standard, justification of the standard is based on the premise that its implementation will make a substantial contribution to halting the decline of Bay/Delta aquatic resources. To the extent that this is true, then the water supply impacts of the standard may be justified.

CUWA reviewed the pertinent literature to identify factors which had been identified as having a potential impact on Bay/Delta resources. CUWA supplemented this review with an analysis of the potential impacts of several factors identified as potential causes of aquatic biota declines.

A. CUWA identified a number of categories of factors which may be to some extent responsible for the observed decline in Bay/Delta aquatic biota:

   The introduction of exotic species
   Alterations to the food chain
   Long-term and continuing dam and upstream water development
   Land development and loss of physical habitat
   Pollution (pesticides, herbicides, metals)
   Reductions in BOD and nutrient loading
   Entrainment/impingement into diversion systems
   Fishing and direct resource exploitation
   Exports and water development in the Delta

B. CUWA notes that cumulative impacts from mining, loss of 90-95% percent of Central Valley wetlands and estuarine habitat, alteration of hydrologic regimes, exotic species introductions, loss of spawning habitat, resource exploitation, introduction of pesticides and other pollutants, and other factors have subjected the Bay/Delta to constant and significant changes which collectively impact the aquatic ecosystem.

C. CUWA notes that the period of documented decline in Bay/Delta aquatic resources corresponds to a period of extreme hydrology (two severe droughts and four severe flood years). Depending on particular habitat affinities, these conditions would be expected to have variable impacts to fish and invertebrate populations, absent all other developments.

D. CUWA notes that drought periods may have affected migration patterns for anadromous fish; reduced egg and larval survival; increased the concentration of toxics; increased the abundance of filter feeding organisms with high salinity tolerance, such as the exotic Asian clam which crops the food base at a high rate; decreased the influx of food to the Delta; increased fish vulnerability to parasites and diseases, by increasing stress; elevated water temperatures; increased vulnerability of some species to predation; and decreased phytoplankton blooms, because exotics favored by drought conditions filtered a greater percentage of the water column.

E. CUWA notes that wetland and habitat degradation are cited (Meiorin et. al. 1992) as the major reasons for the decline of the delta smelt and Sacramento splittail and the extinction of the thicktail chub and Sacramento perch.

F. CUWA (citing Moyle and others) notes that 27 species of fish have been introduced since the 1840's, with several significant introductions occurring during the period of decline defined by the EPA (1976-1991), including: the Asian clam (which may alter nutrient availability significantly), the inland silversides (which may compete with delta smelt), the chameleon goby (which may compete for habitat or resources with native species), and others. These exotic species may impact native species by direct competition for food or space, predation, habitat interference, and/or hybridization (Moyle 1976). CUWA notes that Herbold et. al. (1992) summarized the history of introduced species in the Bay/Delta and their widespread impact on ecosystem structure.

G. CUWA documents the changes in pollutant load in the Bay/Delta during the period and notes that there have been significant changes in the types of pesticides and herbicides used since the EPA began its activities to control use of persistent pesticides and herbicides in the early 1970's. As a result of environmental regulation, pesticides such as chlordane and DDT have been effectively eliminated from the pollutant load in the Bay/Delta but they have been replaced by chemicals such as rice herbicides. In particular, CUWA notes that recent U.S.G.S. studies indicate that diazinon levels in outflows may be greater than the minimum lethal dose for some species, particularly following the first significant runoff event following the summer.

H. CUWA evaluated the potential impacts of power plant operation on abundance of selected species in the Bay/Delta, but found that during the period of decline defined by EPA (1976-1991), power plant diversions from the Bay/Delta declined slightly. No simple statistical relationship could be found between diversions, discharge temperature and the overall abundance of the nine indicators used by Jassby (SFEP 1993).

I. CUWA notes the general concern in the scientific community regarding the impacts of the Asian clam on zooplankton productivity; the decline in zooplankton in the estuary may be a major factor affecting the ability of populations to rebound from recent drought conditions.

The CUWA analysis has not answered all of the questions concerning the factors influencing abundance of aquatic resources. CUWA comments raise more questions than are answered. What is clear is that there are substantial weaknesses in our understanding of the various factors affecting the health of the Bay/Delta. Data necessary to evaluate the potential impacts of other factors on the Bay/Delta ecosystem are dispersed in a variety of data bases and formatted in a variety of ways, making quantitative analysis of the available data difficult, especially in the limited time frame. Until a unified data base is established, and additional data are collected which measure the potential effects of other factors on the Bay/Delta aquatic biota, a reasonably quantitative understanding of the dynamics of the ecosystem will not be feasible.

The operation of these other factors on the condition of the estuary and its aquatic resources needs to be systematically addressed through a multi-agency comprehensive monitoring and research effort which will capture data about:

- Changes in the status of a wide range of biological resources in the Bay/Delta;
- Changes in the hydrology of the Bay/Delta;
- Changes in other factors potentially affecting aquatic, wetlands, upland species;
- Biological responses to the standard; and
- Responses to habitat modifications and improvements.

This broad focus is needed to ensure that the relative influence of the various factors affecting the estuary is defined and used as the basis for decision making in the future. Such a comprehensive monitoring and research program should be broad enough so that it can support development and evaluation of a long-term multi-species plan for the Bay/Delta which would address the many factors responsible for the decline in Delta resources. As the plan is implemented, outflow and/or water quality standards should be modified to reflect new habitat conditions. Any regulatory approach should allow for incorporation of the results of this program in the future. This is important because any standard must reflect changed conditions in the estuary to ensure that it continues to meet its goal of protecting beneficial estuarine habitat uses. This is important because the standard must reflect changed conditions in the estuary to ensure that it continues to meet its goal of protecting beneficial estuarine habitat uses.

2.2.4 <u>The Water Cost Associated with the Estuarine Habitat Criteria</u>

The EPA estimate of water costs associated with the proposed estuarine habitat criteria are described in its "Draft Regulatory Impact Assessment" dated December 15, 1993. The EPA estimated that the cost of implementing its standards would be 0.54 million acre-feet (MAF) on average and 1.1 MAF in dry or critical years. These additional outflows, necessary to locate X2 at the three proposed compliance locations, would result in reduced deliveries to urban and agricultural water users. EPA states that reductions would be implemented through negotiations with federal and state agencies and special districts. CUWA analyzed the potential water costs of both the EPA-proposed estuarine habitat criteria and the CUWA-proposed Suisun Estuary Standard.

CUWA analyzed potential water costs by calculating the outflow required to meet the proposed salinity standard at all three locations (Confluence, Chipps, and Roe) on a daily basis and then comparing this outflow with the estimated Net Daily Outflow for the period 1930 to 1991, based on the DWR DAYFLOW estimates. CUWA did not evaluate impacts of increased outflow requirements on project operations. CUWA's analysis indicated that the relationship between measured surface electrical conductivity (EC) and practical bottom salinity (2 ppt) used by EPA was inaccurate, and that a surface EC of 2640 μS/cm represents a practical bottom salinity of 1.5 ppt, instead of 2.0 ppt. CUWA's analysis suggests that a surface EC of 3406 μS/cm converts to a 2.0 ppt bottom salinity. CUWA therefore calculated water costs based on both a surface EC set at 3406 μS/cm and 2640 μS/cm.

The water cost estimates for the EPA-proposed estuarine habitat standard are summarized on Table 1. Note that CUWA calculated water costs for several implementation scenarios, including conversion of the X2 standard to an outflow standard, and several different periods of record. Key points are:

A. Implementation of an outflow standard would result in approximately 300 TAF/year greater outflow required on average than a 2 ppt salinity standard. This can be attributed to the salinity standard's greater ability to take advantage of wet antecedent conditions.

B. The estuarine habitat standard, as proposed, would have required additional outflows averaging 50 to 200 TAF per year during the period 1930-1950 (prior to operations of the CVP and SWP), 250 to 600 TAF during the period 1951-1967 (prior to operation of the SWP), and 850-1300 TAF during the period 1968-1991.

C. For any given year during the chosen period of record, the range of additional outflows required by the estuarine habitat standard for any given year during the chosen period of record were 0 to 1190 TAF for the period 1930-1950, 0 to 1880 TAF for the period 1951-1967, and 0 to 3090 TAF for the period 1968-1991, with the highest additional outflow in any given year generally produced by implementation of a steady state outflow standard, rather than a salinity standard.

D. The water costs of the standard, on average, are higher for critical (1500 TAF to 1850 TAF per year) than for wet years (1000 TAF to 1300 TAF per year), even though the Roe Island standard would not be triggered in critical years.

E. Although implementation of a standard based on the average daily location of X2 generally resulted in a lower additional water cost than implementation of an outflow standard, this general rule does not apply to all of the years analyzed. In several years, an equivalent outflow standard resulted in lower outflow requirements than an X2 standard.

F. Comparing additional outflows developed using CUWA's analysis with additional outflows estimated using DWR's model (DWRSIM) at two different levels of demand (6 MAF and 7 MAF) and assuming no buffer required shows only minor differences in the estimates of additional outflow required for critical and wet water year types, but more significant differences for dry, below-normal, and above normal year types. However, for the period 1968-91, the DWRSIM estimated average annual additional outflow required at a demand of 6000 TAF was about equal to the CUWA estimate of 1000 TAF/year. At a demand level of 7000 TAF, the difference between the two estimates was 10%.

G. CUWA, using the daily Kimmerer-Monismith equation, determined that the steady-state flow required to meet the X2 standard would be: 29,200 cfs for kilometer 64 (Port Chicago, representing Roe Island), 12,460 cfs for kilometer 75 (Chipps Island), and 6,860 cfs for kilometer 81 (Collinsville).

Table 1.
Potential Water Costs of the Proposed Estuarine Habitat Criteria
Average Annual Additional Outflow in Thousands of Acre Feet (TAF)
Contra Costa Water District Analysis

Period of Record	Year Type	Additional Outflow Required		
		2640 μs/CM Standard	3406 μS/cm Standard	Outflow Standard
1930-50	WET	0 TAF	0 TAF	0 TAF
	ABOVE NORM	0 TAF	0 TAF	0 TAF
	BELOW NORM	50 TAF	0 TAF	100 TAF
	DRY	150 TAF	100 TAF	350 TAF
	CRITICAL	350 TAF	250 TAF	450 TAF
	AVERAGE	100 TAF	50 TAF	200 TAF
1951-1967	WET	200 TAF	100 TAF	250 TAF
	ABOVE NORM	400 TAF	250 TAF	600 TAF
	BELOW NORM	800 TAF	500 TAF	1050 TAF
	DRY	500 TAF	300 TAF	900 TAF
	CRITICAL	-------	-------	-------
	AVERAGE	450 TAF	250 TAF	600 TAF
1968-1991	WET	900 TAF	700 TAF	1000 TAF
	ABOVE NORM	550 TAF	350 TAF	650 TAF
	BELOW NORM	1000 TAF	1250 TAF	1900 TAF
	DRY	1000 TAF	900 TAF	1600 TAF
	CRITICAL	1550 TAF	1200 TAF	1600 TAF
	AVERAGE	1000 TAF	850 TAF	1300 TAF

Implementing the EPA-proposed standard would require compliance for a specified number of days, depending on water year type. The hydrologic impacts of this compliance requirement were investigated.

A. Using DWR DAYFLOW data and the conversion for outflow to X2, with X2 based on a surface of 3406 μS/cm, CUWA determined that, during the EPA-chosen period of record from 1940-1975, the EPA requirement for Roe Island would have been met only about 50% of the time, for all water year types.

Year Type	EPA Requirement	Number of Times Requirement Was Met, 1940-1975
Wet	133 days	8 Wet years out of 15
Above-Norm	105 days	3 AN years out of 5
Below-Norm	78 days	4 BN years out of 9
Dry	33 days	5 Dry years out of 7
Critical	0 days	No critical years in this period

B. CUWA analyzed the number of days during various periods of record during which the proposed standard would have been met. This analysis indicates the proposed X2 standards tend to require a significantly greater number of days of compliance "than the least squares linear fit through the 1968-1975 data." CUWA analysis of other periods of record indicate that the tendency of the proposed X2 standard to require compliance for a greater number of days than has historically occurred is consistent for all post 1955 periods.

C. The inconsistency between the EPA's goal and the levels of compliance required is due to the method EPA used to calculate the standard.

a) Using essentially the same data set used by CUWA and DWR, and a daily version of the Kimmerer-Monismith equation, EPA calculated the average number of days of compliance, by water year type, for the period 1940-1975 and then determined that the average number of days would be the minimum number of days of compliance for each water year type.

b) Using the average as the minimum effectively eliminates much of the variability in outflow which EPA states is a purpose of selecting a longer period of hydrologic record.

D. The water year type index used by EPA in its analysis, the 40-30-30 index developed by the State Water Resources Control Board to define water year availability over a full water year does not represent the salinity regime for Suisun Bay for the regulatory period because it includes indices of runoff which do not affect salinity during February through June. Use of a February through June Sacramento River Index of unregulated flow provides a more relevant basis for determining water year type.

E. Using the Sacramento River Index and a least-squares linear fit to the historic outflow data as the basis for determining the number of days necessary to accomplish the EPA's goal of recreating conditions of the late 1960's and early 1970's results in a significant decline in the number of days of required compliance.

F. The average annual additional incremental Delta outflow required by a Roe Island standard, compared to a Chipps Island and Confluence standard, for the period 1968-1991, was calculated by CUWA to be:

Wet Year:	800 TAF	
Above-normal Year:	500 TAF	
Below-normal Year:	500 TAF	
Dry Year:	200 TAF	
Critical Year:	0 TAF	(Roe Island Standard not triggered)

Implementation of the EPA proposed standard will have significant water supply impacts, with the highest average Impacts occurring during dry and critical dry years. In any given year, water supply impacts may vary significantly from average annual water costs for that year type. Implementation of the standard as proposed would result in more days of the required outflow than would have occurred either during the EPA target period or during the period of hydrologic record used by EPA to develop its proposed rule.

A. The CUWA-recommended Suisun Estuary Standard would reduce average annual water requirements from approximately 700 TAF to approximately 300-500 TAF, although water requirements in dry and critical dry years would remain in the 1000 TAF range.

B. The CUWA-recommended Suisun Estuary Standard would maintain the variability in hydrology which supports biological diversity in the estuary, while maintaining flows adequate to provide transport of eggs, larvae, and nutrients through the Delta and into the estuary.

C. By reducing water requirements in wet years, the CUWA-recommended Suisun Estuary Standard will help address the concern that loss of carryover storage could adversely impact winter-run chinook salmon and delta smelt.

2.2.5 Additional Refinements and Implementation Considerations for the CUWA-Recommended Suisun Estuary Standard

CUWA stresses that its recommended standard should be promulgated in 1994. CUWA believes that this prompt and effective implementation of its recommended Suisun Estuary Standard would be facilitated by adopting the following refinements and implementation recommendations.

A. All parties involved in promulgation and implementation of the CUWA-recommended Suisun Estuary Standard, including EPA, SWRCB, NMFS, USF&WS, USBR, CDF&G and others should consult to ensure that implementation of the proposed standard does not have adverse impacts on threatened or endangered species. Of particular concern is the impact of the standard on carryover storage needed to ensure low-temperature releases to the upper Sacramento River for winter-run chinook salmon and flows required for the delta smelt.

B. Salinity should be measured near the surface, rather than at the bottom, because it is the standard measurement technique to reduce measurement difficulties. Surface electrical conductivity (EC) would be measured and these measurements would be converted to bottom salinity using well-established conversions. This recommendation not intended to affect the required position of the 2 ppt isohaline.

C. The appropriate agency(s) should develop a comprehensive monitoring and research program which would result in better understanding of how abundance and distribution of aquatic and marsh wetlands species are related to a full range of potential causative factors in the Delta and upstream areas. The purpose of the monitoring program would be to measure how the estuarine standard is meeting its objectives and how other actions, such as those to restore habitat, and contributing to estuarine health. Any regulatory approach should allow for incorporation of the results of this program in the future. This is important because any standard must reflect changed conditions in the estuary to ensure that it continues to meet its goal of protecting beneficial estuarine habitat uses.

D. A water supply impact threshold (cap) should be established, beyond which the standard would be met with purchased water paid for by an environmental fund established for this purpose and supported by payments by the basin water users. This will ensure that the goals of the Suisun Estuary Standard are met in an economically viable manner.

E. All parties involved in promulgation and implementation of the CUWA-recommended Suisun Estuary Standard, including EPA, SWRCB, NMFS, USF&WS, USBR, DWR, CDF&G and others should coordinate with USF&WS and NMFS to address issues such as QWEST and take limits to ensure that cross delta transfers are feasible. As EPA notes in the Regulatory Impacts Analysis, transfers are a critical element of reducing the water supply impacts of a standard.

F. To avoid confusion and thus ensure orderly and prompt compliance, a compliance schedule should be established which would phase in requirements in recognition of the need for operators to develop procedures for compliance, the need for the State Water Resources Control Board to address water allocation issues, and the need to equitably phase the water supply impacts of the standard among Bay/Delta watershed users.

G. All parties involved in promulgation and implementation of the CUWA-recommended Suisun Estuary Standard, including EPA, SWRCB, NMFS, USF&WS, USBR, CDF&G, BDOC, IESP, and others should develop and implement a long-term multi-species plan for the Bay/Delta, addressing the many factors responsible for the decline in Delta resources. As the plan is implemented, outflow and/or water quality standards should be modified to reflect new habitat conditions. As modifications are proposed, EPA should perform an ecological risk assessment before proposing modifications. EPA should then modify the standard as habitat improvements are made in the Delta and biological resources respond to these changes. This is important because the standard must reflect changed conditions in the estuary to ensure that it continues to meet its goal of protecting beneficial estuarine habitat uses.

H. Implementation of the CUWA-recommended Suisun Estuary Standard should be coordinated with other habitat enhancement and instream flow efforts in upstream areas to make it possible to concurrently meet both objectives whenever coordinated water releases are feasible.

I. A multi-species ecosystem approach to long-term Delta protections should be developed along with commencement of a joint State/Federal process, guided by the requirements of the California Environmental Quality Act and the National Environmental Policy Act, to develop a comprehensive water resources management plan for the estuary, addressing the many factors responsible for the decline in Delta resources including consideration of a full range of alternatives.

3.0 THE FISH MIGRATION AND COLD-WATER HABITAT CRITERIA

The Salmon Smolt Survival Index proposed under the Fish Migration and Cold-Water Habitat Criteria was developed by USF&WS, which has often noted that there are limits to its application. Consistent with the concerns of the USF&WS, CUWA analysis of the proposed Fish Migration and Cold-Water Habitat Criteria indicates that the proposed criteria is not the appropriate tool for accomplishing EPA's stated goals. The indices are not valid over a wide range of conditions and operational scenarios likely to occur; compliance with the standard would be impossible under some circumstances, regardless of CVP, SWP or other project actions. The findings in support of these conclusions are:

A. The proposed Sacramento River index predicts smolt survival on the basis of water temperature and measures related to flow. The San Joaquin Index considers only flow parameters.

B. According the U.S. Bureau of Reclamation, the temperature component of the smolt survival standard for the Sacramento River is almost entirely a function of ambient air temperature and therefore is outside of the control of CVP, SWP, or other water users.

C. CUWA determined that the equation used to derive the Sacramento River smolt survival index is statistically flawed. The mortality equations used to develop the Sacramento River index are based on probabilities of mortality occurring in a particular reach. However, since survival estimates using these equations with experimental data often exceed 100% (an impossible result), the USF&WS has divided all estimates by the highest experimental multiplier, 1.8. Scaling using this multiplier to bring survival estimates to unity (1.0) or less invalidates their use as probabilities, and they therefore cannot be used in the type of equations developed. In short, the correction factor applied is fundamentally inappropriate for the type of statistical equation being used. This invalidates all subsequent use of the indices, including their use in regression equations used to justify the proposed standards.

   There is also a lack of experimental data to validate the proposed San Joaquin River index. In order to relate index results with experimental data, USF&WS has applied the 1.8 scaling factor to the San Joaquin River relationship. The use of this correction factor, derived for the Sacramento River, has no basis within the San Joaquin River index and further invalidates the index as a measurement of biological response.

D. There are a number of other sources of potential mathematical error in the index equation for the Sacramento River. For example, adjusting the sampling width of the trawl used to collect data on smolt abundance, as discussed by U.S. F&WS in their testimony to the State Water Resources Control Board (Exhibit 31, Appendix 12) and placing 95% confidence intervals on the predicted smolt survival indices changes the resulting prediction by approximately 100%.

E. Application of the proposed Sacramento River standard, under a variety of operational scenarios, often results in biologically invalid results. For example, if State and Federal exports are set at zero and the proportion of flow through the Delta Cross Channel and Georgiana Slough is 0.3 and equations are solved for zero mortality, the results are biologically meaningless. Under these conditions, the temperature needed to reduce mortality to zero in Reach 1 (above Walnut Grove) is approximately 58 degrees. In Reach 3, the temperature required to accomplish zero mortality is approximately 50 degrees. In Reach 2, the temperature required to reach a calculated zero mortality is 30 degrees. Aside from the fact that the equation requires frozen water to achieve zero mortality in Reach 2, the variation in these results suggests that there are factors other than water temperature and proportion of flow diverted which are responsible for the observed mortality in the experimental data.

The U.S. Fish and Wildlife Service has cautioned that the results of their smolt survival analysis should not be used outside of the parameters from which they were developed. The EPA has not incorporated these limitations into the equation; as a result, the equation is used to predict smolt survival indices for conditions outside of its range of validity. At very high flows, for example, it is possible to be in violation of the standards under normal operating procedures simply because the equation does not behave predictably at this range of flows.

The EPA criteria only consider a Delta channel configuration which includes a barrier in Old River. Alternative criteria and compliance measurement formulae would be required if other potential Delta channel configurations are to be considered. The water supply impacts associated with these alternative Delta channel configuration have not been considered by EPA.

Because, as U.S. Fish and Wildlife Service points out, the index does not accurately predict survival under the full range of probable conditions, it is irrelevant to the measures which could actually improve salmon smolt survival.

CUWA notes that USF&WS and CDF&G have identified factors which they feel are responsible for the decline in winter-run chinook salmon and other runs of salmon in the Sacramento and San Joaquin Rivers, including loss of spawning habitat, diversion of outmigrating smolts into the central delta where they are subject to predation and where their migration to the ocean is delayed, and other factors. CUWA believes that the appropriate tool should be used to address salmon smolt survival issues. In lieu of the Fish Migration and Cold-Water Habitat Criteria, water management and other basin-wide management provisions for ensuring salmon smolt survival should be developed by the appropriate federal and state agencies.

4.0 THE FISH SPAWNING CRITERIA

4.1 Introduction

The EPA's proposed Fish Spawning Criteria is intended to establish water quality criteria to protect the historic spawning range of striped bass, an introduced species of value to recreational anglers. The EPA further states that it intends to "ensure the genetic diversity of the population as well as increase the size of the overall striped bass population." A literature review, including analysis of State Water Resources Control Board testimony, was conducted. The findings are summarized below.

A. CUWA notes that striped bass are predators on delta smelt, a species listed as threatened under the Federal Endangered Species Act, and winter-run chinook salmon, a species listed as endangered under the Federal Endangered Species Act.

B. CUWA further notes that there may be competition for the same water supply between the proposed EPA standard and standards intended to meet the requirements of other species. Water used to support striped bass spawning in the San Joaquin River may not be available to meet the requirements of either delta smelt or other species or habitats needing protection.

C. CUWA, citing the State Water Resources Control Board, notes that the cause of high salinity in the San Joaquin River reaches of concern is agricultural return flows, and the proposed criteria amounts to dilution flows to correct discharge pollution. The SWRCB has also made a similar finding.

D. CUWA cites an analysis by the State Board that finds the EPA proposed criterion will create an environment in excess of conditions that existed during the targeted period. CUWA provides data to confirm this finding.

E. Other proposed and existing criteria will substantially achieve the objectives of the Fish Spawning Criteria incidentally.

F. CUWA cites correspondence between EPA and DWR in acknowledging that the water supply analyses were performed without incorporating all of the modeling assumptions necessary to full comply with the Fish Spawning Criteria. Thus, the current water supply impact analysis does not indicate the full amount of water required by the standard.

G. According to the SFEP Status and Trends Report (SFEP 1992), "Increased loss of eggs and larvae into the hazardous Central Delta is the only well-documented and sufficiently powerful mechanism to explain the continuing destruction of the striped bass fishery." This report does not mention loss of spawning habitat as one of the limiting factors affecting striped bass populations, but instead addresses issues such as toxics, larval starvation, increased entrainment, and declining egg abundance. The report also notes that disease has been considered, but rejected, as a cause of the observed population decline.

The goal of the proposed rule is to increase striped bass spawning success by reducing electrical conductivity in the San Joaquin River, which would probably be accomplished by dilution of high salinity runoff from agricultural return flows using reservoir releases. Successful implementation of the standard would increase populations of a predator of several threatened and endangered species (winter-run chinook salmon and delta smelt). EPA should consider this potential conflict more carefully. There are broader ecological reasons for addressing the high salinity of flows in the San Joaquin River. At an appropriate time, EPA should develop and implement a standard keyed to preparation of a management plan for the various species in the river, and to solving the agricultural drainage problems which are the demonstrated cause of the problem.

5.0 RESPONSES TO EPA'S REQUEST FOR COMMENTS

Many of the issues raised in EPA's request for comments have been addressed by CUWA in the above comments. Many are related to the need for additional protections for Bay/Delta ecosystem resources. CUWA generally feels that its recommended Suisun Estuary Standard will address the hydrologic needs of Suisun Bay, but that other factors need to be addressed as well. Additional protections for the estuary should be developed which remedy other causative factors concurrent with implementation of the Suisun Estuary Standard.

5.1 Setting water quality criteria based on a smooth function.

CUWA has described a smooth function which it recommends be used to determine the required number of days of compliance at both locations specified in its recommended Suisun Estuary Standard. All parties involved in promulgation and implementation of the CUWA-recommended Suisun Estuary Standard should meet with CUWA interests and other interested parties to develop such a smooth function based on the Sacramento River Index for the period February through June. In these discussions, if CUWA's proposed smooth function is adopted, then it will be unnecessary to address the issues in 1(b) of the Requests for Comments.

5.2 Use of a 14-day rolling average.

Given that CUWA's recommendation for three-way compliance, a 14-day averaging period for measuring compliance is adequate and there will be no need for a longer averaging period to adjust for conditions beyond human control which cause short-term periods of non-compliance. CUWA therefore stresses that the most flexible approach to compliance, one which will ensure the goals of the Suisun Estuary Standard are met while giving project operators the most operational flexibility, is the three-way compliance standard under which compliance can be accomplished when 1) the average daily salinity is below 2 ppt, or 2) the 14-day average salinity is below 2 ppt, or 3) the net Delta outflow index is equal to or greater than the outflow calculated to be necessary to place the X2 location at the appropriate monitoring station, then this issue has lower priority to all parties concerned.

CUWA concurs with EPA that compliance should be measured independently at each compliance point and that non-compliance at one station should not affect compliance at other stations.

5.3 Use of a "confidence interval" or margin of safety.

The CUWA-recommended Suisun Estuary Standard will ensure protection of the estuary, without use of a confidence interval, because it provides for the three-way compliance methodology recommended in these comments, section 2.2.5. This methodology which will ensure the minimum outflow needed to place physical processes beneficial to the estuary at or downstream of Chipps Island. CUWA believes use of the flow calculated to result in maintenance of steady-state X2 at each compliance point is adequate, and that no additional margin of safety is needed to provide protection of the estuary.

5.4 Ability of the standard to protect low-salinity habitat conditions in wetter years.

EPA's concern about the proper level of protection which can be provided in wet years is based on a misunderstanding of the Kimmerer-Monismith equation, which is outside of its range of validity when addressing very high outflows. Also, the level of outflow which EPA appears to be concerned about is beyond the operational control of all water users in the Sacramento-San Joaquin Bay/Delta ecosystem. Outflows experienced in very wet years, such as 1983, are measured in 100,000's of cubic feet per second. It is beyond the physical capability of all water users in the basin combined to either control or significantly influence such flows. Development of a more protective standard than proposed would therefore ensure non-compliance. Further, CUWA believes that its recommended Suisun Estuary Standard will provide the base flows needed to protect the estuary, with unregulated outflows providing some of the natural variability in estuarine conditions EPA is concerned about.

5.5 The proper historical reference period for the standard

As CUWA analysis indicates, a number of different hydrologic periods of record may be used as the basis for the standard with only small differences in the number of days which would be required for compliance. CUWA has recommended that 1968 is an appropriate year to begin hydrologic analysis because salinity data are available for the period 1968-present. As CUWA indicates, the 1968-1975 period of hydrology may be chosen or extended to include the period 1968 to 1992 to allow several periods of dry and critical dry hydrology to be included in the analysis. This does not cause a significant change in the slope of the least squares fit of the relationship between the number of days at 2 ppt and the February-June Sacramento River Index.

5.6 A Trigger for the Roe Island Standard

CUWA does not recommend a Roe Island standard, for reasons described above; therefore no comments are provided by CUWA regarding recommendations for a trigger for a Roe Island standard.

5.7 Extended droughts

A special criteria to address problems associated with extended drought periods is speculative, but a coordinated state and federal process to address the issue of extended droughts should be developed. This process should be opened to all interested parties. This process should be focused on developing mechanisms to resolve the problems associated with extended droughts.

5.8 Tidal Marsh Protections

Management plans for the tidal marshes of Suisun Bay are more appropriately developed by the U.S. Fish and Wildlife Service under its authority and California Department of Fish and Game under its authority to develop Natural Community Conservation Plans. EPA and other interested agencies should coordinate with U.S. F&WS to develop such plans.

5.9 Delta Smelt Spawning

The specific requirements of any single species, such as delta smelt are best addressed by agencies with responsibility for their management. The focus of the EPA's regulatory efforts should be on protecting estuarine habitat conditions necessary to protect a wide range of beneficial uses of the Suisun Bay. CUWA found delta smelt were widely distributed in the Suisun Bay, the Delta, and the Sacramento River within a given month, suggesting that the response of adults to salinity is not entirely predictable. Data from the 1993 delta smelt sampling program indicate that in summer and fall of 1993 approximately 50% of the delta smelt population was found upstream of Suisun Bay and 50% was found in Suisun Bay. It is therefore premature to consider adjusting the estuarine habitat criteria to meet the, at present, poorly-defined habitat requirements of a single species. If the compliance period were extended into July for delta smelt spawning, this would have an impact on carryover storage and water supplies available for winter-run salmon.

5.10 Potential Water Temperature Criterion for Salmon Smolt Survival

While there is a scientific basis to explain the effects of temperature on outmigrating salmon smolts, such a criterion would not be attainable because ambient air temperature is the overriding determinant of water temperature in the reaches considered by EPA. Protection of outmigrating salmon smolts is a subject for a multi-species management plan for the Bay/Delta ecosystem, which CUWA encourages EPA and other agencies to develop in cooperation with State, regional, and local agencies.

5.11 Effectiveness of Barriers at the Head of Georgiana Slough

Barriers to prevent salmon smolts from entering the central delta, where they are subject to higher predation and where their migration to the ocean is delayed, are an important component of an overall management program for anadromous species in the Sacramento-San Joaquin River Basin. Action to provide barriers, particularly those which do not adversely affect water quality in the central delta (such as acoustic barriers), are, however, independent of target Fish Migration and Cold-Water Habitat Criteria values. Barriers are an appropriate subject for a multi-species management plan for the Bay/Delta ecosystem, which CUWA encourages EPA and other agencies to develop in cooperation with state, regional, and local agencies.

5.12 Old River Barrier Issues

As noted above, the salmon smolt survival indices are not a valid measure of actual smolt survival, and therefore they are irrelevant to the issue of the proposed barrier at the head of Old River during the migration of San Joaquin River smolts. Barriers to prevent smolts from being "lost" in the central delta are acknowledged by many to be useful management tools, but their construction and operation is irrelevant to the issue of the validity of salmon smolt survival indices. Barriers are an appropriate subject for a multi-species management plan for the Bay/Delta ecosystem, which CUWA encourages EPA and other agencies to develop in cooperation with state, regional, and local agencies.

5.13 Export Limits on the San Joaquin during Migration Periods

As noted above, the salmon smolt survival indices are not a valid measure of actual smolt survival. Further, the proposal to revise the San Joaquin River salmon smolt survival indices to account for potential operational scenarios points out how sensitive these indices are to changes in operational scenarios related to outflow. EPA should address the poor conditions in the San Joaquin River by promulgating regulations which regulate water quality of discharges from agriculture and industry. Management plans for specific species should be developed by USF&WS, NMFS, and CDF&G, as appropriate to ensure that a wide range of factors which may influence these species are addressed.

5.14 Impact of Proposed Standards on CVPIA Goal to Double Production of Anadromous Fish Throughout the Central Valley Project Watershed

The CVPIA goal of increasing anadromous fish populations is commendable. CUWA notes that carryover storage to provide for low-temperature releases to the upper Sacramento River may be important to accomplishing this goal, and the loss of carryover storage associated with implementation of the EPA-proposed standard could therefore have an impact on accomplishment of the CVPIA goal.

5.15 Kimmerer Salmon Population Model

CUWA has no comment on the Kimmerer salmon population model, but notes any model needs to be validated to represent the full range of factors affecting population abundance, distribution, behavior, and mortality.

5.16 Revisions to the Proposed Standards to Protect Estuarine Species in July to January Period

Revision of the proposed standards to cover the period July through January would be justified if strong causal relationships could be demonstrated between the proposed changes in outflow and biological variables known to affect abundance and distribution of fish.

Given the findings of Herbold and Moyle (1986) that fish abundance in the tidal marshes increases in the summer when salinity and temperature are higher, it is possible that extending the regulatory period could have some adverse as well as beneficial impacts to the estuary. This is an issue which should be addressed in a multi-species plan for the Bay/Delta ecosystem.

5.17 Need for Biological Resource Monitoring Data

As noted in Section 2.2.5, above, there is a strong need for additional research into the relationship between the abundance and distribution of aquatic and wetland marsh species in the Bay/Delta and a full range of potential causative factors. At present, as the SFEP report notes, regulatory efforts are being based on a relatively limited set of correlations and indicators, and no attempt has been made to establish causal relationships between X2 and abundance and distribution. The EPA, as participant in the Interagency Ecological Studies Program for the San Francisco Bay Estuary, should direct this program towards such basic scientific research so that the full range of problems facing the estuary can be explored and long-term recovery can be addressed.

APPENDICES

APPENDIX 1

Re-calculation of the abundance indices for longfin smelt, striped bass, delta smelt, and Sacramento splittail, as corrected and with the potential statistical error shown for longfin smelt and striped bass.

APPENDIX 2

Primary productivity vs abundance calculations. Note the general positive relationship between riverine particulate organic carbon and abundance, suggesting that nutrients in freshwater inflows may be in part responsible for the effects of outflows on the condition of the estuary, and therefore the usefulness of X2 as an indicator of estuarine condition.

APPENDIX 3

The relative contribution of riverine and locally-derived particulate organic carbon in Suisun Bay.

APPENDIX 4

Some representative indicators of sampling bias in the Fall Midwater Trawl sampling program: delta smelt.

APPENDIX 5

X2 vs abundance for a suite of estuarine and marine species in Suisun Bay and San Pablo Bay.

APPENDIX 6

Results of correlations between abundance indices and the number of days during which X2 was at or downstream of Chipps Island vs Roe Island

APPENDIX 7

Turbidity readings vs outflow for areas in the Suisun Bay.

APPENDIX 8

Analysis of potential impacts of the Chipps and Roe Island standards, based on the amount of preferred habitat for each of 41 species which utilize the estuary (some brackish water species, some marine species), based on habitat preference analysis from National Marine Fisheries Service.

APPENDIX 9

Comparison of the abundance of several estuarine species. Note that the shape of most of the graphs suggests that when one species is abundant, the other species evaluated is not. Conditions which favor one species may therefore be hypothesized to disfavor the other.

APPENDIX 10

Data from the CUWA water cost analysis.

APPENDIX 11

References

APPENDIX 1

Re-calculation of the abundance indices for longfin smelt and striped bass, adjusted and with the potential statistical variance shown (GLM = generalized linear model).

a. In Figures 1-1 and 1-2, note the location at which potential errors in the X2 vs abundance series increases. The predictive ability of the X2 vs abundance relationships shown is greatest when X2 is upstream of Chipps Island (low abundance) and lowest when X2 is downstream of Roe Island.

b. In Figure 1-3, note how the variance in abundance index for longfin smelt increases as the total index increases, suggesting uncertainty in the relationship for high indices.

c. In Figures 1-4 through 1-7, the total abundance index for four species has been re-calculated using the average index method used by the Bay Study. Note that the variance in annual index often approaches the mean value, suggesting low predictive value for the index. Use of total indices and omission of variance from the mean of the four monthly indices for each species obscures the uncertainties in these indices.

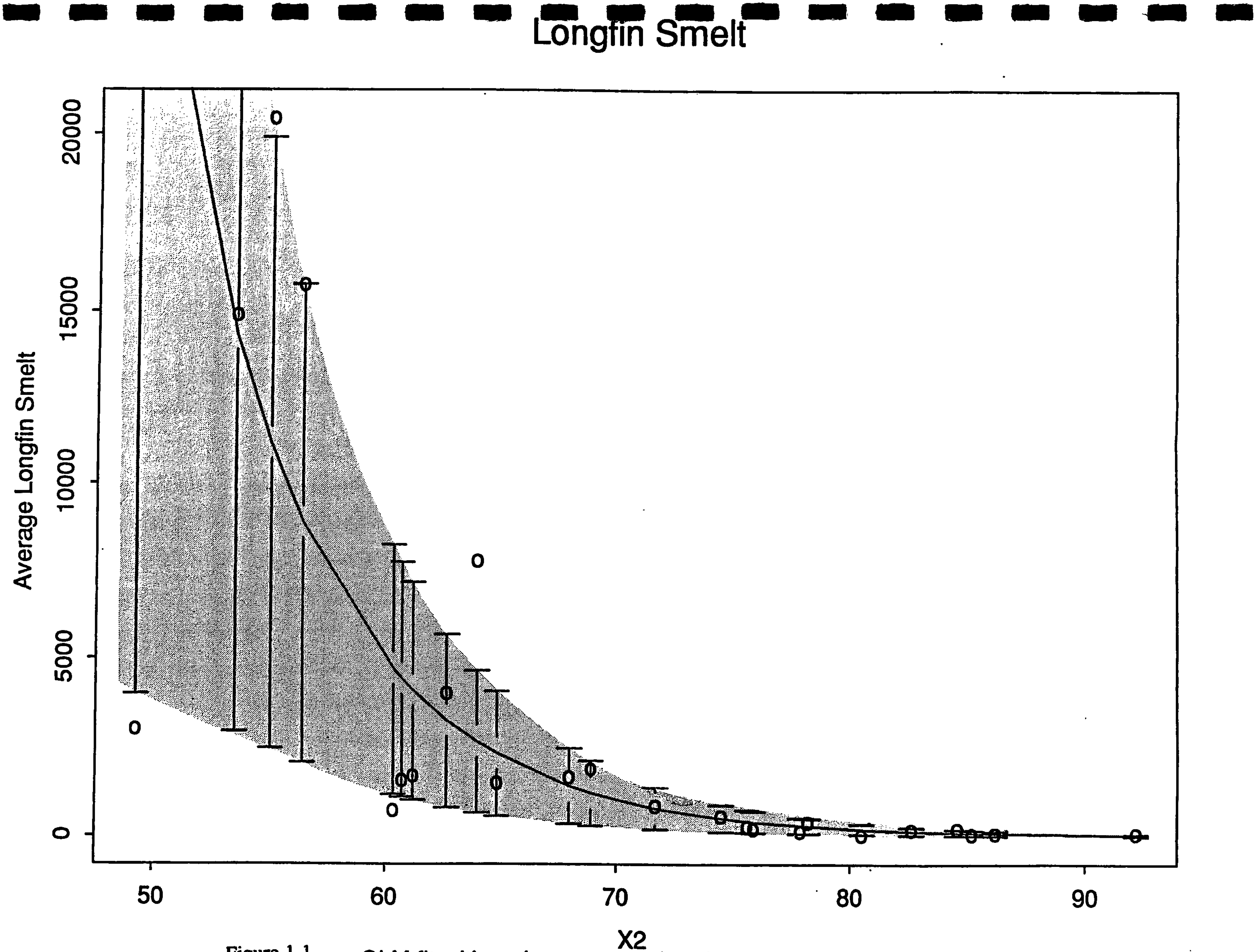


Figure 1-1 GLM fit with variance proportional to square of mean

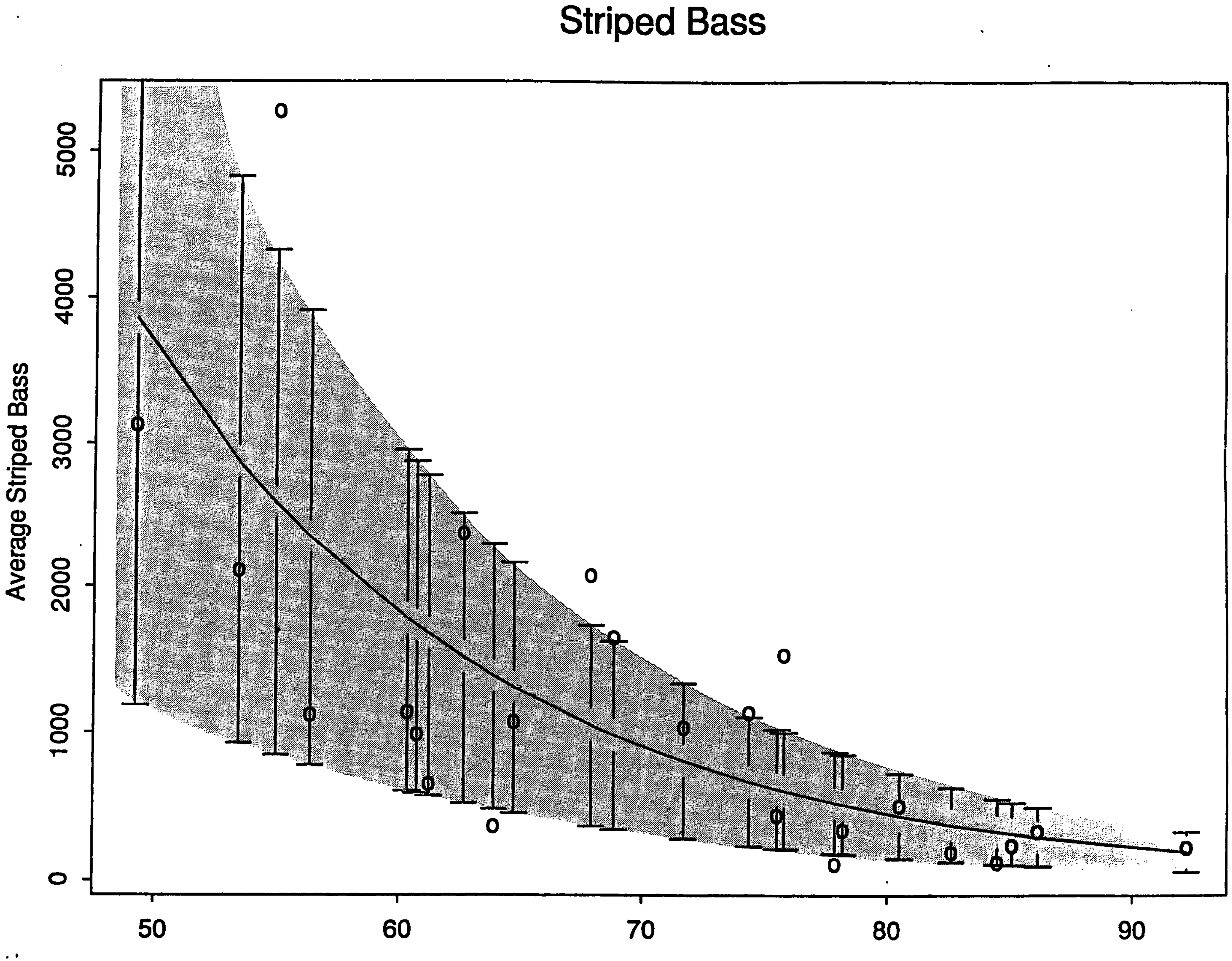


Figure 1-2
GLM fit with variance proportional to square of mean

Figure 1-3. Variance in the longfin smelt index.

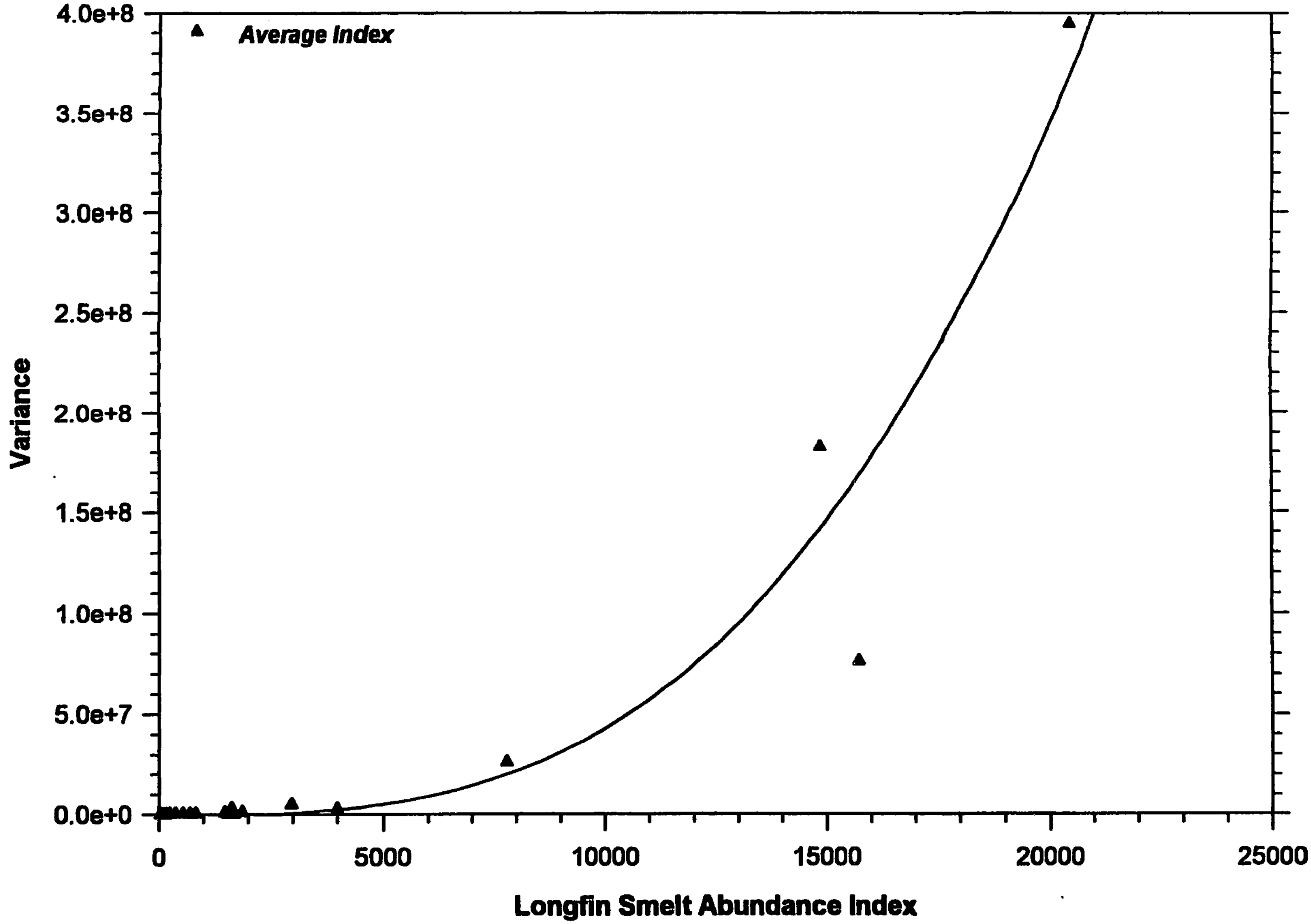


Figure 1-4. Total FMWT index for striped bass compared to average FMWT index, with variance in the 4 monthly indices shown.

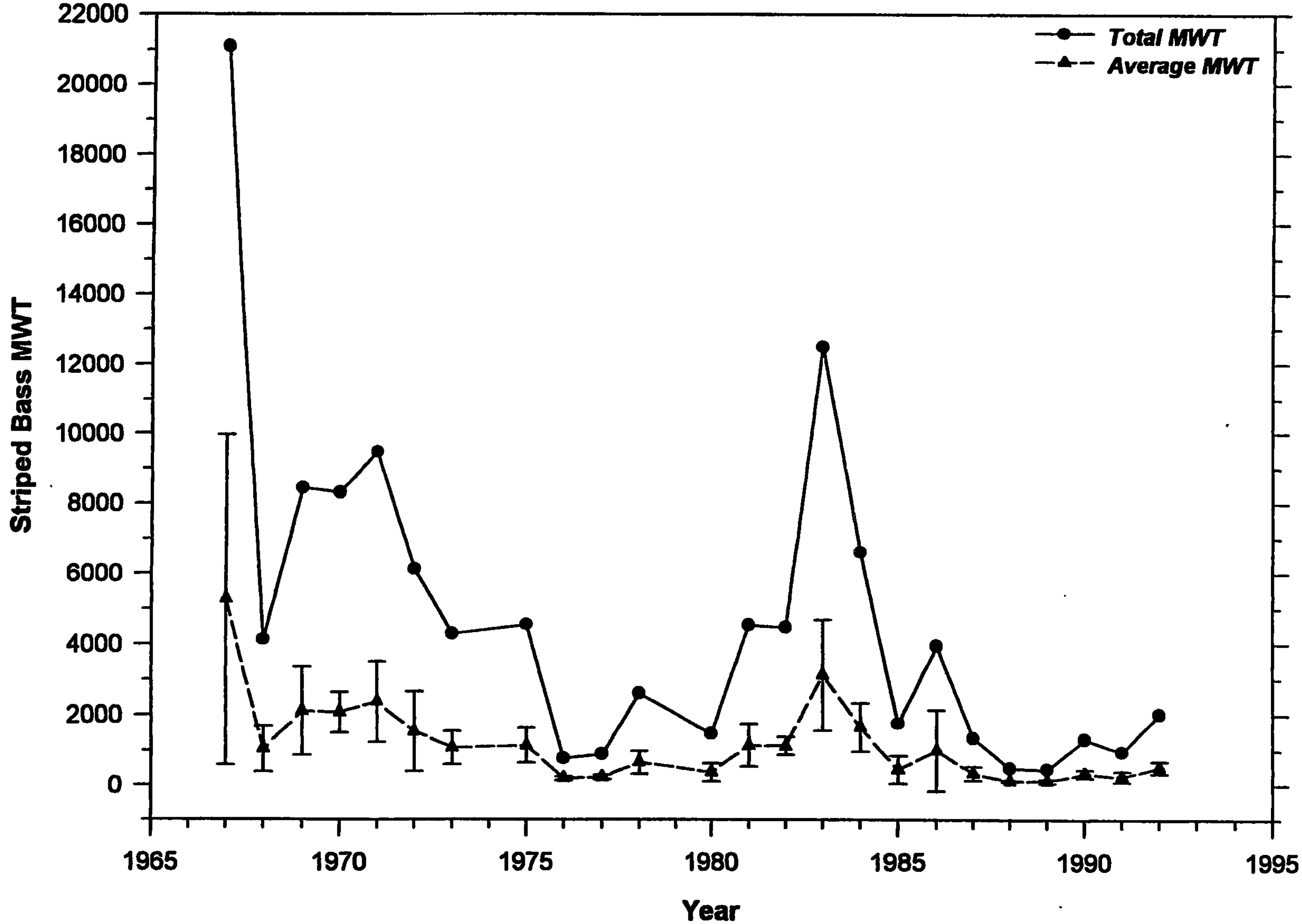


Figure 1-5. Total FMWT index for splittail compared to average FMWT index, with variance in the 4 monthly indices shown.

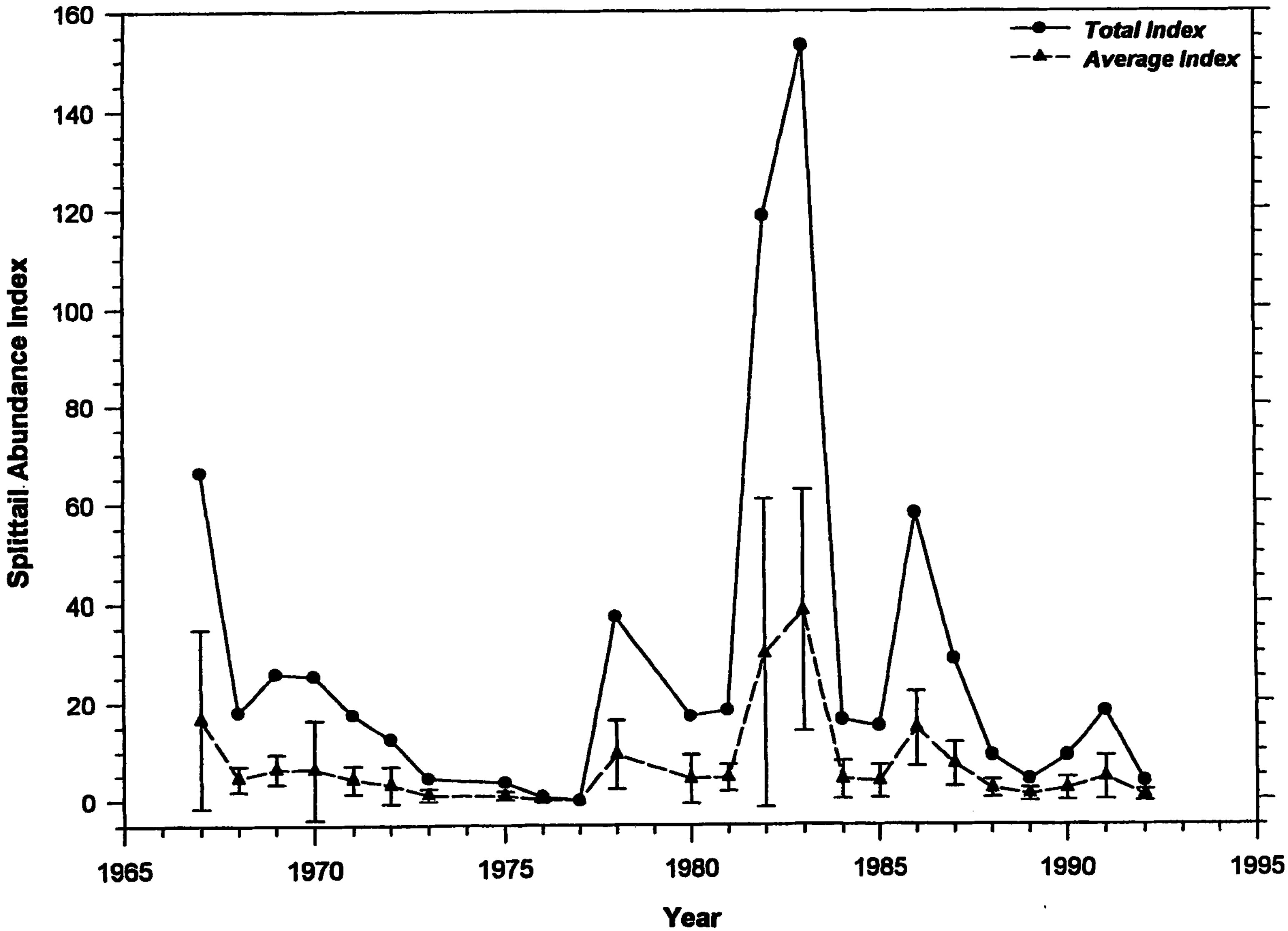


Figure 1-6. Total FMWT index for longfin smelt compared to average FMWT index, with variance in the 4 monthly indices shown.

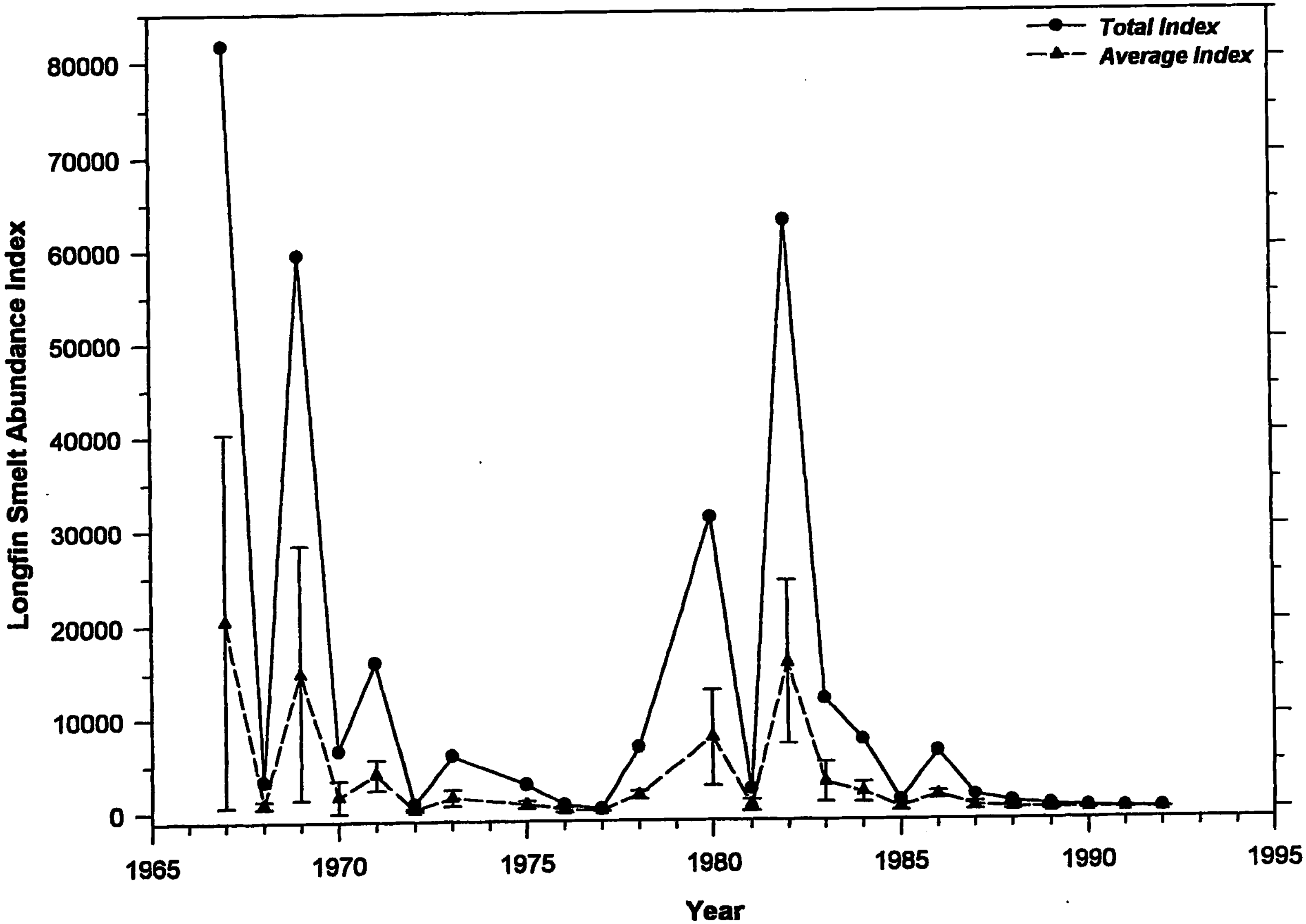
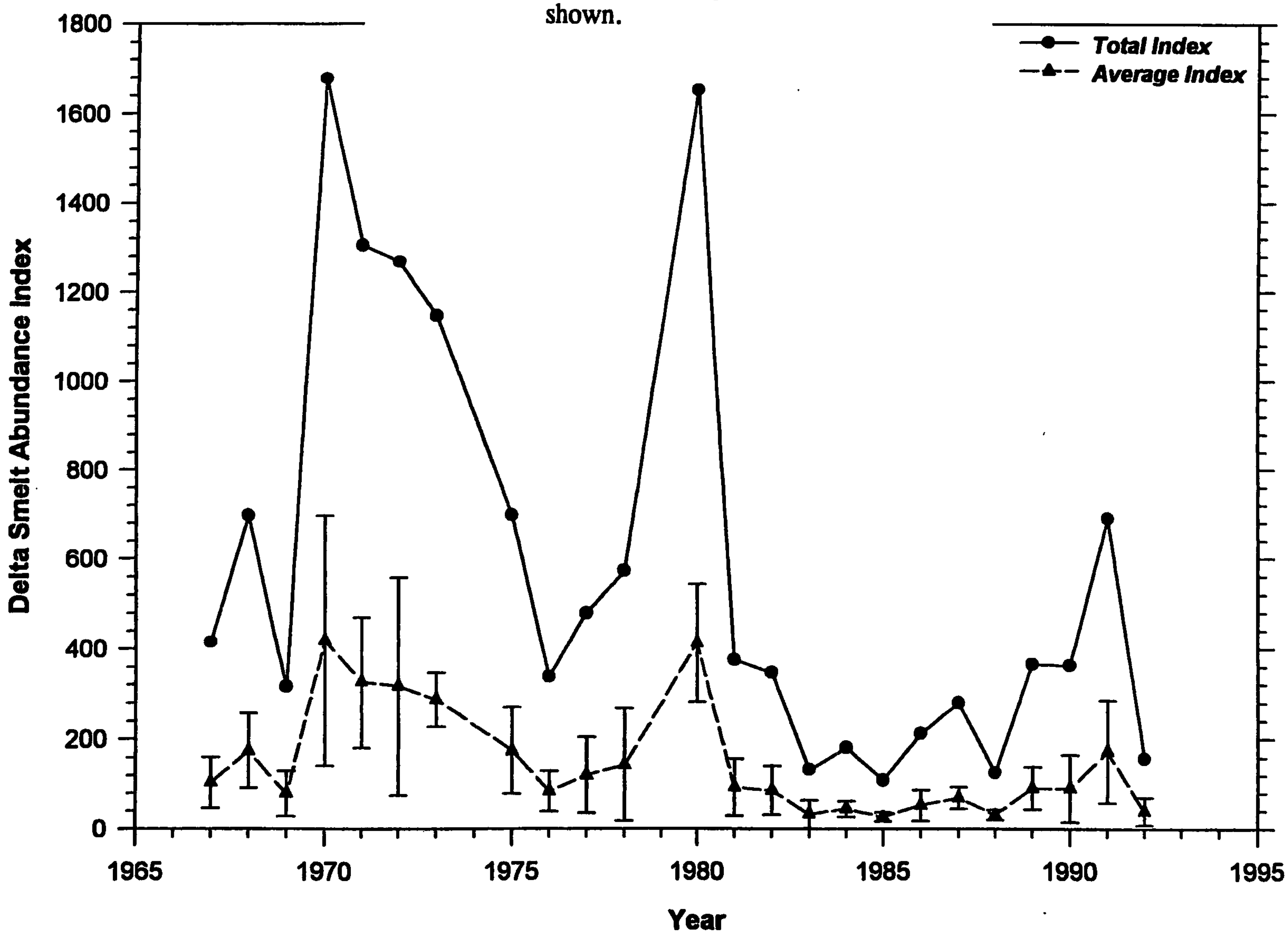


Figure 1-7. Total FMWT index for delta smelt compared to average FMWT index, with variance in the 4 monthly indices shown.

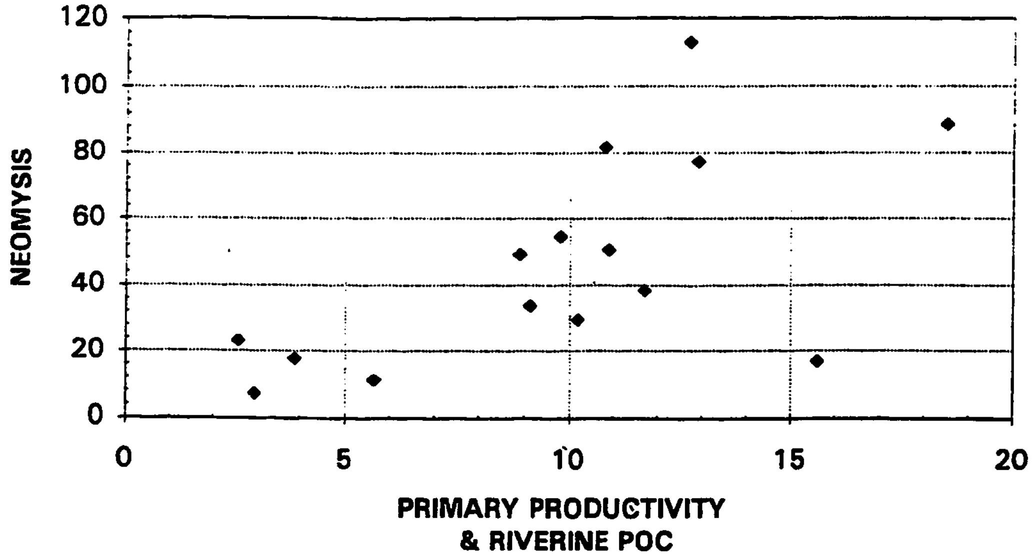


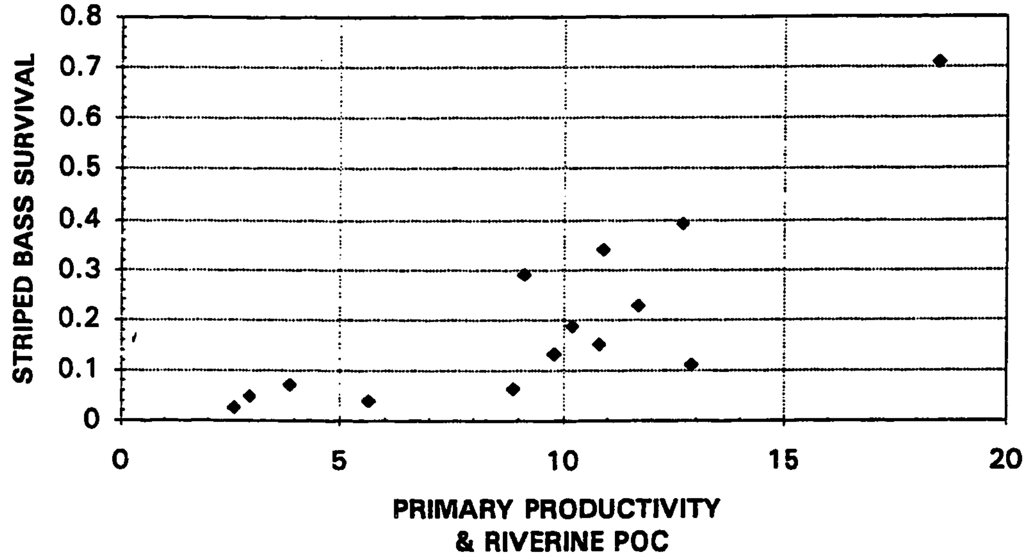
APPENDIX 2

Primary productivity vs abundance calculations. Note the general positive relationship between riverine particulate organic carbon and abundance, suggesting that nutrients in freshwater inflows may be in part responsible for the effects of outflows on the condition of the estuary, and therefore the usefulness of X2 as an indicator of estuarine condition.

Figure 2-1

SACRAMENTO / SAN JOAQUIN / BAY DELTA ANNUAL ABUNDANCE INDICES





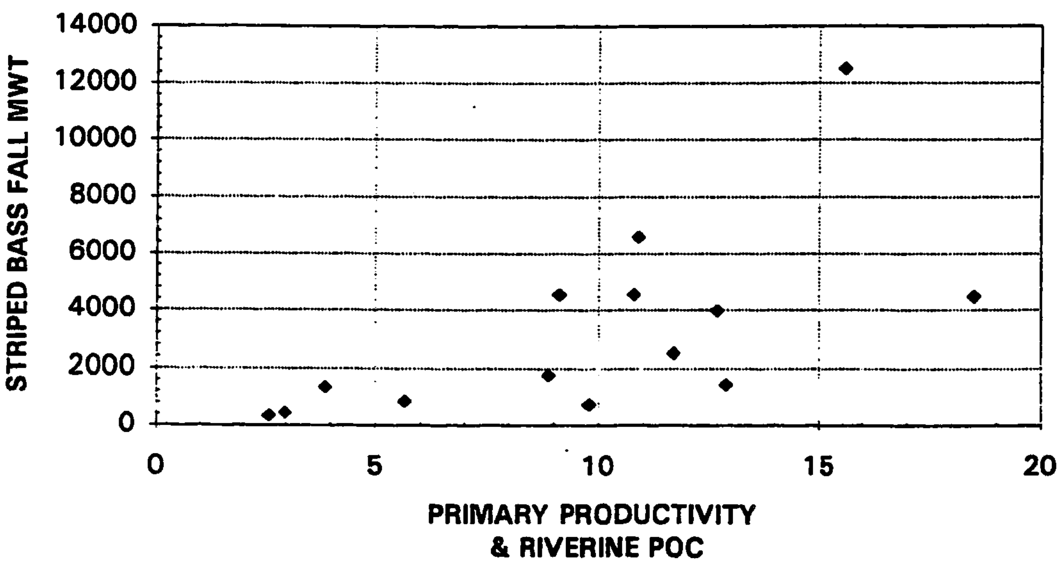


Figure 2-2

SACRAMENTO / SAN JOAQUIN / BAY DELTA ANNUAL ABUNDANCE INDICES

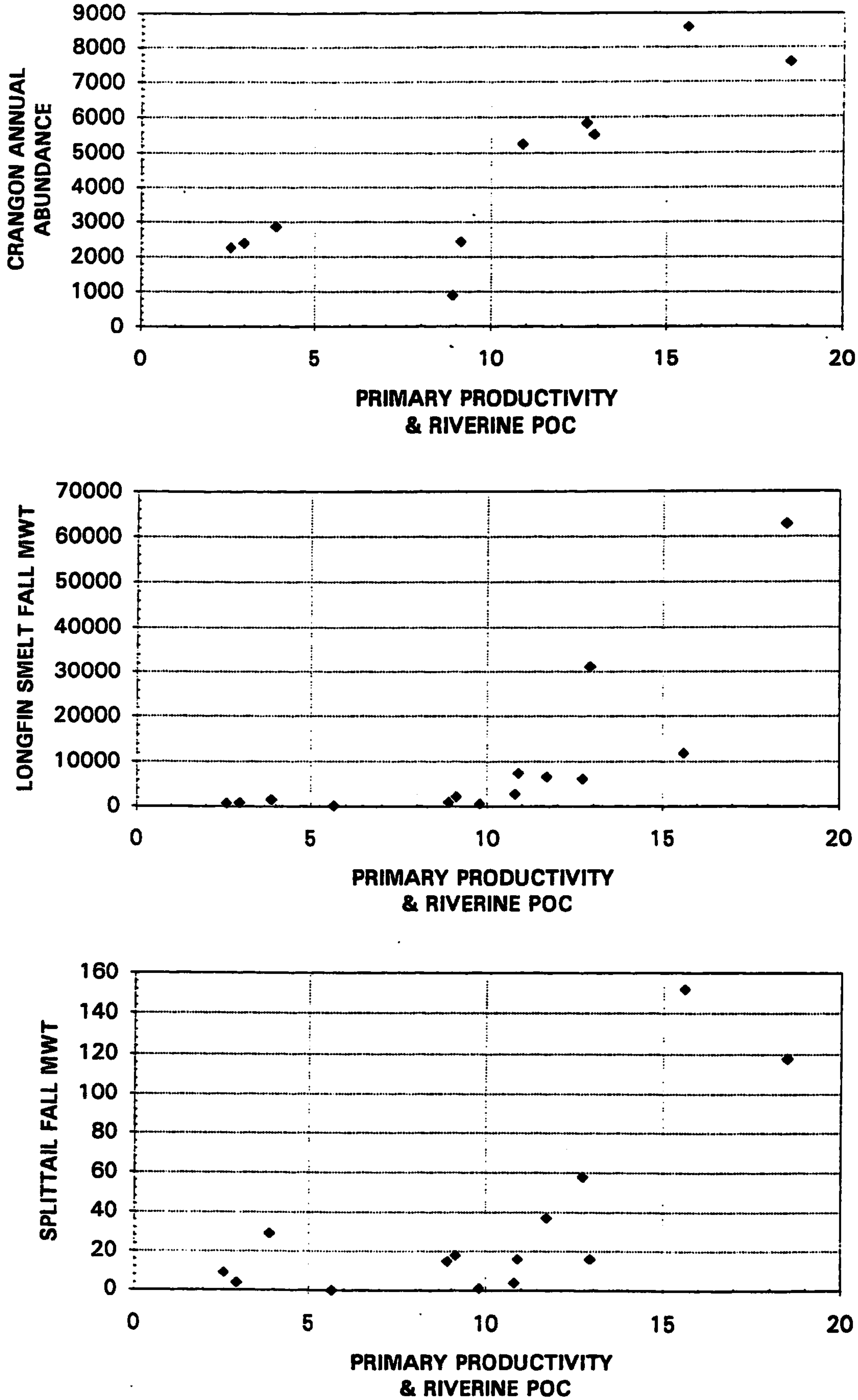
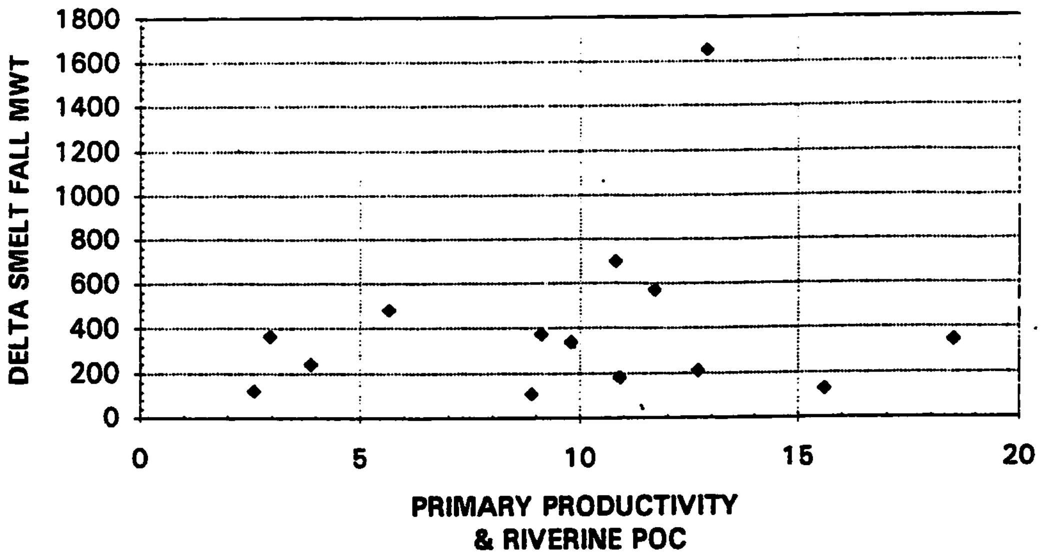
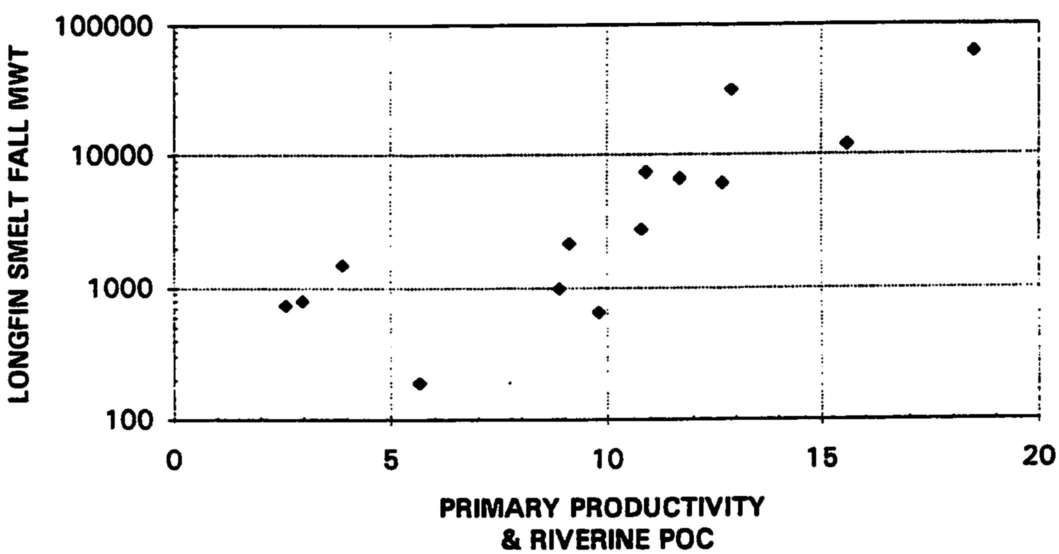


Figure 2-3

SACRAMENTO / SAN JOAQUIN / BAY DELTA ANNUAL ABUNDANCE INDICES





APPENDIX 3

The relative contribution of riverine and locally-derived particulate organic carbon in Suisun Bay. Note that riverine particulate organic carbon contributes less than 50% of organics to the estuary at flows under 10,000 cfs, but rapidly becomes the dominant source of organic carbon thereafter. This suggests that transport of nutrients is an important feature of higher outflows. Note also that locally-derived organic carbon declines with high outflows, suggesting a flushing of nutrients to San Pablo Bay at higher outflows.

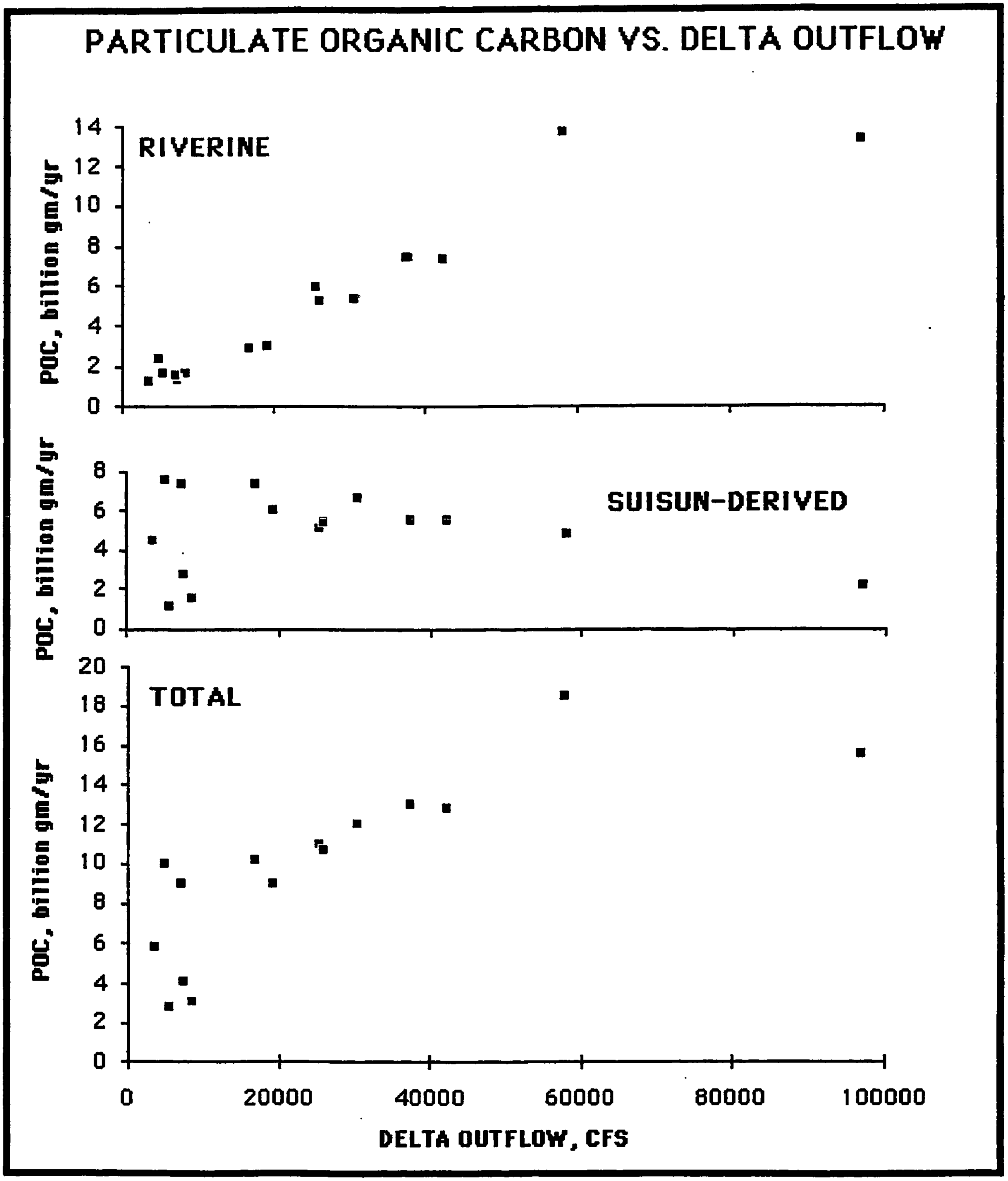


Figure 3-1

Relationship Between Particulate Organic Carbon ("POC") and Delta Outflow (Jassby et al., 1993)

APPENDIX 4

Some representative indicators of sampling bias in the Fall Midwater Trawl sampling program: delta smelt.

a. In Figure 4-1, note that there is a clear peak in catch efficiency when river discharge is at about 25,000 cfs. This suggests that catch can be influenced by outflow.

b. In Figure 4-2, note that there is an apparent bias in sampling of delta smelt in the river km 80 to river km 95 area; more smelt are caught in the morning.

c. In Figure 4-3, note that the relationship between surface electroconductivity and delta smelt catch changes when it is corrected for sampling effort.

These types of sampling bias may not be systematic enough to make their correction possible at this time, but they add to the uncertainty over the usefulness of the various abundance indices over a wide range of predicted conditions.

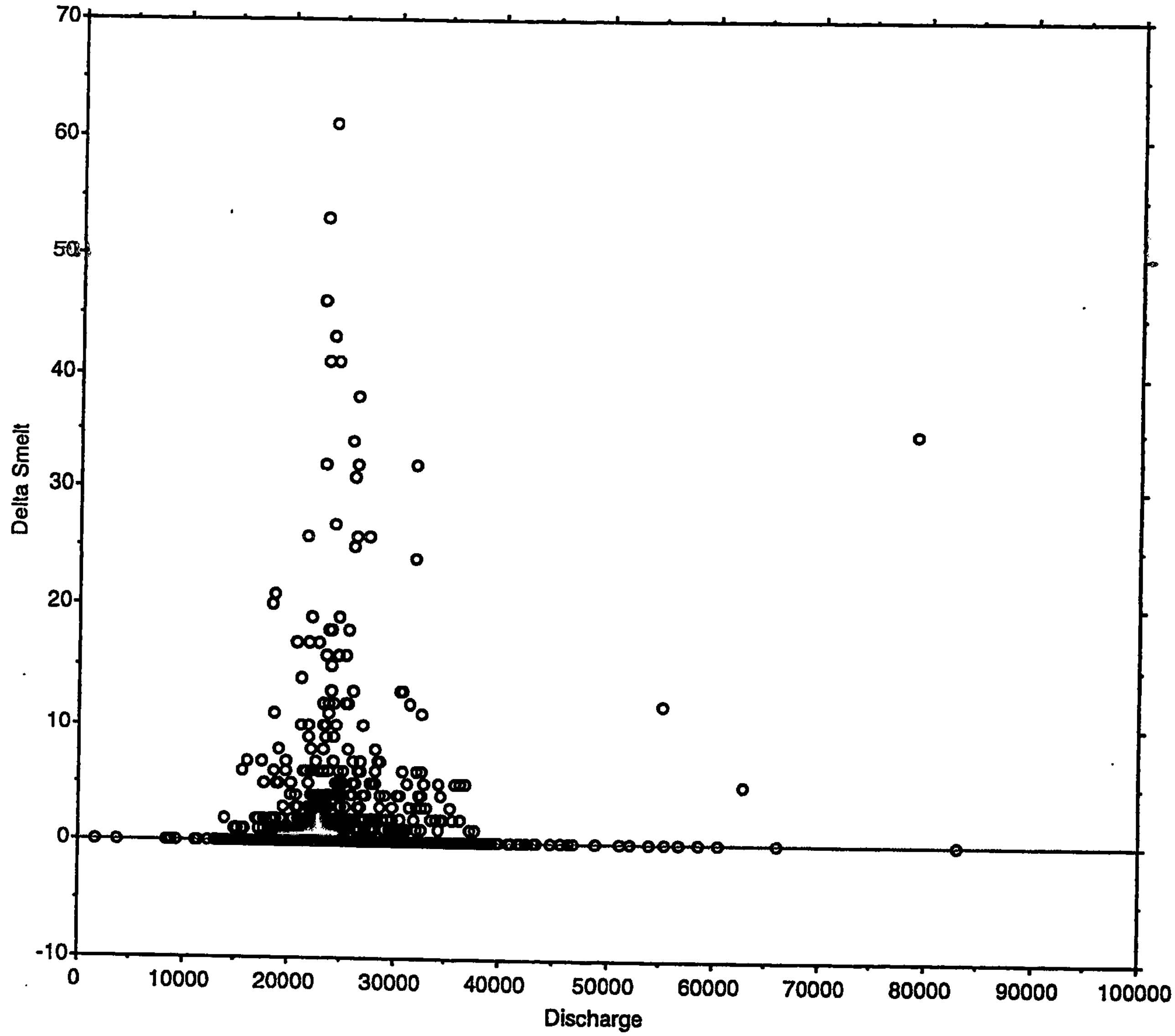


Figure 4-1. Catch abundance of delta smelt by volume of water (meter reading) sampled in midwater trawl (source: CFG midwater trawl study).

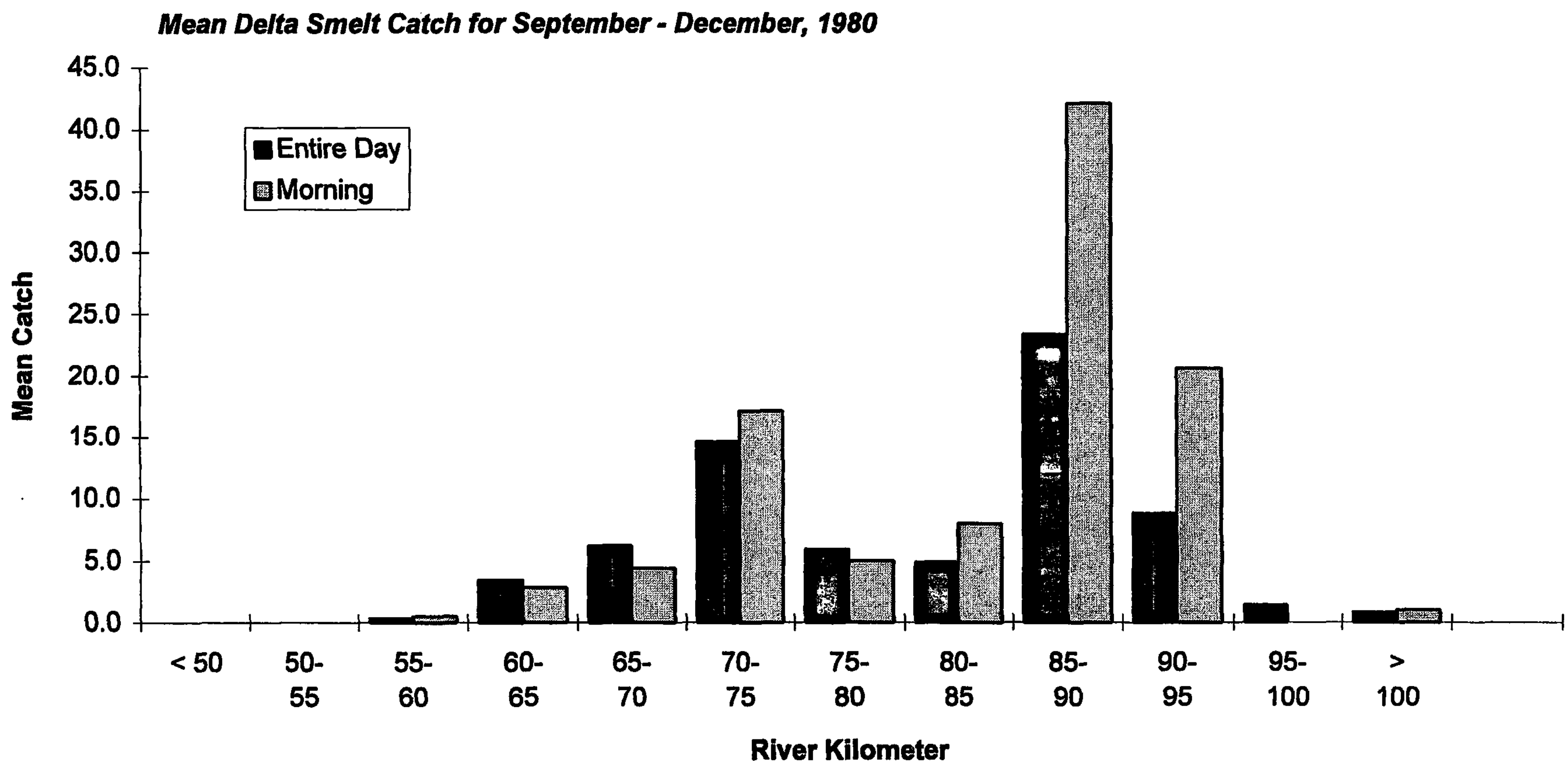


Figure 4-2. Mean delta smelt catch abundance for September, 1980 for entire day of sampling and for morning (before 10:00 am) only (source: CFG midwater trawl data).

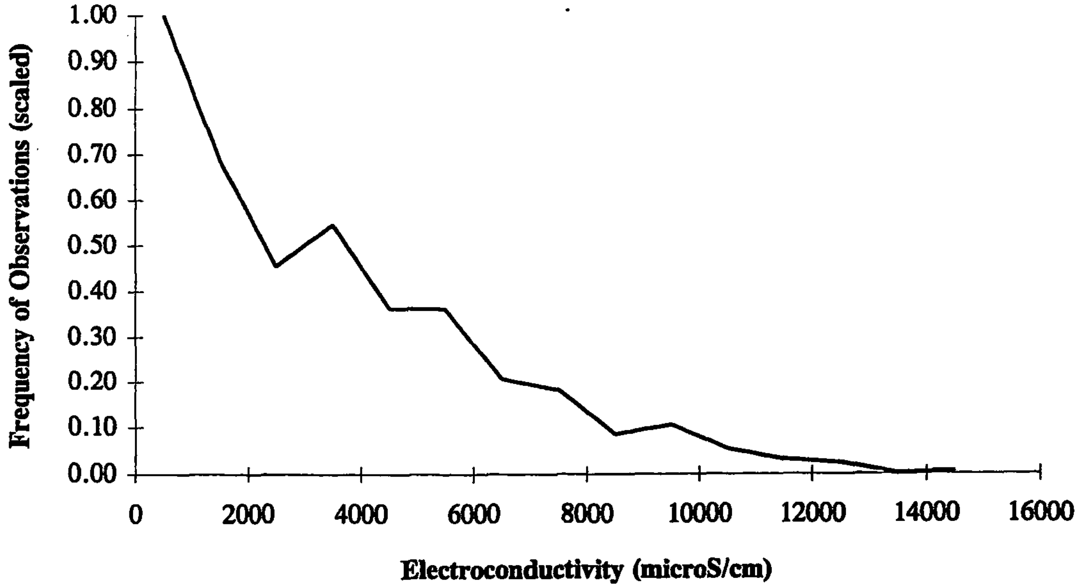


Figure 4-3. Delta smelt abundance frequency curve for electroconductivity prior to adjusting for sampling effort, September 1967-92 (source: CFG fall midwater trawl).

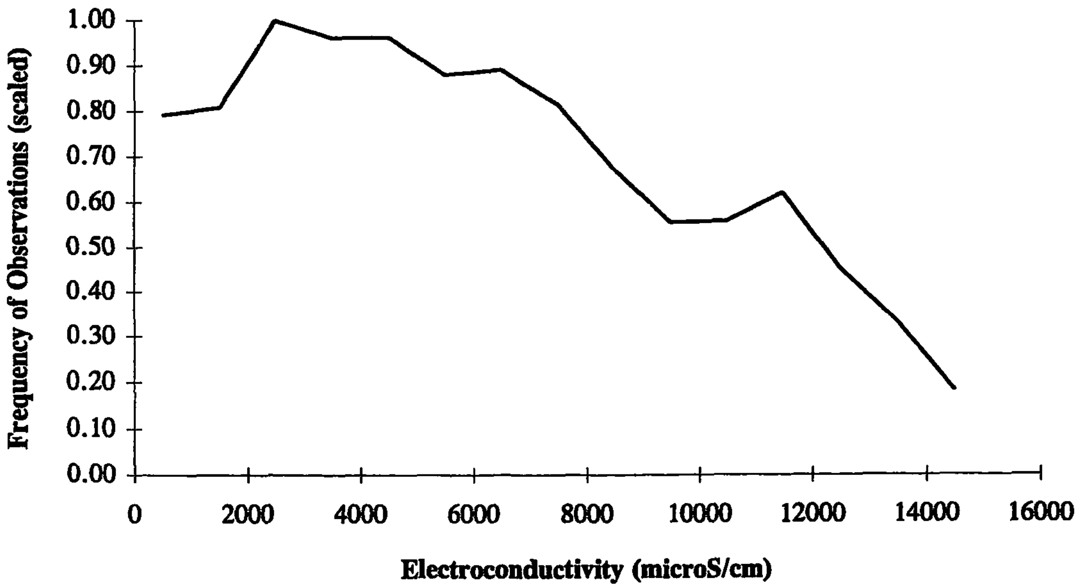


Figure 4-4. Delta smelt abundance frequency curve for electroconductivity after adjusting for sampling effort, September 1967-92 (source: CFG fall midwater trawl).

APPENDIX 5

X2 vs abundance for a suite of estuarine and marine species in Suisun Bay and San Pablo Bay (r^2 is a measure of how much variability in the dependent variable is accounted for by the independent variable). Note the low predicted response to X2 for species not considered by SFEP (Jassby 1993), the inability to fit a model to the X2/abundance relationship for 5 species (including delta smelt), and the inverse relationship between several estuarine species and movement of X2 downstream. This analysis suggests that X2 is not as strong a predictor of estuarine ecosystem conditions as it is of conditions favorable to the particular suite of indicators selected by the SFEP in their analysis.

Table 5. Summary Statistics for the Relationship Between Abundance Indices and the Location of X2 During the February to June Period

INDICATOR	R^2	SLOPE[1]
Jassby et al. 1994		
Bay Shrimp	0.86	
Longfin Smelt	0.79	
Opossum Shrimp	0.62	
POC	0.72	
Starry Flounder	0.58	
Striped Bass Survival	0.35	
Striped Bass MWT	0.72	
Others		
American Shad	0.36	
California Splittail	0.51/0.61[2]	
Chinook Salmon	0.36	
Delta Smelt	NM[3]	
Inland Silversides	0.16	—
Jacksmelt	0.17	
Northern Anchovy	0.43	
Pacific Herring	0.27	
Threadfin Shad	NM	—
Topsmelt	NM	—
White Croaker	NM	
White Sturgeon	NM	

[1] A minus sign (—) indicates that abundance decreases as X2 moves downstream. Otherwise, the reverse is true.

[2] The first-listed value was fit using weighted least squares in TableCurve and the second-listed value using generalized linear models.

[3] All fitted models and coefficients are individually statistically significant at the 0.05 level. NM indicates that a well-behaved model could not be fit to the data.

APPENDIX 6

Results of correlations between abundance indices and the number of days during which X2 was at or downstream of Chipps Island vs Roe Island (increases in r^2 from Chipps to Roe are an indication of a continuing benefit to be derived from moving X2 downstream; decreases suggest that there is no incremental benefit from moving X2 downstream). Note that only some of the indicators used by SFEP have an apparent incremental benefit from location of X2 at or downstream of Roe Island. In short, most of the benefit from an estuarine habitat standard may be gained by location of X2 at or downstream of Chipps Island.

Table 6-1. Comparison of biological benefits of locating X2 at or below Roe Island and Chipps Island.

	NUMBER OF DAYS X2 IS LOCATED			
	at or below Roe Island </= 64 km		at or below Chipps Island </= 74 km	
INDICATOR	Slope[1]	r^2	Slope	r^2
Crangon franciscorum	48	0.94*	38	0.76*
Delta Smelt	0.37	0.13	0.27	0.08
Longfin Smelt	12	0.56*	2.1	0.11
Neomysis mercedis	0.33	0.27*	0.35	0.39*
POC	0.065	0.56*	0.061	0.63*
Splittail	0.012	0.13	0.013	0.23*
Striped Bass MWT	7.1	0.40*	3.8	0.31*
Striped Bass Survival	0.0019	0.35*	0.0017	0.39*
Starry Flounder	0.34	0.37*	0.26	0.28

[1] AU/days = number of abundance units per number of days that X2 is downstream of the compliance point.

* An asterisk indicates that when a straight line is fit to the data, the overall regression is significant at the 0.05 level.

APPENDIX 7

Turbidity readings vs outflow for areas in the Suisun Bay (the lower the value of the Secchi disk reading, the more turbid the water). Note the highest turbidity occurs between 10,000 and 20,000 cfs, when X2 would be near Chipps Island; further note that turbidity in areas 12, 13, and 14 (Suisun Bay, see Figure 7-1) does not increase significantly for higher flows.

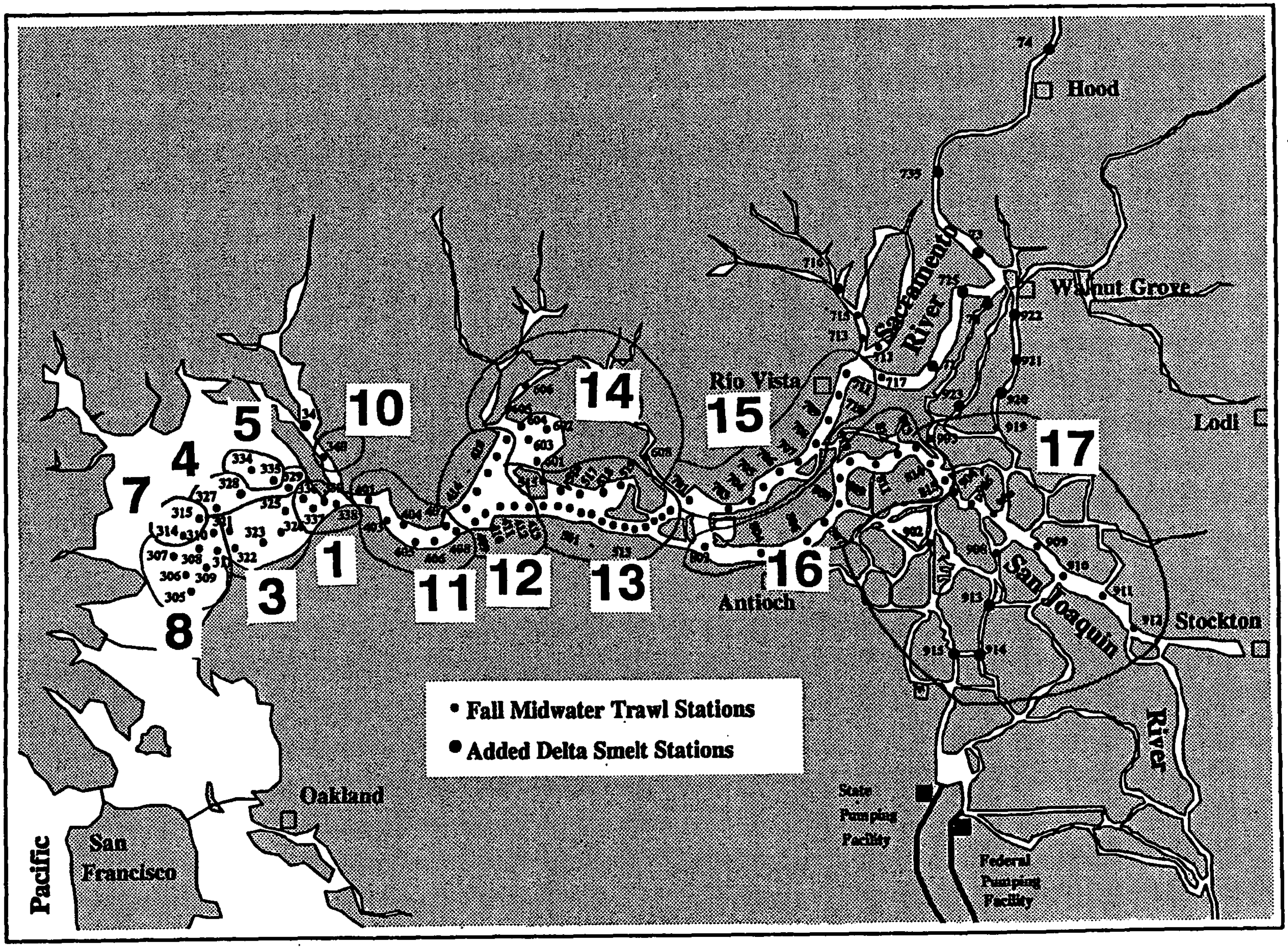


Figure 7-1 **Stations and Subareas Used in the Fall Midwater Trawl.**

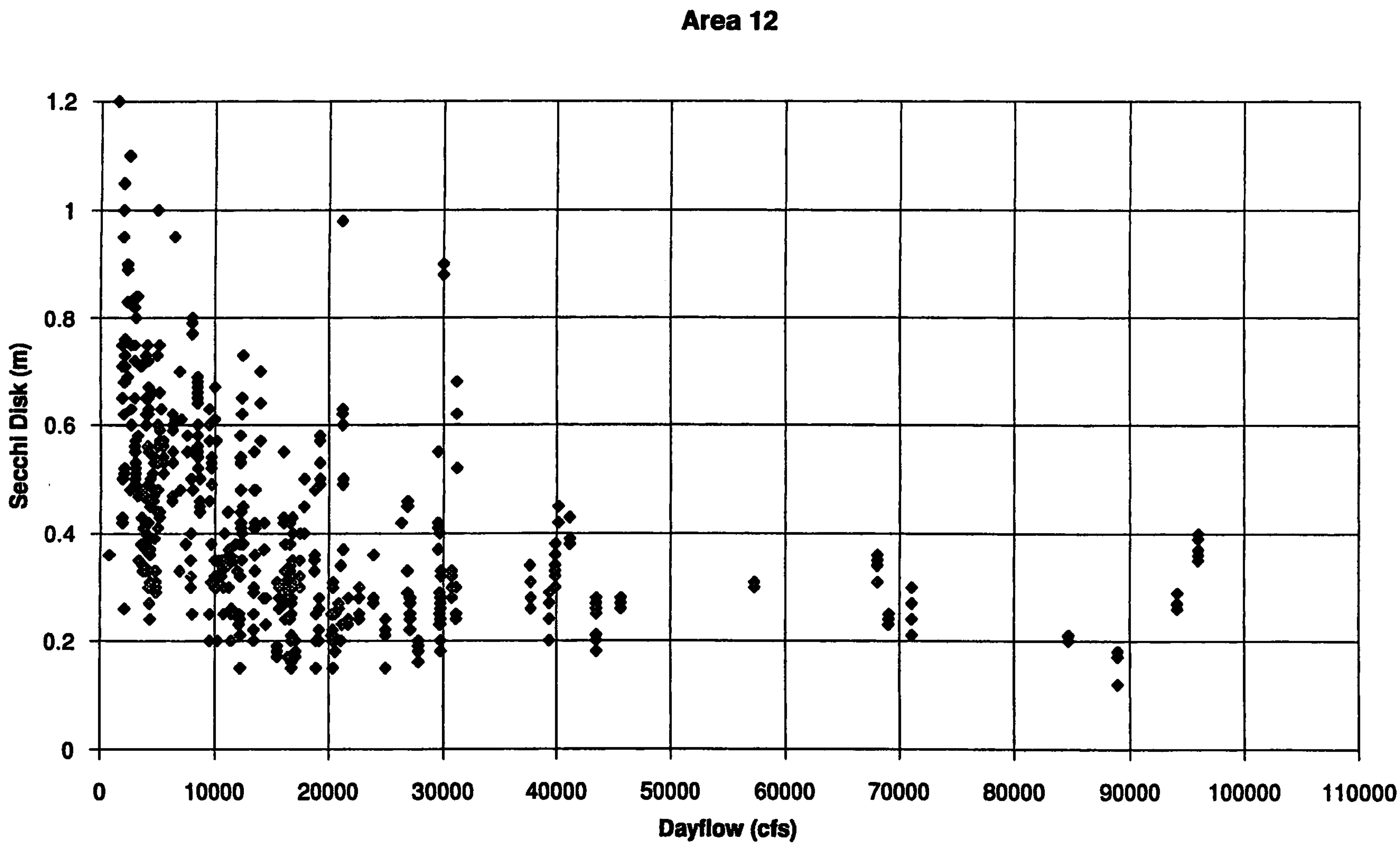


Figure 7-2. Turbidity vs dayflow, Area 12.

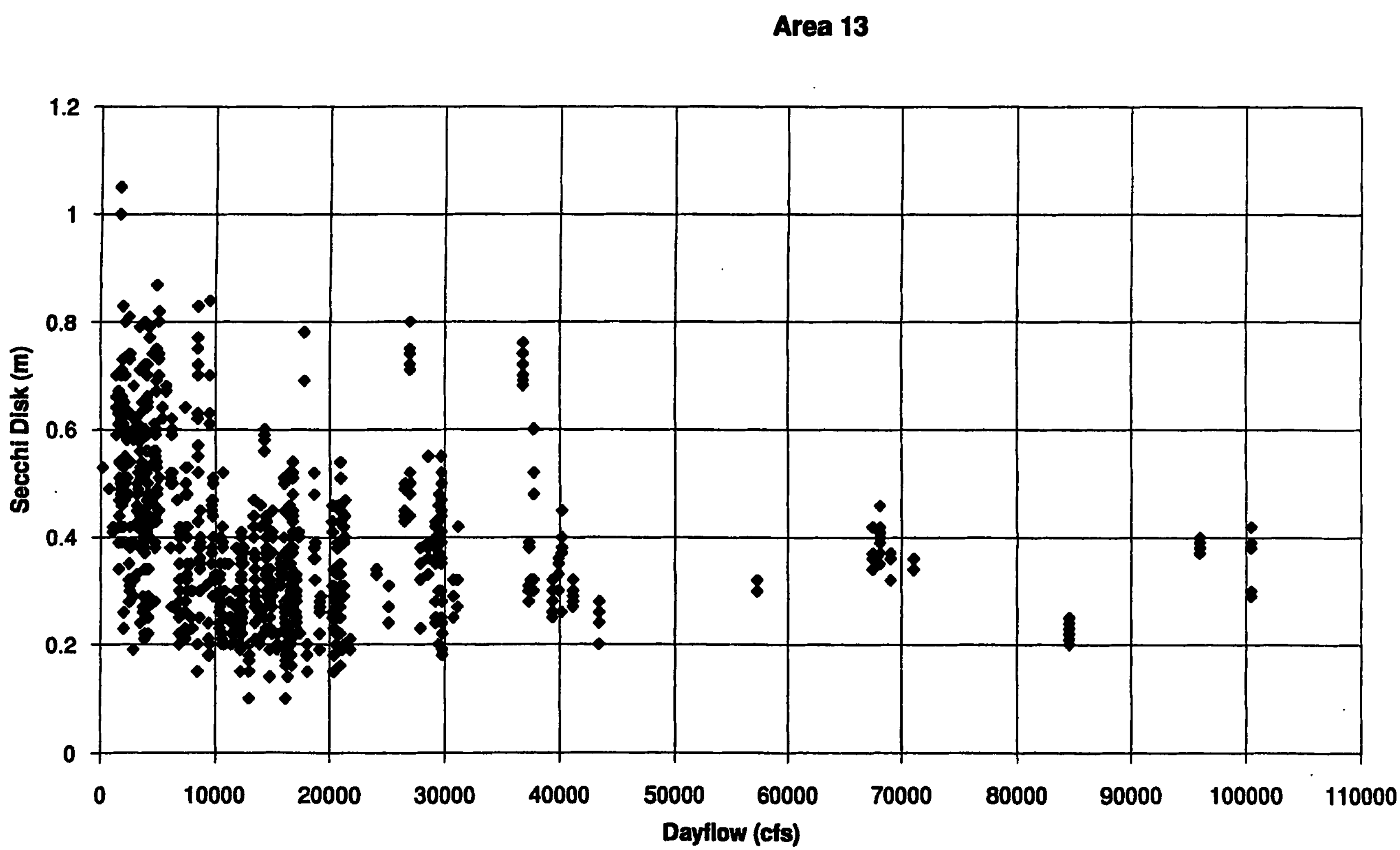


Figure 7-3. Turbidity vs dayflow, Area 13.

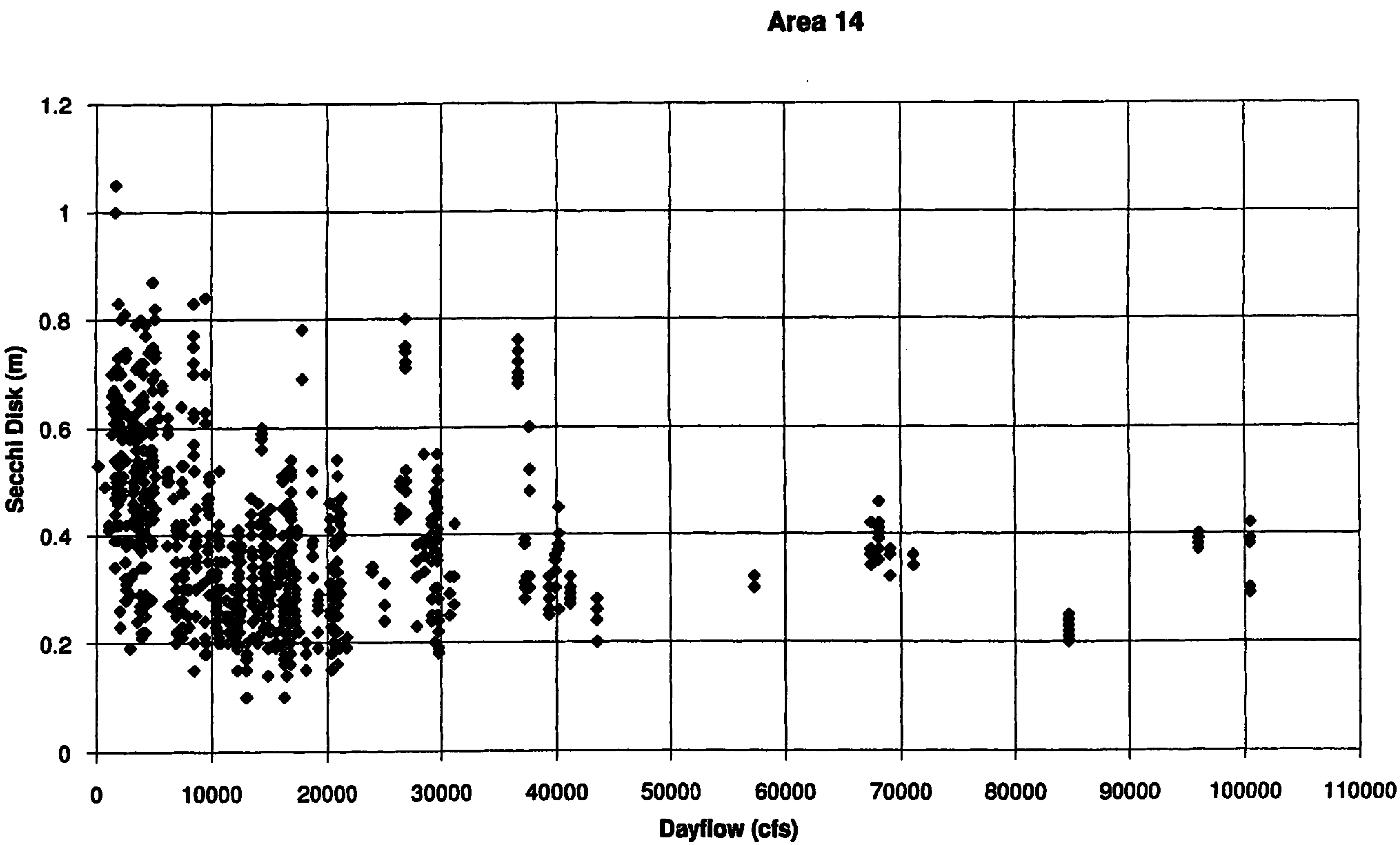


Figure 7-4. Turbidity vs dayflow, Area 14.

APPENDIX 8

Analysis of potential impacts of the Chipps and Roe Island standards, based on the amount of preferred salinity habitat, determined on a longitudinal basis, for each of 41 species which utilize the estuary (some brackish water species, some marine species), based on habitat preference analysis from National Marine Fisheries Service.

Note that the *potential* for adverse impacts, based on an analysis of habitat availability, increases for the Roe Island location of X2. This casts further doubt on the value of an X2 standard as a measure to protect the general condition of the estuary, further suggesting that the suite of species analyzed by SFEP was too narrowly defined to give a picture of general estuarine condition.

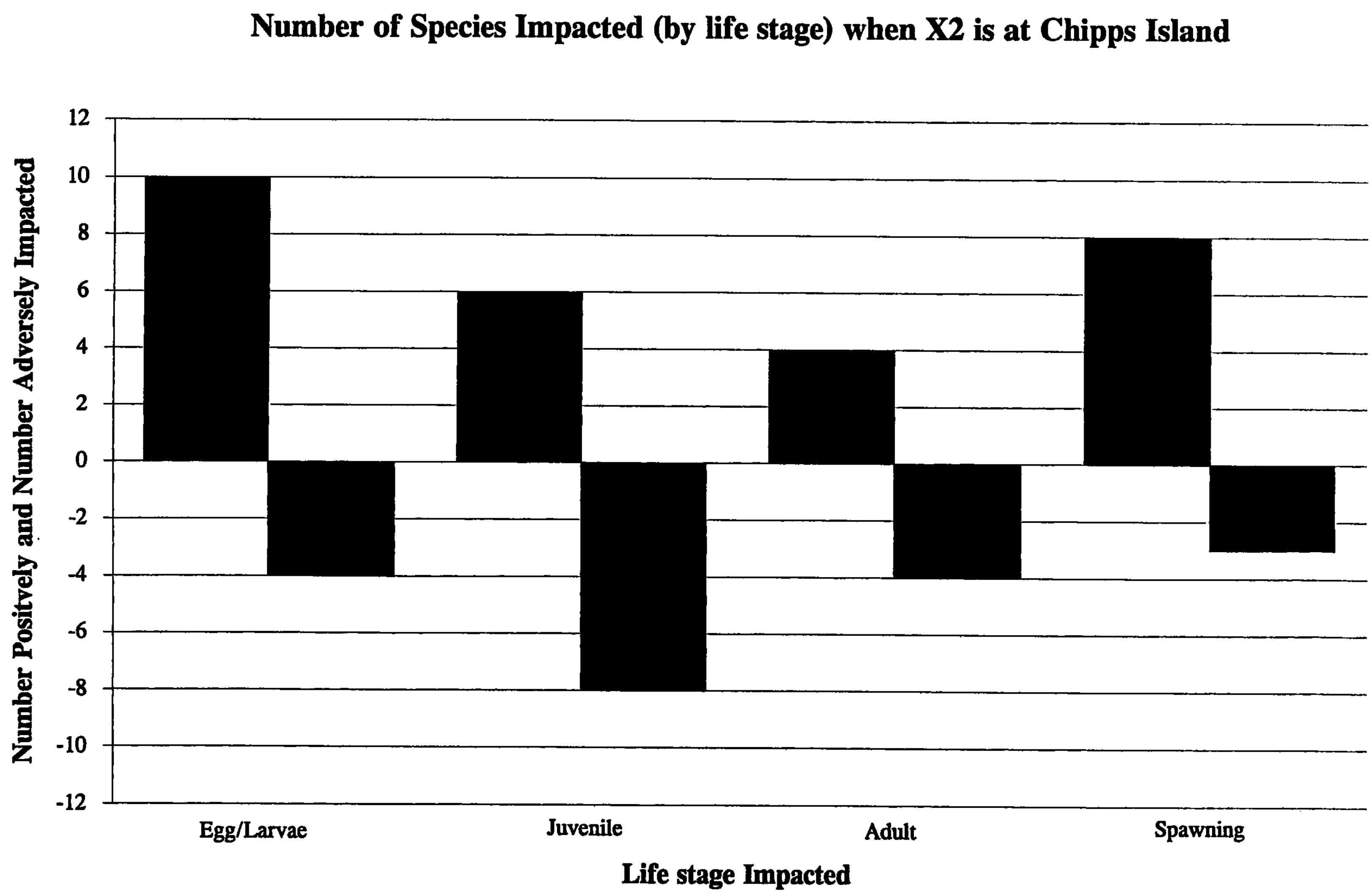


Figure 8-1. Number of species beneficially and adversely impacted (by life stage) under the Chipps Island Operational Scenario.

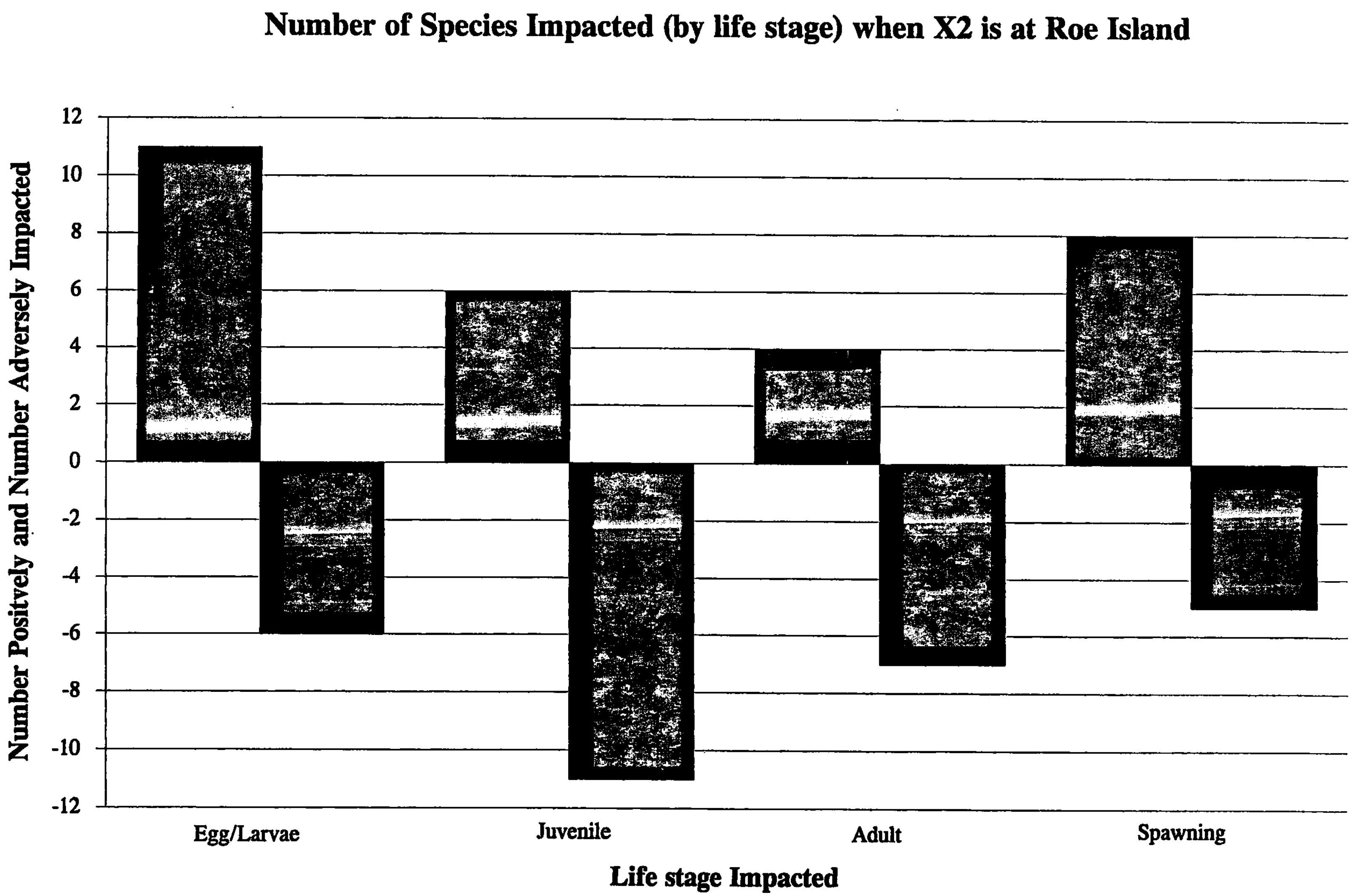


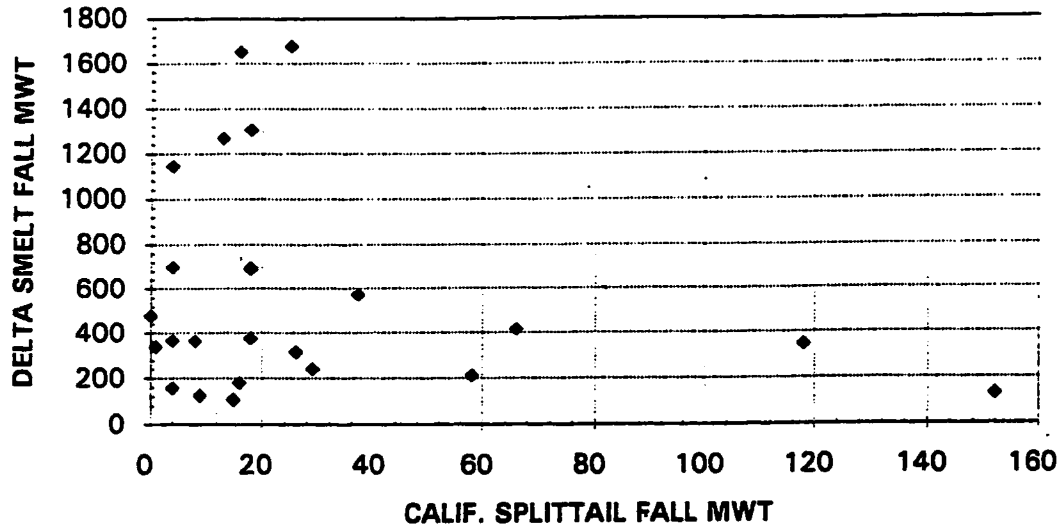
Figure 8-2. Number of species beneficially and adversely impacted (by life stage) under the Roe Island Operational Scenario.

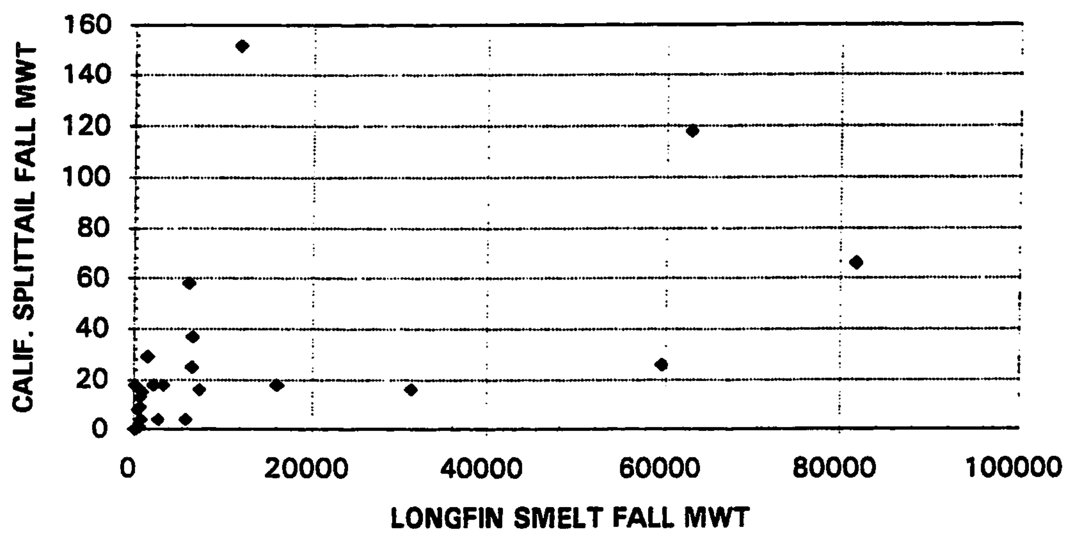
APPENDIX 9

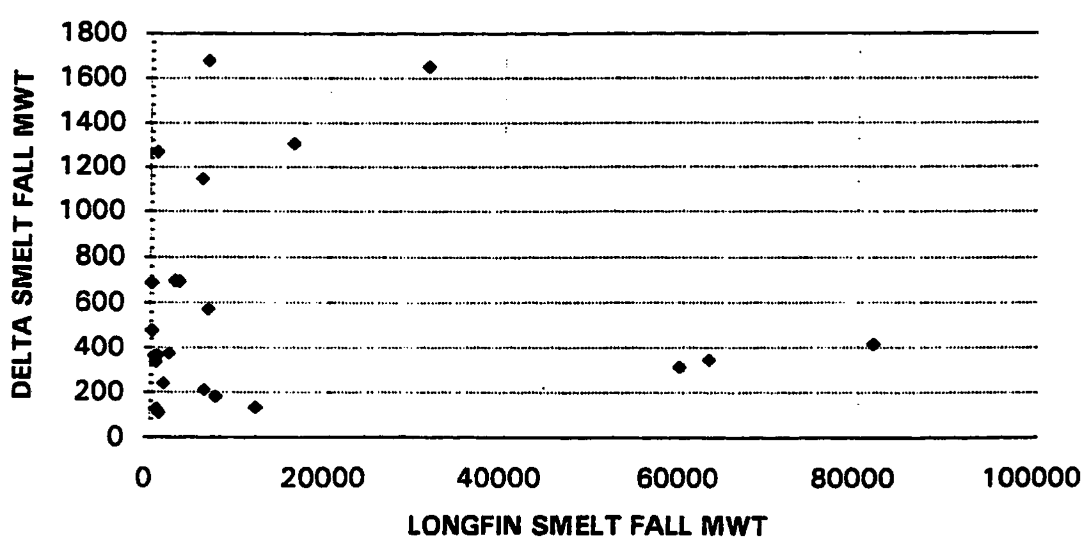
Comparison of the abundance of several estuarine species. Note that the shape of most of the graphs suggests that when one species is abundant, the other species evaluated is not. Conditions which favor one species may therefore be hypothesized to disfavor the other. This analysis suggests that variability in application of a standard which requires consistency in the location of X2 may favor one species over another, while a standard which permits greater within-year variability may provide a better balance of conditions.

Figure 9-1

SACRAMENTO / SAN JOAQUIN / BAY DELTA ANNUAL ABUNDANCE INDICES







APPENDIX 10

Data from the CUWA water cost analysis from Reference 13 (see references below):

a. Calculation of the number of days when X2 would have been at or downstream of the three compliance points proposed by EPA for the period 1930-1992.

b. Weighted least squares regression of days at X2 during various periods of record and the corresponding Sacramento River Index for the EPA-proposed regulatory period.

2.2. Historical Perspective on X2 Attainability

An analysis was performed using two different methodologies to determine the number of days the X2 standards (treated as an equivalent surface EC of 2640 μS/cm) were met historically for the period, 1930-1992, at Port Chicago, Chipps Island, and Collinsville. The first methodology used Denton's antecedent flow-salinity relations (discussed in chapter 4) to determine salinity as a function of time at the three stations. The second methodology used the X2 equation (discussed in chapter 4) to determine X2 as a function of time. In both cases, historical DAYFLOW estimates of net Delta outflow were used. The historical number of days the X2 standards were met are given in table 2.2.1.

	Port Chicago		Chipps Island		Collinsville		Annual
Water Year	Gave days	X2 days	Gave days	X2 days	Gave days	X2 days	40/30/30 Index
1930	72	91	144	143	150	150	5.90
1931	0	0	73	70	101	98	3.66
1932	127	145	151	151	151	151	5.48
1933	18	0	150	150	150	150	4.63
1934	19	16	101	100	120	113	4.07
1935	131	150	150	150	150	150	6.98
1936	140	149	151	151	151	151	7.75
1937	135	137	150	150	150	150	6.87
1938	150	150	150	150	150	150	12.62
1939	19	0	103	102	130	126	5.58
1940	132	141	151	151	151	151	8.88
1941	150	150	150	150	150	150	11.47
1942	150	150	150	150	150	150	11.27
1943	135	142	150	150	150	150	9.77
1944	41	22	143	142	151	151	6.35
1945	114	135	150	150	150	150	6.80

Water Year	Port Chicago Gave days	Port Chicago X2 days	Chipps Island Gave days	Chipps Island X2 days	Collinsville Gave days	Collinsville X2 days	Annual 40/30/30 Index
1946	127	132	150	150	150	150	7.70
1947	41	26	110	109	145	141	5.61
1948	91	81	146	139	151	151	7.12
1949	72	74	141	140	150	150	6.09
1950	103	119	150	150	150	150	6.62
1951	109	123	146	146	150	150	9.18
1952	151	151	151	151	151	151	12.38
1953	101	115	150	150	150	150	9.55
1954	113	117	139	139	150	148	8.51
1955	0	0	118	104	150	144	6.14
1956	142	151	151	151	151	151	11.38
1957	53	50	146	145	150	150	7.83
1958	150	150	150	150	150	150	12.16
1959	41	39	79	79	118	115	6.75
1960	33	34	121	111	137	132	6.20
1961	38	19	87	86	135	132	5.68
1962	67	68	143	137	150	150	6.65
1963	108	125	150	150	150	150	9.63
1964	7	8	74	71	142	140	6.41
1965	95	124	150	150	150	150	10.15
1966	20	33	113	110	129	123	7.16
1967	145	150	150	150	150	150	10.20
1968	54	49	81	81	122	120	7.24
1969	150	150	150	150	150	150	11.05
1970	58	68	91	97	148	144	10.40
1971	57	68	150	150	150	150	10.37
1972	0	0	64	62	93	88	7.29
1973	69	82	124	123	150	146	8.58
1974	96	119	150	150	150	150	12.99
1975	84	105	150	150	150	150	9.35
1976	0	0	0	0	63	52	5.26
1977	0	0	0	0	0	0	3.09
1978	114	125	141	142	150	150	8.65
1979	44	47	121	108	143	137	6.67
1980	77	93	151	151	151	151	9.04
1981	19	0	79	76	133	108	6.21
1982	137	150	150	150	150	150	12.72
1983	150	150	150	150	150	150	15.29
1984	60	68	92	89	151	151	10.00
1985	0	0	39	31	110	99	6.47
1986	84	85	139	138	150	150	9.93
1987	0	0	51	30	96	91	5.83
1988	0	0	7	0	52	28	4.63
1989	24	0	45	37	111	104	6.13
1990	0	0	0	0	38	9	4.81
1991	5	0	34	14	54	37	4.21
1992	11	0	48	41	83	78	4.07

Table 2.2.1. Number of days X2 standards were met using: (1) Denton's antecedent flow-salinity relations; (2) Kimmerer-Monismith X2 equation.

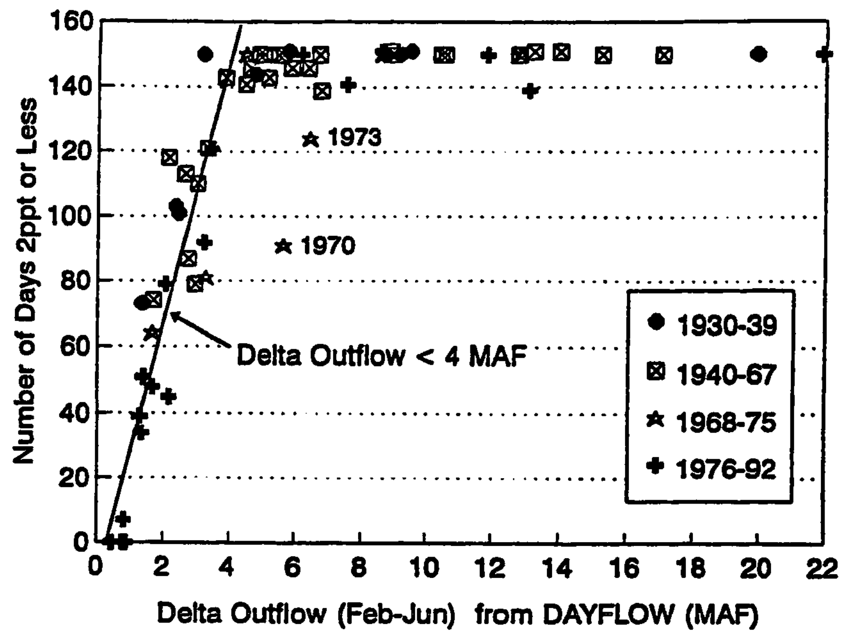


Figure 2.2.5. Relation between the number of X2 days at Chipps Island and the February-June net Delta outflow for the period, 1930-1992.

2.2.3 Sliding Scale Approach to X2 Standards

EPA has recommended a level of protection for San Francisco Bay and the Delta similar to that which existed during the late 1960s and early 1970s. In developing the X2 standards, however, EPA used a longer period, 1940-1975, to determine the X2 day requirements for specified year types. This longer period was deemed necessary to ensure sufficient data for the analysis. EPA used the 40-30-30 Sacramento River Index to categorize water years into one of five water year types (wet, above normal, below normal, dry, and critical) and averaged the data within each category. In essence, EPA's methodology reduced the data from 36 years to four points: the average number of X2 days during wet, above normal, below normal, and dry years (the period, 1940-1975, contained no critical years).

It is recognized that the 40-30-30 index, which was developed as part of the SWRCB D-1630 process to define water year availability over a full water year (October-September) may not be representative of the salinity regime in Suisun Bay for the period, February-June; e.g. the 40% component of the 40-30-30 index is the sum of monthly unimpaired runoffs for April-July and July runoff cannot affect salinity in the previous period, February-June. Similarly, unimpaired runoff in October, November, and December that is not stored in upstream reservoirs will not significantly effect salinity in the February-June period. EPA has considered using other indices than the 40-30-30 index to define the X2 day requirements (Issue #1, USEPA 1994, p.834). One alternative EPA has considered is to modify the 40-30-30 split of the April-July runoff, October-March runoff, and the previous water year's index. A somewhat better approach may be to use the sum of the monthly runoffs for the period, February through June, as this most directly affects salinity in the Delta and Suisun Bay. This index may be further refined by including January to account for antecedent effects of outflow on salinity and/or including an additional factor to account for carryover storage in upstream reservoirs at the end of January.

To determine appropriate X2 day requirements historical X2 attainability may be plotted versus the February-June runoff index. This enables analysis of periods such as 1955-1975 (21 points), 1964-1975 (12 points), or 1968-1975 (8 points) to address EPA's Issue #5 (USEPA 1994, p.839) which deals with the determination of the appropriate historical reference period for developing target number of X2 days. Figure 2.3.1 shows X2 days at Roe Island for a period compatible with the required level of protection, 1968-1975, along with a least squares linear fit. The data plotted in figure 2.3.1 and in figures 2.2.2 to 2.2.4 suggest that since a simple linear equation reasonably fits the data use of a higher order polynomial appears unwarranted. Also shown in figure 2.3.1 are the number of X2 days required under the proposed X2 standards. There is some overlap in required number of days because the water year types for the proposed standards are based on the 40-30-30 index rather than a February through June runoff index. The proposed X2 standards tend to require significantly greater number of days of compliance than the least squares linear fit through the 1968-1975 data.

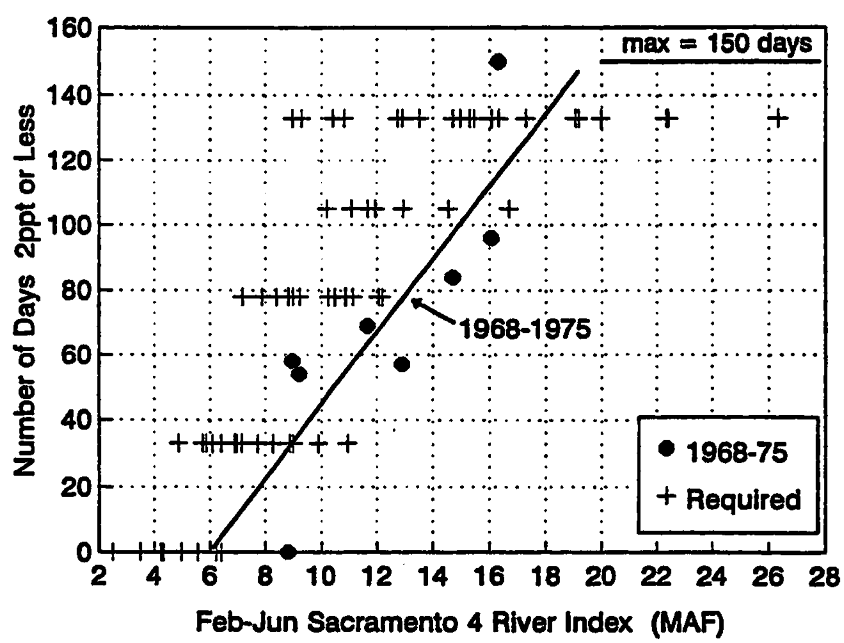


Figure 2.3.1. Number of X2 days at Roe Island for the period, 1968-1975. The solid line represents a least squares linear fit through the data. The crosses represent the required number of days under the EPA-proposed X2 standards.

Figure 2.3.2 shows the number of X2 days at Chipps Island for the period, 1968-1975, along with a least squares linear fit. Data for which the February through June index was greater than 14 MAF were not included in the least squares linear fit since they were at the maximum number of days (150 days). EPA's extrapolation to set a critical year standard (the period 1940-1975 used by EPA contains no critical years) appears to have overstated the necessary level of protection at Chipps Island. The linear fit through the 1968-1975 data shown in figure 2.3.2 suggests that very few days of 2 ppt or less would be required at Chipps Island during critical years for appropriate protection. The proposed below normal and above normal year X2 day requirements also appear to be overstated.

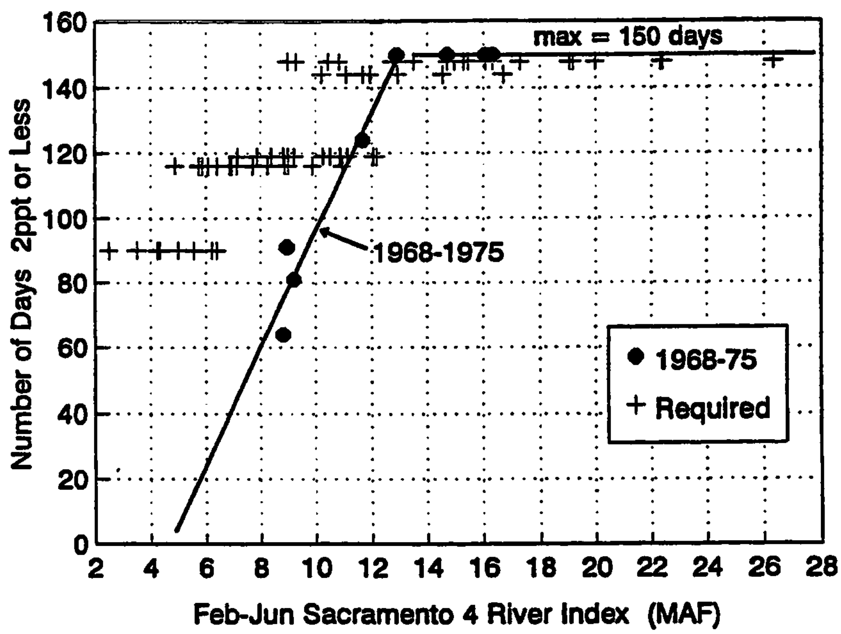


Figure 2.3.2. Number of X2 days at Chipps Island for the period, 1968-1975. The solid line represents a least squares linear fit through the data for values of the February-June Index less than 14 MAF. The crosses represent the required number of days under the EPA-proposed X2 standards.

Figures 2.2.2, 2.2.3, and 2.2.4 indicate that the least squares linear fits are sensitive to the choice of historical period. Figure 2.3.3 shows X2 days at Chipps Island for the period, 1955 through 1992, with linear fits for the periods, 1955-1976, 1968-1975, and 1968-1992. Prior to

1968 (pre-SWP) there were fewer diversions upstream of the Delta and less exports and the number of days of X2 compliance were correspondingly higher. The linear fit for 1955 through 1976 therefore reflects the correspondingly higher ratio of Delta outflow to unimpaired runoff relative to the period, 1968-1975. It is interesting to note that including the period, 1976 through 1992, with the period of desired level of protection, 1968-1975, results in only a small change to the least squares linear fit.

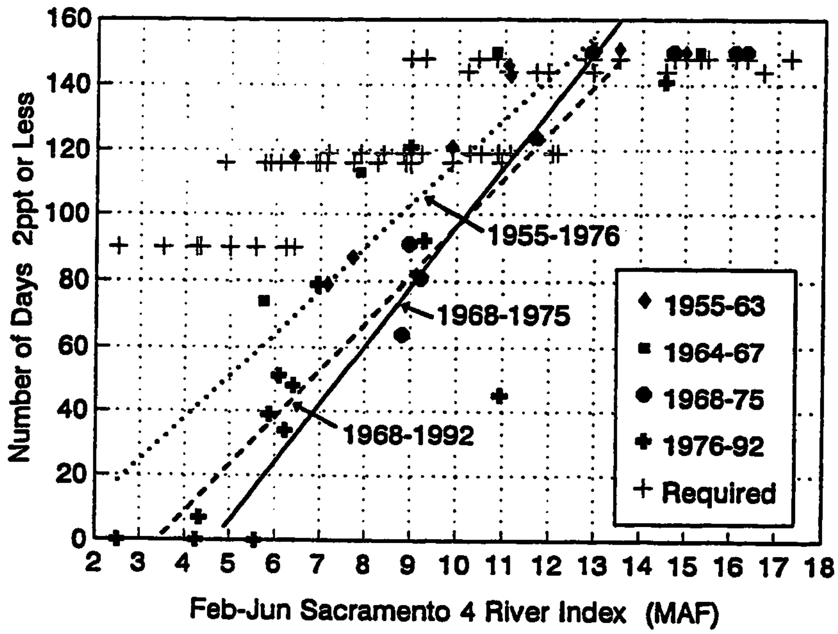


Figure 2.3.3. Number of X2 days at Chipps Island for the period, 1955-1992. The solid line represents a linear fit through the data for 1968-1975; the dashed line represents a linear fit through the data for 1968-1992; the dotted line represents a linear fit through the data for 1955-1976.

The proposed X2 day requirement at Collinsville is 150 days for all water year types. Figure 2.3.4 shows the number of X2 days at Collinsville for the period, 1964-1992. There were only two years during 1968-1975 when the number of X2 days was significantly less than 150 days. However, the data from the longer period, 1964-1992, suggest that in critical years (beyond the range of conditions in the 1968-1975 period) some relaxation in the proposed X2 day requirements may be warranted.

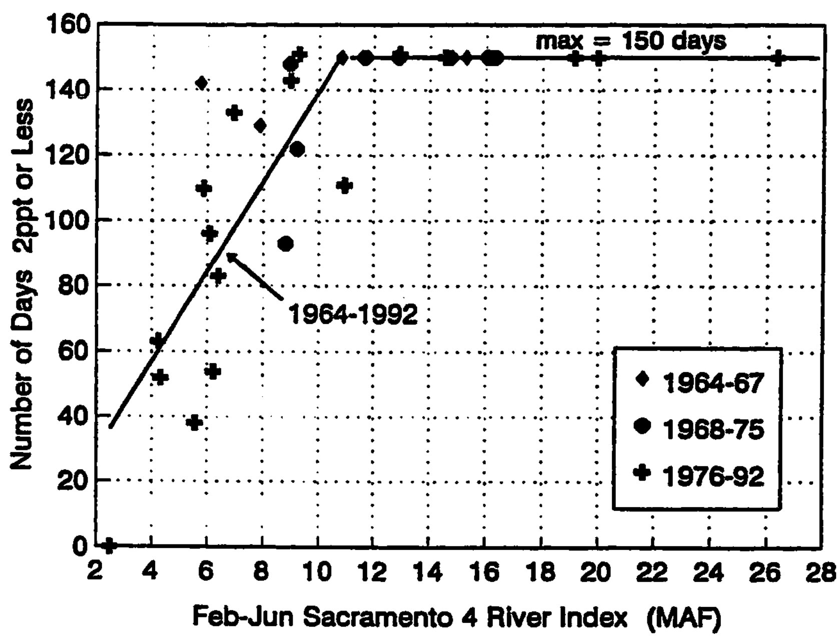


Figure 2.3.4. Number of X2 days at Collinsville for the period, 1968-1975.

In summary, the data presented in figures 2.2.1-2.2.5 and in figures 2.3.1-2.3.4 suggest that a sliding scale methodology based on linear fits to data for individual years provides an effective way to define day requirements for the X2 standard. An index based on the February-June Sacramento Four River Index appears to correlate well with the historical number of X2 days. Because the number of X2 days depends both on the runoff index and on the total amount of diversions from the system, an X2 standard based on a linear sliding scale equation would in effect impose a limit on the amount of total diversions from the whole watershed for the February-June period. While the period, 1968-1975, has been used to illustrate the sliding scale methodology, alternate periods may be selected, such as 1964-1976.

APPENDIX 11

References

1. Arakawa, Stephen N. Potential Refinements and Alternatives to the Environmental Protection Agency's Proposed San Francisco Bay/Delta Water Quality Standards. Report prepared for California Urban Water Agencies. March 7, 1994.

2. Bailey, Randy. A Review of Information Used as the Basis for the U.S. Environmental Protection Agency's Proposed Water Quality Standards. Report prepared for California Urban Water Agencies. March 7, 1994.

3. Bailey, Randy. A Review of the Salmon Smolt Survival Index Proposed by the U.S. Environmental Protection Agency as a Water Quality Standard for the San Francisco Bay Estuary. Report prepared for California Urban Water Agencies. March 7, 1994.

4. Fox, J. Phyllis. Evaluation of the Relationship between Biological Indicators and the Position of X2. Report prepared for California Urban Water Agencies. March 7, 1994.

5. Jassby, Alan *et.al.* Isohaline Position as a Habitat Indicator for Estuarine Populations. Environmental Management, 1994.

6. Miller, William J. Water Costs of the EPA Standards. Report prepared for California Urban Water Agencies and the San Luis Delta-Mendota Water Authority. March 7, 1994.

7. Reiser, Dudley *et. al.* Evaluation of Factors Potentially Limiting Aquatic Species Abundance and Distribution in the San Francisco Bay/Sacramento-San Joaquin Estuary. Report prepared for California Urban Water Agencies. March 7, 1994.

8. Reiser, Dudley *et. al.* Review and Evaluation of Foundational Literature and Data Related to the Proposed EPA Salinity Standard. Report prepared for California Urban Water Agencies. March 7, 1994.

9. Reiser, Dudley *et. al.* Evaluation of Potential Effects of the Proposed EPA Salinity Standard on the Biological Resources of the San Francisco Bay/Sacramento-San JOaquin Estuary. Report prepared for California Urban Water Agencies. March 7, 1994.

10. Herbold, Bruce *et. al.* Status and Trends Report on Aquatic resources in the San Francisco Estuary. SFEP, 1992.

11. Schubel, J.R. *et. al.* Managing Freshwater Discharge to the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: The Scientific Basis for an Estuarine Standard. SFEP, 1992.

12. Steiner, Daniel B. Review and Analysis of EPA Proposed San Joaquin River Salmon Smolt Survival and Striped Bass Salinity Criteria. Report for California Urban Water Agencies. March 7, 1994.

13. Sullivan, Greg and Richard Denton. Report on Clean Water Act X2 Water Quality Standards. Report for California Urban Water Agencies. March 7, 1994.

APPENDIX 2

ENVIRONMENTAL IMPACTS OF THE PROPOSED EPA BAY-DELTA WATER QUALITY STANDARDS IN THE SERVICE AREAS OF THE BAY-DELTA URBAN COALITION

March 11, 1994

Submitted by:

John T. Gray, Ph.D.
Woodward-Clyde Consultants
5951 Encina Road, Suite 200
Santa Barbara, California 93117

On Behalf of:

Bay-Delta Urban Coalition

Submitted to:

Patrick Wright
Bay-Delta Program Manager
Water Quality Standards Branch W-3
Water Management Division
Environmental Protection Agency
75 Hawthorne Street
San Francisco, California 94105

TABLE OF CONTENTS

1.0 INTRODUCTION

On 15 December 1993, the U.S. Environmental Protection Agency (EPA) issued water quality standards for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta). These standards include three sets of federal criteria to protect the beneficial uses of the Bay-Delta, including a standard to protect estuarine habitat and fish and wildlife uses, a salinity criterion to protect fish spawning uses in the lower San Joaquin River, and a set of salmon smolt survival index criteria to protect fish migration and cold freshwater habitat uses. These standards supersede and supplement the water quality standards contained in the California State Water Resources Board's (State Board's) 1991 *Water Quality Control Plan for Salinity for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary.*

Under the provisions of the Clean Water Act, EPA expects the State Board to implement the salinity standards by making appropriate revisions to operational requirements in the water rights permits issued by the State Board for Bay-Delta diverters. EPA has urged the State Board to spread the burden of compliance with these standards across a broad spectrum of Bay-Delta water users.

On 15 December 1993, the U.S. Fish and Wildlife Service (USFWS) also issued a proposal to revise the proposed critical habitat designation in the Bay-Delta for the threatened Delta smelt. The revised critical habitat designation links directly to the proposed EPA water quality standards, USFWS states, because salinity is a key criterion for determining critical habitat for life-stages of the smelt. The USFWS' proposed revision to the critical habitat incorporates the EPA-proposed standards; USFWS states that compliance with the EPA standards would ensure the integrity of the critical habitat and avoid jeopardy to the species.

The EPA has prepared a Regulatory Impact Assessment (RIA) dated 15 December 1993 for the proposed water quality standards, as well as the proposed revision to the Delta smelt critical habitat. EPA has assumed that increased Delta outflows through changes in the water rights permits issued by the State Board would constitute the primary method for implementing their proposals. The RIA states that additional measures may also be necessary to protect critical habitat for the smelt.

EPA and other federal agencies have estimated the water supply impacts of the proposals using a Department of Water Resources (DWR) model for the Bay-Delta. The RIA contains the results of this assessment, which predicts reductions in water supplies from the Delta an average of 540,000 acre-feet in all water years, and up to 1.1 million acre-feet (MAF) in critically dry years. EPA has assumed that agricultural users would bear 80 percent of these reductions, and that urban users would bear the remaining 20 percent reduction. EPA assumed these reductions would come from both the State Water Project (SWP) and the federal Central Valley Project (CVP).

The RIA identifies three scenarios by which urban users would respond to the reductions in water supply. The first scenario assumes urban users would rely predominantly on drought-management techniques and reclamation to compensate for the lost supplies. The second scenario assumes that urban users would utilize a water bank, in addition to drought-management and reclamation. The third scenario assumes that urban areas would compensate for lost supplies predominantly through a water bank and other water transfer programs.

DWR has conducted an independent assessment of the potential water supply impacts of the federal proposals, using their Bay-Delta model and different assumptions that DWR deems more accurate than the assumptions used in the RIA, including the use of an outflow buffer to ensure daily compliance with salinity standards. The results of the DWR modeling indicate that EPA's proposed standards would reduce water supplies from the Bay-Delta by 1.7 MAF per year on average, and up to 3.1 MAF in critically dry years. These figures contrast sharply with EPA's finding of reductions of 540,000 acre-feet and 1.1 MAF, respectively.

The allocation of water supply reductions stemming from the new standards between agricultural users and urban users, and between the CVP and SWP, are unknown at this time. Therefore, it is uncertain whether EPA's prediction of a 20 percent allocation to urban water users will be accurate; implementation of the standards by the State Board may result in the urban areas bearing a higher percentage of the burden than EPA predicts. If, however, EPA's assumption of a 20 percent allocation to urban users in correct, then DWR's computations indicate that the new standards would reduce available supplies to urban users by 340,000 acre-feet/year on average, and 620,000 acre-feet in critically dry years.

Approximately 10 percent of CVP deliveries go to urban users, while about 50 percent of the entitlements to SWP water resides with urban users. Hence, the water supply reductions to urban users from EPA's proposed standards would affect SWP urban water users more than urban users of the CVP.

EPA issued the preliminary standards as a proposed rule in the 6 January 1994 Federal Register (FF 59:810). EPA will receive written comments until 11 March 1994. This document represents a response to the proposed water quality standards and critical habitat designation. The objective of this document is to identify the adverse environmental impacts that could occur in the service areas of SWP urban water users due to water supply reductions associated with EPA's proposals. These adverse environmental impacts would affect a variety of environmental resources outside the Bay-Delta. Most of these impacts are considered long-term and significant, using the definition of significance contained in the California Environmental Quality Act (CEQA) Guidelines (Section 15382). Furthermore, the RIA does not consider these impacts in its analysis of economic costs. Therefore, EPA should revise the RIA to include economic impacts resulting from environmental damage in the urban water users' service areas. In addition, EPA should consider these environmental impacts in its determination of any final water quality standards.

These comments do not include an assessment of potential environmental impacts of reduced urban water supplies for CVP contractors, although the arguments presented herein are likely to apply to the CVP urban water users, as well.

2.0 MAJOR BAY-DELTA WATERSHED USERS

Users of water in the Bay-Delta watershed include contractors of the SWP and users, such as the City and County of San Francisco, who obtain their supplies outside the state system.

The SWP supplies a wide variety of agricultural and urban water contractors throughout the State. Water is diverted from the Bay-Delta to the south and west for delivery to 29 contractors. Contracted entitlements to SWP water total 4.23 MAF. Generally, the San Joaquin Valley use of SWP water has been near full contract amounts since about 1980 (except during very wet or dry years), while Southern California has received on average only about 60 percent of its full entitlement. SWP contracts allocate about 2.5 MAF to the Southern California region, 1.36 MAF to the San Joaquin Valley, and about 0.37 MAF to the San Francisco Bay and Central Coast regions. Actual deliveries of SWP water has varied greatly each year depending on demand, climate, and availability of facilities. For example, total SWP deliveries in 1990, 1991, 1992 totaled about 2.6, 0.5, and 1.5 MAF, respectively. The estimated 7-year average dry-period yield of the SWP with current facilities operating according to Water Rights Decision 1485 requirements is about 2.3 MAF.

Major urban users in the Bay-Delta watershed are listed below using the hydrologic units defined by DWR in their California Water Plan Update (Draft Bulletin 160-93):

South Coast: The South Coast hydrologic region includes most of San Diego, western Riverside and San Bernardino, Orange, Los Angeles, and Ventura counties. Urban water use in the region accounts for about 80 percent of all water uses. SWP contractors include Metropolitan Water District of Southern California (Metropolitan), City of Ventura, Castaic Lake Water Agency, United Water Conservation District, San Gabriel Valley Municipal Water District, and Casitas Municipal Water District. The combined SWP entitlement to these contractors totals approximately 2,400,000 AFY.

San Francisco Bay:

SWP Contractors: Urban water use in the San Francisco Bay Region accounts for about 19 percent of total water use in the area. North Bay SWP contractors are Napa County Flood Control and Water Conservation District and Solano County Flood Control and Water Conservation District which have a combined entitlement of 67,000 acre-feet per year (AFY). South Bay SWP contractors are Alameda County Water District, Alameda County Flood Control and Water Conservation District Zone 7, and Santa Clara Valley Water District. These contractors have a combined entitlement of 188,000 AFY.

City and County of San Francisco: San Francisco obtains its primary water supply outside the SWP, through the Hetch Hetchy Aqueduct. The Aqueduct imports water from the Tuolumne River, which lies in the Bay-Delta watershed. The Hetch Hetchy Aqueduct imports 269,000 AFY (Draft Bulletin 160-93, page 55).

Central Coast: The Coastal Branch, Phase II Aqueduct is currently under construction and scheduled for completion in 1997. The Aqueduct will bring SWP water from the California Aqueduct in Kern County to SWP contractors in San Luis Obispo and Santa Barbara counties. Although the original entitlements of these contractors was 70,486 AFY, they are now 47,316 AFY. SWP contractors in this region include (among others) San Luis Obispo County Flood Control and Water Conservation District and the Central Coast Water Authority. Urban water use accounts for about 20 percent of total water use in the region. SWP deliveries are anticipated to begin upon completion of the Coastal Branch, Phase II in 1997.

South Lahontan: This region includes the western Mojave Desert. Urban water uses account for about 22 percent of all water use and is increasing due to rapid population growth in the Palmdale and Antelope Valley areas. SWP contractors include Antelope Valley/East Kern Water Agency, Littlerock Creek Irrigation District, Palmdale Water District, and Mojave Water Agency. Entitlements to these contractors totals 69,000 AFY.

3.0 SUMMARY OF POTENTIAL ADVERSE IMPACTS

The contractors listed above represent major urban users of the Bay-Delta watershed. Actual deliveries of SWP supplies in most years exceed the contract entitlements. According to DWR Bulletin 132-91 (pages 278-281), deliveries in 1990 to the urban SWP contractors listed above totaled approximately 1.69 MAF (South Coast -- 1.47 MAF, San Francisco Bay -- 160,000 AF, South Lahontan -- 57,300 AF). A reduction in these supplies of 220,000 to 620,000 AFY (based on EPA's assumption of 20 percent reduction to urban users) or more due to the proposed EPA standards would represent a substantial curtailment of current supplies, and would likely result in both short and long-term environmental impacts, even though urban SWP contractors and local purveyors would seek alternative sources of water to replace the amount lost due to the proposed standards.

Significant environmental impacts caused by the reduction in urban water supplies would include the following:

- **Curtailment of groundwater replenishment and conjunctive-use programs by SWP urban users.** Reductions would curtail or possibly cause abandonment of existing and future conjunctive-use programs. The benefits to the affected basins of the programs would thus be lost.

- **Potential overdraft and/or saltwater intrusion.** Pumping of local groundwater basins would increase in response to reductions in imported water supplies, possibly resulting in overdrafting of basins and the substantial depletion of groundwater storage in the region. Severe overdrafting may also result in permanent aquifer damage including loss of storage and reduced recharge rates. The increased pumping and reduced replenishment could curtail seawater-intrusion barrier programs, thereby resulting in degradation of the basin as saltwater migrates to actively pumped areas.

- **Impairment of groundwater basin clean-up/recovery programs and possible increased contamination and basin degradation.** Water quality in the basins could deteriorate due to: (1) a reduction in high-quality replenishment water; (2) pumping of poorer quality water as drawdowns of basins occurs; (3) further degradation of contaminated basins if imported water for remediation is curtailed; and (4) degradation of coastal basins if imported water for seawater intrusion barrier programs is reduced. These effects could render basins unusable within several years if water quality becomes irreversibly degraded.

- **Potential land subsidence due to overdrafting.** The depletion of groundwater supplies due to a curtailment of replenishment water could result in the drawdown of groundwater in the basins of the service areas. In some basins, the prolonged decrease in groundwater elevations may cause a consolidation of water-bearing formations leading to land subsidence which could affect utilities, roads, and private property.

- **Reduced opportunities for new wastewater reclamation projects.** Wastewater reclamation and reuse are contingent upon the availability of source waters with relatively low Total Dissolved Solids (TDS) concentration, such as SWP water. Use of poorer quality water such as local groundwater or water from the Colorado River could result in greater levels of TDS in wastewater, and ultimately in reclaimed water. The high TDS levels in the reclaimed water could limit discharges to the environment, commercial and agricultural uses, and groundwater recharge. Limiting the uses of reclaimed water would reduce opportunities to develop new supplies through reclamation technology.

- **Conflicts with regional water quality control basin plans.** Conflicts would arise due to water agencies' impaired ability to meet water quality objectives because of groundwater basin degradation, less blending of SWP and local water supplies, and reduced wastewater reclamation. In addition, the curtailment of replenishment programs at adjudicated basins could represent a conflict with approved groundwater plans developed by the courts.

- **Reduced environmental enhancement due to decreased groundwater spreading, surface storage, and water reclamation discharges.** Reduced imported water supplies could result in a decrease in the amount of runoff from urban users into natural and man-made watercourses, and discharge from reclamation plants into spreading ponds or watercourses where habitat is created. Natural and man-made wetland habitats reliant on this runoff could be adversely affected because: (1) live streams may be precluded; (2) insufficient runoff could be available to saturate the upper soils to support wetland vegetation; and (3) significant wetland habitat dependent on this runoff could be degraded and possibly destroyed as groundwater elevations drop.

- **Reduced or modified recreational opportunities at SWP surface-storage facilities.** A reduction and/or seasonal restriction of SWP water could result in lower reservoir levels and greater fluctuations in water surface elevations, particularly during the summer when recreational demands are the highest. Lower water levels and greater fluctuations in these reservoirs could adversely affect, and possibly preclude, recreational activities.

- **Negative impacts on fish spawning at lowered reservoirs.** Much of the viable spawning area in reservoirs exists near the higher average surface levels. The curtailment of water supplies resulting from the EPA standards may force agencies to draw the levels of reservoirs down, thus keeping fish away from the present, more viable spawning areas.

In addition to the above direct effects, numerous other indirect effects could occur as a consequence of the responses of Bay-Delta users to curtailed supplies, particularly the development of new water supplies to offset the reduced Delta exports, including the following:

- Increased groundwater extractions
- Construction of bedrock wells
- Construction of new local stream diversion and dam projects
- Cloud seeding and watershed management
- Artificial and/or enhanced recharge
- Construction of desalination plants

The time to develop these new supplies would vary according to the nature of the source. For example, increased pumping and installation of new wells for additional groundwater extractions could occur immediately, while new local stream diversions would require years. Regardless of the timing of these new supply projects, most of them would involve impacts to the physical environment, and in some cases, potentially significant impacts.

In summary, the EPA standards as proposed would cause reduction in the amount of imported water available for "direct" use in groundwater replenishment and storage, surface storage, and clean-up of contaminated basins. The "indirect" effects listed directly above result from the need to develop supplemental supplies to compensate for the reductions caused by the proposed standards. Space limitations prevent this document from discussing these indirect effects in more detail.

4.0 GROUNDWATER IMPACTS

Reductions in SWP deliveries to urban water users would cause significant impacts to groundwater resources in most SWP service areas as described in Section 3.0. The following subsections elaborate upon the groundwater resources and programs that would be affected by water supply reductions from the proposed standards.

4.1 Groundwater Replenishment and Conjunctive-Use Programs

Groundwater is an important water supply for all Bay-Delta watershed users, particularly for Metropolitan, where groundwater accounts for about 90 percent of the local supplies in the service area. Groundwater aquifers provide water storage necessary to meet seasonal, drought, and emergency demands. Dependable annual groundwater supplies (defined as dry-year supplies) in the Metropolitan service area are estimated at 1.06 MAF and are derived from the following basins or regional basin systems:

- Ventura County Basins
- Upper Los Angeles River Area Basin
- Raymond Basin
- Main San Gabriel and Puente Basins
- Claremont Heights, Live Oak, Pomona, and Spadra Basins
- Santa Monica, Central, and West Coast Basins
- Orange County Basins
- Riverside County Basins
- Chino Basins
- Coastal San Diego Basins

Percolation of rainfall and stream runoff naturally replenishes groundwater basins in the Metropolitan service area. Some runoff is retained temporarily in flood control basins for later release to downstream recharge areas. Programs for the replenishment of groundwater, an essential element in maintaining long-term productivity of basins in Southern California, are described below. Metropolitan operates a variety of groundwater replenishment programs to assist in the management of local groundwater basins to meet demands, maintain water quality, avoid overdraft, and remediate contamination. These programs consist of either direct replenishment (i.e., injection or artificial recharge by spreading) or in-lieu replenishment of imported water into the basins. Under in-lieu replenishment, local member agencies curtail groundwater pumping or surface water withdrawal in the fall, winter, and spring, and instead, utilize imported water provided by Metropolitan. The local agencies would then extract their groundwater supplies as necessary in the summer months, when imports from Metropolitan are least available.

Since 1974, the average annual replenishment of groundwater basins by Metropolitan has been 275,000 acre-feet, with a range of 125,000 to 442,000 acre-feet. This replenishment supply, in addition to the local surface runoff and recharge with reclaimed wastewater, has maintained an average annual groundwater production in the Metropolitan service area of about 1.4 MAF per year.

Metropolitan's major replenishment program is the Seasonal Storage Program which provides economic incentives to member agencies to purchase imported water from Metropolitan during winter months for storage in local groundwater basins. The objectives of the program are to make more efficient use of imported and local supplies, encourage construction of local groundwater production facilities, and reduce the member agencies' dependence on Metropolitan during peak summer months. Under this program, local groundwater and surface water storage also can serve as: (1) emergency resources for unplanned outages; (2) carryover storage for drought years; and (3) peak seasonal demands.

Replenishment and conjunctive use programs by Metropolitan include the following:

- <u>Chino Basin Conjunctive-Use Program.</u> In 1990, a total of 28,725 acre-feet of storage was made available to Metropolitan in the Chino Basin in exchange for delivery of an equal amount of imported water to the Ontario and Cucamonga Water Districts. By the end of 1990, Metropolitan had accumulated about 48,000 acre-feet through the exchange agreements with these local water agencies. Metropolitan is currently planning a larger conjunctive-use program in the basin for drought-year supply and emergency reserves.

- North Las Posas Basin Conjunctive-Use Project. Metropolitan and Calleguas Municipal Water District are planning an extensive conjunctive-use program in the North Las Posas Basin in eastern Ventura County. Up to 350,000 acre-feet of storage capacity is available in this overdrafted basin for emergency and dry-year purposes. SWP water would be conveyed to the basin through the proposed West Valley Project pipeline.

- Whitewater River Spreading Basin. Exchange and advance delivery agreements with the Desert Water Agency and Coachella Valley Water District allow Metropolitan to store at least 600,000 acre-feet of imported water through use of the Whitewater River Spreading Basins. Metropolitan exchanges its Colorado River water for use of these local agencies' SWP entitlements.

- Arvin-Edison Water Exchange Program. Metropolitan and Arvin-Edison Water Storage District are developing a cooperative water banking project in the southern San Joaquin Valley. Metropolitan would deliver a portion of its SWP water in wet years to Arvin-Edison for groundwater replenishment. In return, Metropolitan would receive some of Arvin-Edison's CVP water during dry years. Up to 800,000 acre-feet could be stored during wet years, and up to 100,000 acre-feet could be delivered to Metropolitan during dry years.

- Semitropic Groundwater Banking Project. Metropolitan and Semitropic Water Storage District are developing a conjunctive-use program in the southern San Joaquin Valley that is one of seven elements of DWR's Kern Water Bank. The project would allow delivery of a portion of Metropolitan's SWP water to Semitropic for groundwater replenishment. Metropolitan would then extract the stored water when SWP deliveries were limited. This program would assist in correcting severe overdraft conditions at Semitropic and provide a drought buffer for Metropolitan. Demonstration projects in 1990 and 1993 involved storage of 100,000 and 48,000 acre-feet of SWP water on behalf of DWR and Metropolitan, respectively.

- San Gabriel Basin Conjunctive-Use Program. Metropolitan has two contracts with the Main San Gabriel Basin Watermaster for cyclic storage of up to 167,000 acre-feet of SWP water for subsequent transfer to the Upper San Gabriel Valley Municipal Water District and Three Valleys Municipal Water District. Currently, Metropolitan is engaged in discussions to increase the amount of storage available through this program.

All of the replenishment programs described above rely substantially on the availability of SWP water to Metropolitan.

4.2 Seawater Barrier Projects

Most coastal basins exhibit varying degrees of water quality degradation due to seawater intrusion. There are several major seawater barrier projects in the Metropolitan service area in which imported water is injected to protect the basin from intrusion. These programs are listed below with the annual requirements for imported water:

Basin	Project	Annual Replenishment (10-year avg)
West Basin	West Coast Barrier	25,200 acre-feet
West Basin	Dominguez Gap Barrier	6,000 acre-feet
Central Basin & Orange County Basins	Alamitos Barrier	5,400 acre-feet

For these basins, the delivery of 36,000 acre-feet of SWP water annually ensures the annual combined groundwater production of these basins of 510,000 acre-feet per year.

The Alameda County Water District has successfully protected important groundwater supplies in their service area through a seawater barrier project. Historically, saline water from the San Francisco Bay has entered the water-bearing aquifers of the Niles Cone groundwater basin. To reverse this trend that began in the 1920s, the Alameda County Water District has delivered local runoff from Alameda Creek to storage basins for recharge. However, the local supply has been insufficient to reverse the water quality degradation in the basin due to seawater intrusion. Hence, the District uses high-quality SWP water to recharge the basin and maintain a positive gradient towards the bay and prevent seawater intrusion.

Therefore, the availability of Delta exports is crucial to maintain important seawater barrier projects.

4.3 Groundwater-Recovery Programs

Many groundwater basins within the service areas of urban water users are unusable because of mineral or organic degradation. In particular, the current dependable groundwater supplies in the Metropolitan service area are threatened by spreading of mineral and organic constituents. In 1987, it was estimated that about 80,000 acre-feet of annual groundwater production had been lost to high mineral and organic concentrations. This shortfall is met through increased deliveries of imported SWP water.

Metropolitan's Groundwater-Recovery Program was developed to encourage member agencies to recover and treat contaminated groundwater to optimize the use of local supplies and avoid significant degradation of affected basins. Under this program, Metropolitan promotes the development of treatment and remediation plans for localized areas of individual basins by offering financial incentives to its member agencies for recovering and treating contaminated supplies.

Projects currently approved under Metropolitan's Groundwater Recovery Program will result in the recovery of 15,200 acre-feet of contaminated groundwater when fully operational in a few years. In the year 2000, the Groundwater Recovery Program is expected to make available 200,000 acre-feet of groundwater annually, of which approximately 100,000 acre-feet will be recovered local supply. Therefore, meeting the goal will require approximately 100,000 acre-feet of additional replenishment from imported and reclaimed water sources.

One of the most ambitious groundwater remediation programs is currently being developed by Metropolitan and others for a portion of the San Gabriel Basin. The groundwater in the Baldwin Park area is severely contaminated by nitrates and organic compounds, and has been designated a Superfund Site by the EPA. The EPA has recently issued a draft feasibility study for clean-up options for the Baldwin Park Operational Unit which identified methods to extract and treat contaminated groundwater. Metropolitan is developing a groundwater extraction and replenishment program that would complement the EPA's clean-up efforts. The Metropolitan program would involve extraction and treatment of contaminated water that would then be delivered for urban uses. The basin would be recharged with imported high-quality SWP water, thereby facilitating the removal of contaminated water. At the conclusion of the program, the basin could provide up to 500,000 acre-feet of storage for emergency use and in dry years.

Metropolitan is operating other groundwater-recovery programs with the City of Oceanside, City of Tustin, City of Santa Monica, Irvine Ranch Water District, and West Basin Municipal Water District.

The reduced availability of imported water that might result from proposed EPA standards would significantly impede these programs, which are crucial to sustaining the viability of the region's groundwater resources.

4.4 Land Subsidence from Overdrafting

Excessive groundwater pumping from unconsolidated aquifer-aquitard systems in urban service areas that would occur in the absence of replenishment programs could cause another undesirable environmental impact: land subsidence. In addition to permanent compaction and its impact on recharge capabilities, land subsidence could cause differential subsidence resulting in costly and in some cases irreparable damages to: (1) existing wells; (2) structures and roadways; and (3) utility lines, such as gas and water lines.

There are documented cases of land subsidence caused by groundwater withdrawal in Southern California, including portions of San Bernardino, Riverside, and Los Angeles counties. In the Temecula and Murrieta areas of Riverside County, surface fissures have led to structural damage in recent developments. In these areas, large fissures have grown along two or more active fault traces due to excessive groundwater pumping. The fault traces are considered to be zones of less structurally sound soil which are more prone to collapse from excessive groundwater pumping.

Land subsidence has occurred in the San Jacinto Valley of Riverside County where groundwater levels have declined throughout much of the valley, largely as a result of pumping overdraft. Artesian heads which were as much as 25 feet above the ground surface in the early 1930's declined to more than 200 feet below ground by the early 1970's. Concurrent widespread land subsidence occurred in many areas. Areas of differential settlement and earth fissures developed in numerous localities in the valley, and permanent aquifer compaction appears to have occurred.

In the Lancaster and Edwards Air Force Base areas of Los Angeles County, land subsidence and the resultant surface fissuring have been documented since the 1970's. Subsidence of more than four feet in the Antelope Valley just east of Lancaster was recorded from 1955 to 1976. Ongoing studies of subsidence by the U.S. Geological Survey in the Edwards Air Force Base area show subsidence of 3.1 to 4 feet between 1961 and 1990.

Between 1925 and 1977, 5,200 square miles of the San Joaquin Valley floor subsided between one to thirty feet. Bridges and roads cracked and sank, one canal dropped as much as eight feet, agricultural irrigation grades and slopes of natural streams were changed, and at least 1,200 wells were damaged. Ground surface fissuring, surface faulting, and related ground subsidence in the southern San Joaquin Valley have been attributed to groundwater withdrawal. Experts estimate that 16 MAF of aquifer storage space has been permanently lost in the San Joaquin Valley due to permanent aquifer compaction.

Overpumping of the groundwater basins in northern Santa Clara County caused serious land subsidence in excess of 13 feet prior to the importation of SWP and CVP water supplies. A recharge program was initiated in the 1930s to alleviate the subsidence. However, subsidence continued until 1968, shortly after the delivery of SWP supplies to the area. The Santa Clara County Water District operates an extensive recharge program using SWP water to prevent future subsidence.

5.0 REDUCED WATER RECLAMATION

Wastewater has been reclaimed and reused in the service areas of the urban water users for many years in an effort to maximize the yield of local sources and the beneficial use of imported supplies. Southern California now accounts for the largest portion of urban water reclamation and reuse in California. At present, the use of reclaimed water is limited by state health regulations to non-potable uses and indirect potable use through groundwater replenishment.

Groundwater replenishment using reclaimed water is carried out by the controlled percolation of reclaimed water into spreading basins, as well as by the high-pressure injection of reclaimed water to protect against seawater intrusion. Direct use of reclaimed water is also practiced, where the reclaimed water is conveyed in separate or "dual" piping systems to parks, golf courses, and businesses for limited forms of irrigation, industrial, and power-plant cooling purposes.

Wastewater reuse and groundwater recovery are integral components of Southern California's water supplies. In 1981, Metropolitan initiated the Local Projects Program to provide financial support for local agencies to develop viable water reclamation and other supply projects to replace deliveries from Metropolitan.

Through the continued support of this program, the annual yield from wastewater reclamation and reuse projects in Metropolitan's service area is expected to increase from 402,000 acre-feet in 1992 to approximately 680,000 acre-feet by 2010. This projected increase in local supplies will reduce the need for imported water to meet projected demands.

However, the expanded practice of wastewater reclamation and reuse is contingent upon the availability of source waters with relatively low TDS concentrations. Without the blending of sufficient supplies of low-TDS SWP water with relatively high-TDS water from other sources, many of the existing and potential water reclamation projects in the Metropolitan service area may be unable to meet the minimum water quality requirements necessary for discharges and use of reclaimed water.

For example, Metropolitan imports Colorado River water with a TDS concentration of 600 to 750 mg/l. Because the TDS levels of this water after reclamation reach about 900 to 1050 mg/l, it is of only marginal quality for agricultural and groundwater recharge uses. In comparison, TDS levels in SWP water averages approximately 250 mg/l under normal flow conditions. Reclaimed SWP water has sufficiently low TDS levels to permit a wider variety of uses including irrigation of avocado and citrus crops.

Therefore, maintaining a necessary amount of Delta exports is vital to continue the progress currently being made in the field of water reclamation.

6.0 CONFLICTS WITH EXISTING REGIONAL WATER QUALITY PLANS

As noted above, reducing imported water supplies might result in the degradation of groundwater supplies and quality, which could generate conflicts with basin plans prepared by the State's regional water quality control boards, as described below.

Water Quality Control Plans for regional basins contain water quality objectives designed to protect the beneficial uses of groundwater and surface water. The overriding water quality objective for most basins is the non-degradation of existing water quality, such that wherever the existing quality of water is better than the established Plan objectives, the existing quality shall be maintained. The Plans also contain various specific water quality objectives for characteristics such as taste, odor, bacteria, and chemical constituents. These objectives often relate directly to state drinking-water standards.

The Basin Plans also acknowledge and support various water resource management efforts and programs. For example, the Los Angeles Basin Plan calls for an increase in SWP water and a decrease in Colorado River water to avoid additional water quality degradation in the basin. The

Plan also supports increased levels of water reclamation, which can occur only if high-quality SWP water is available.

The Santa Ana Basin Plan contains a groundwater-management element with specific goals to reduce groundwater quality degradation by various efforts, including use of additional imported SWP water for recharge of degraded basins, minimizing recharge with poor quality reclaimed water, reducing agricultural cycling of high-salinity water from the Colorado River, additional dilution of wastewater discharges to minimize health effects, and specific groundwater remediation and management objectives for the Chino Basin.

Urban water supplies in the Santa Ana Basin include local sources and imported Colorado River water and SWP water. The high mineral content of the Colorado River water limits its reuse in the region. The Water Quality Control Plan for the Santa Ana region indicates that the build-up of dissolved minerals in the ground and surface waters is the most serious water quality problem in the region. According to the Plan, importation of high quality SWP water is essential in controlling TDS levels because the low-TDS SWP water allows maximum reuse of water supplies without aggravating mineralization. SWP water is also used for recharge and replenishment to improve the quality of local water supply sources which might otherwise be unusable. The Plans call for importing approximately 192,600 acre-feet/year by the year 2000 for use in the upper Santa Ana Basin.

Water from the SWP is also critical in achieving water quality objectives specified by the Regional Water Quality Control Board in the San Diego Basin, where 90 percent of the urban water supplies are met by SWP and Colorado River water. The high-TDS levels of Colorado River water limit the use of reclaimed water in the area for most agricultural and landscaping uses, and for groundwater discharge. Blending the better-quality SWP water with Colorado River water facilitates the meeting of drinking water quality standards and wastewater reclamation discharge limitations.

The San Diego Basin Plan identifies opportunities for conjunctive-use programs in which poor quality groundwater is replaced with better quality water. The Plan calls for pumping poor quality groundwater from selected basins to the ocean, and recharging the basins with reclaimed and natural runoff. This water could later be extracted for beneficial uses when water quality objectives are met. Because ninety percent of the potable water supply, which would ultimately provide the primary reclaimed water supply for these programs, comes from the Colorado River and the SWP, blending SWP water with Colorado River water is necessary for the wastewater-reclamation discharge limits to be met.

The San Diego Basin Plan also identifies a need to use reclaimed water in ephemeral surface streams to enhance beneficial uses of the streams, including in-stream habitat and recreational uses.

Reductions in water supplies diverted from the Delta to the above three regions could significantly compromise the ability to meet the water quality standards, objectives, reclamation goals and recharge programs set forth in the Water Quality Control Plans.

At this time, the following basins in the Metropolitan service area are adjudicated and under the management of a court-appointed watermaster: Raymond Basin, Central Basin, West Coast Basin, Main San Gabriel Basin, Upper Los Angeles River System, and Chino Basin. All of these basins have groundwater-replenishment programs using imported water, either directly through spreading or through participation in Metropolitan's in-lieu programs. The curtailment of these replenishment programs due to reduced SWP deliveries could jeopardize the integrity of these basins, and could also represent a conflict with an approved plan developed in the judicial system.

7.0 IMPACTS ON HABITAT

Reduced imported water supplies to the urban water users' service areas is expected to cause a reduction in water use, which in turn could result in a decrease in the amount of:

1. Runoff from urban and agricultural users into natural and man-made watercourses;

2. Discharge from wastewater treatment (reclamation) plants into spreading ponds or watercourses; and,

3. Groundwater recharge programs that involve spreading basins.

Water from runoff and discharge percolates into the groundwater basins and provides an important source for recharge. In addition, this water may create or support wetland and riparian habitats by: (1) establishing live streams, particularly immediately downstream of wastewater-treatment discharge points; and (2) creating prolonged soil moisture in the upper soils in spreading basins, natural creeks, and man-made flood control channels that supports the growth of wetland and riparian plants such as cattails and willows. These types of habitat are highly valuable for wildlife because they support a wide variety and abundance of fish, insects, invertebrates, birds, amphibians, and mammals. Wetland and riparian habitats are particularly important to wildlife in Southern California due to the arid nature of most of the region.

The Santa Ana River and Prado Basin in Orange and Riverside counties provide an example of the importance of runoff from urban and agricultural areas and the discharge of treated effluent in creating and maintaining significant wetland habitat. Prado Basin is a major flood-control facility along the Santa Ana River, and impounds water during the winter for flood control. As a consequence of this temporary impoundment, extensive wetland habitat has been created in the 9000-acre basin. There is a tremendous abundance and diversity of wildlife in the basin, including migratory waterfowl, raptors, large mammals, spring-breeding birds, and the endangered least Bell's Vireo.

There are numerous wastewater treatment plants in the Santa Ana River watershed above Prado Basin which discharge year-round into the river and its tributaries. In addition, the watershed has changed from a predominately agricultural area to a highly urbanized area with substantial urban runoff. At this time, the summer base flow in the Santa Ana River at Prado Basin is due entirely to discharges from the upstream wastewater treatment plants. This artificial runoff in the river creates wetland conditions in Prado Basin by increasing the duration and amount of surface water and increasing soil moisture available to plants through rising groundwater.

The reduction in the delivery of imported water to the region could result in lower levels of runoff and wastewater discharge. Natural and man-made wetland habitats reliant on this runoff could be adversely affected because: (1) live streams may be precluded; (2) insufficient runoff could be available to saturate the upper soils to support wetland vegetation; and (3) significant wetland habitat dependent on this runoff could be degraded and possible destroyed as groundwater elevations dropped. Based on these considerations, it appears that substantial reduction of SWP water could adversely affect habitat for fish, wildlife, and plants.

Any degradation of wetland habitats is likely to adversely affect threatened, endangered, or other sensitive species due to their relative high probability of occurring in wetland habitats. These species may include the red-legged frog, tidewater goby, the least Bell's vireo, willow flycatcher, tri-colored blackbird, yellow-billed cuckoo, and western pond turtle. The potential degradation of wetland habitat and any resident endangered species might be considered a significant impact and potential conflict with the state and federal endangered species acts.

8.0 IMPACTS ON RECREATIONAL OPPORTUNITIES

Recreational opportunities related to Delta exports to urban water users are available in two ways: (1) recreational facilities that are part of the SWP conveyance and storage facilities; and (2) recreational opportunities that are available as a consequence of the use of exported water. Recreation at the SWP facilities include camping, boating, fishing, swimming, sailing, windsurfing, bicycling, and other activities, and occur both at the reservoir sites and along the California Aqueduct. Recreational activities along the Aqueduct are primarily bicycling and fishing. SWP reservoirs containing recreational facilities include Antelope Lake, Lake Davis, Frenchman Lake, Lake Arrival, Lake Del Valley, Bethany Reservoir, San Luis Reservoir, O'Neill Forebay, Los Banos Reservoir, Pyramid Lake, Castaic Lake, Silverwood Lake, and Lake Perris. Annual attendance figures for the recreation facilities at these reservoirs ranges from 85,000 at the Bethany Reservoir to 1,500,000 at Lake Perris in northwestern Riverside County. Rivers downstream of some of these reservoir attract fishing, rafting, kayaking and floating, which depend on upstream releases from reservoirs.

Other recreational activities made possible by the availability of Delta exports include fishing, wildlife viewing, hiking and other activities along streams and impoundments used for groundwater recharge by SWP supplies. The availability of SWP water also enhances the recreational use and value of local water supply reservoirs. The availability of SWP water means that less demand is placed on local reservoirs for day-to-day water supply needs. Then, local facilities can satisfy both water supply and recreational demands.

Reductions in Delta exports could result in lower reservoir levels and greater fluctuations in water surface elevations, particularly during the summer when recreational demands are the highest.

Lower water levels and greater fluctuations in water surface elevations in these reservoirs could adversely affect, and possibly preclude, recreation activities and fish habitat.

Impacts could include distancing of facilities (e.g. hiking trails, picnic areas, campgrounds) from the lake surface due to receding water levels; boat-launching facilities and swimming areas may become unusable due to lack of water; boating and water skiing could be reduced due to reduced surface area and potential increased navigational hazards; the aesthetic values of the area could be reduced due to the effects of fluctuating water levels of lake shorelines; and increases in noxious aquatic plants and algal blooms as water depths become shallower would reduce recreational value and could impact the quality of the water for downstream potable use. In addition, receded water levels might destroy fish spawning grounds which lie near the current surface-lines.

Secondary recreational benefits provided by the availability of imported water supplies would also be significantly affected by reductions of these supplies. For example, the Alameda County Water District uses imported SWP water to prepare Alameda Creek for trout-stocking by the Department of Fish and Game. Drawing down of reservoirs due to import curtailments would hinder local programs for groundwater recharge. The public recreational benefits associated with these facilities and operations would correspondingly diminish.

9.0 CONCLUSIONS

The proposed EPA water quality standards and USFWS critical habitat designation would reduce exports from the Bay-Delta watershed. A reduction in water supplies to urban water users would result in various direct and indirect environmental impacts. Most of these impacts would be associated with the curtailment of groundwater replenishment, conjunctive use, and clean-up programs. Other significant impacts include impairment of efforts to meet regional water quality control plans, reduction in opportunities for future wastewater reclamation, reduction in water supporting wetlands and instream flows in the service areas, reduction in drinking water quality, and reduction in recreational benefits. These adverse environmental impacts would affect a variety of environmental resources outside the Bay-Delta. Most of these impacts are considered long-term and significant. These impacts were not considered in the RIA prepared for the proposed federal actions. Hence, EPA should revise the RIA to include economic impacts of environmental damage in the urban water users' service areas. These environmental impacts should be considered by EPA in the determination of final water quality standards.

APPENDIX 3

Review of Economic Aspects of "Draft Regulatory Impact Assessment of The Proposed Water Quality Standards For the San Francisco Bay/Delta and Critical Habitat Requirements for the Delta Smelt"

Prepared for

Metropolitan Water District of Southern California

By

Wendy Illingworth

Foster Associates, Inc.
120 Montgomery Street, Ste. 1776
San Francisco, CA 94104
415-391-3558

Review of Economic Aspects of "Draft Regulatory Impact Assessment of the Proposed Water Quality Standards for the San Francisco Bay/Delta and Critical Habitat Requirements for the Delta Smelt"

by

Foster Associates

Executive Summary

The Delta is an important ecological resource. It is also a vital link in the State's water supply. Water from the Delta is a necessary ingredient to California's economy. In 1990, the California economy produced more than $730 billion in economic output, and employed over 14 million workers. The major part of this economy is in areas served by projects which transport water from the San Joaquin and Sacramento River watersheds. Much of the water supplied to urban users is diverted at the Delta. These users will be doubly impacted, both by restrictions on diversions and by restrictions on operations within the Delta. These double impacts may interact in ways which exacerbate the total economic impact. For example, the water transfers needed to mitigate for the proposed water quality standards may be prevented by habitat and ESA restrictions in the Delta. This interaction of existing and proposed standards must be examined carefully.

The Draft Regulatory Impact Analysis (Draft RIA) issued by the consortium of federal agencies is aimed at estimating the economic impact of proposed water quality standards within the Delta. Given the importance of the Delta to California's economy, it is necessary to protect the habitat within the Delta in ways which minimize, to the extent possible, the negative economic impacts from these standards. There are seven key issues that can be identified when estimating the economic impact of the proposed water quality standards. These are:

1. The time-frame considered in the analysis;
2. The level of water demands assumed;
3. The level of water supplies prior to the regulations;
4. The level of water supply reductions projected to result from the proposed standards;
5. The allocation of these water supply reductions;
6. The availability and cost of alternate supplies and management options; and,
7. The cost of any shortages resulting from the water supply reductions which cannot be mitigated by the use of alternative supplies or management options.

The Draft RIA does not address all of these issues, and those it does address are treated in an incomplete and incorrect manner. In particular, the Draft RIA fails to recognize the amount by which exports from the Delta watershed have already been restricted. When the most obvious corrections are made, yet maintaining the RIA's stated assumptions, the cost estimates increase dramatically. These increased costs are shown in Table 1, below:

TABLE 1 Comparison of RIA and Corrected Results Annual Average Costs (1990 thousands)		
End-use and Scenario	RIA Result	Corrected
<u>Urban</u> Scenario 1	$78,920	$116,540
Scenario 2	$49,920	$101,345
<u>Agricultural</u> Scenario 2	$20,000	$29,000
Scenario 3	$8,000	$19,000

Results for Scenario 1 of the agricultural sector are not presented above, because it appears to be an estimate of the impacts from the Central Valley Project Improvement Act (CVPIA), rather than the impacts of the proposed standards. When other alternatives are considered, such as the need to maintain a "margin of safety" to ensure compliance with the proposed standards, or a need to go to more expensive sources of water, the estimated economic impacts are even greater. More importantly, there is a wide range of uncertainty which requires more-extensive sensitivity analyses than have been performed to date.

The major problems with the RIA analysis are summarized below.

- The analysis as presented in the Draft RIA is poorly documented, so that the reviewer is reduced to inferring the analytic steps taken. There appear to be internal inconsistencies which invalidate the analysis as it is presented in the Draft RIA.

- The analysis appears to confuse near-term and longer-term impacts. For example, it appears to assume no growth in demand, and assumes that shortages can be mitigated by reclamation plants which have yet to be constructed. Both near-term and longer-term scenarios should be separately identified, and the impacts of each should be explored.

- The Draft RIA has failed to demonstrate that its proposed alternative water supplies to mitigate the effect of the proposed standards (reclamation and transfers) are, in fact, achievable. If they are not, the cost of the proposed standards increases dramatically, to as much as $700 million in critically-dry years. The RIA should address the likelihood of the alternatives being available, and unless it can demonstrate conclusively that this is the case, present a scenario in which the alternatives are not available.

- The Draft RIA presents estimates of water demand for three time periods: 1990, 2000 and 2010. However, there is no obvious linkage between these forecasts and the level of demand used in the RIA analysis. Indeed, the RIA does not identify the demand level used in the analysis. The level of costs are likely to be strongly influenced by the level of demand assumed. The analysis should have identified and used different demand levels appropriate to the time-frame being examined.

- The base case water supplies are inadequately described, and appear incorrect. The RIA has implicitly overstated by 4 million acre-feet (MAF) the amount of water available to consumers during dry years. These reductions must be taken from the base case economic analysis before the impacts of the proposed standards can be estimated. In other than dry years, the overstatement is less extreme, but is still approximately 1 MAF. Dry-year effects are the most critical for determining economic impacts.

- The lack of description of water supplies in the base-case has led to "double counting" of land available for fallowing for transfers in response to the proposed standards. The RIA has assumed that land which would be fallowed under CVPIA restrictions would be available to be fallowed once more to meet the requirements of the proposed standards.

- In the near term, the confusion over water available in the base case economic analysis has the greatest effect on the estimation of impacts to the agricultural sector. When corrected, it is estimated that the annual change in producer's surplus will increase to a range of $19 to $29 million dollars from the $8 to $20 million dollar range presented by the RIA for Scenarios 2 and 3.

- The water supply impacts assumed to result from the proposed standards will vary according to the way the system is operated. The impacts resulting from maintenance of a buffer should be included as a sensitivity analysis. Inclusion of a "margin of safety," or buffer to ensure compliance with the proposed standards could increase urban economic impact estimates to over three to four times the estimates presented in the RIA.

- The Draft RIA's assumption that water diversion reduction resulting from the standards will be allocated between agricultural and urban users on an 80/20 ratio does not reflect the only possible outcome. Indeed, it may not reflect a likely outcome. Once again, a sensitivity analysis should be developed using allocations based on water rights, as opposed to those based on water use.

- The availability of water transfers to mitigate the effect of the proposed standards depends on the implementation of critical habitat rules and on "take" limitations at the Delta pumps. Transfers are not likely to be sufficient unless cross-Delta transfers are permitted and additional facilities are constructed in the Delta. Once again, a range of possible outcomes should be examined.

- Depending on the possibility of "Delta fix" options, the cost of obtaining alternative supplies from reclamation could be as high as $1,500 to $2,000 per acre-foot (AF). Without a "Delta fix", all low-cost waste-water reclamation plants in Southern California will likely be required to meet future base-line demand. Alternative potable water supplies to mitigate the effect of the proposed standards may be restricted to supplies from costly reverse osmosis and desalination facilities.

- A scenario with no "Delta fix" <u>or</u> system operations with a buffer results in an estimate of urban impacts which are three to five times greater than those estimated in the RIA.

- The timing of proposed additional reclamation plants has not been addressed. To construct the proposed additional level of reclamation capacity would require doubling the already-aggressive rate of proposed construction between now and the year 2000. No discussion is presented of the probability of this occurring, and no estimates are developed for the economic impact in years prior to the construction of these plants.

- Costs of both reclamation and shortages have been understated. Reclamation plant costs are assumed to be incurred only in some years, rather than in all years after plant construction. In addition, the shortage cost estimates are so poorly explained as to make adjustment or interpretation difficult. Making simple corrections to the RIA analysis results in a fifty to one hundred percent increase in estimates of urban costs over those reported in the RIA.

- The economic impacts of water shortages to industry are severe, and must be avoided. Long-term uncertainty concerning water supply reliability will also have a negative economic impact. Protecting industry exacerbates service area shortages to residential customers.

- Damage to urban employment and income has been overlooked. A study sponsored by the Green Industry Council and Metropolitan Water District of Southern California (MWD) estimates that in the 1991 drought year, water shortages cost the State a minimum of $54 million dollars in lost income and over 3,000 lost jobs in the Green Industry.

- The discussion of the effects of Critical Habitat Designation (CHD) is insufficient. It does not even mention what could be the major impacts of the CHD: its effect on future Delta water supply facilities, or maintenance of the shipping channels to the Ports of Stockton and Sacramento. If these major projects are restricted by the CHD, the economic impact could be huge, rather than the minimal impact reported in the RIA.

These major shortcomings are discussed in more detail in the body of this report.

1. The Time-Frame Considered in the Analysis

The Draft RIA should address both adjustment period (near-term) costs and longer-term costs from the proposed actions. If a water agency's supplies are already stressed, the near-term impacts during the adjustment period are likely to be much higher than costs in the longer-term. Many of the proposed alternative water-supply or water-management strategies such as conservation or reclamation will take years to be implemented. Reclamation plants need to be designed, permitted and constructed before they can be used. Therefore immediate options for response to the proposed standards will be limited to water transfers and mandatory shortages.

The extent of water transfers available in the near-term is not clear. The Drought Water Bank of 1991 indicates some availability of water transfers. However, in 1991 the City of San Francisco experienced system constraints which prevented it from obtaining all of the transfer water it had contracted to purchase. This indicates that physical limitations to transfers, at least to some parts of the Bay Area, have already been reached. In addition, institutional impediments to widespread water transfers still exist, and ESA "take" limitations and other existing and proposed regulations under the ESA are likely to further restrict the ability of water agencies to take delivery of transferred water. Therefore the adjustment-phase analysis should develop two alternatives, one involving a "drought bank" or transfers, and one assuming that the only response available in the short run is to incur supply shortages. This will reflect the range of uncertainty in the likely near-term impacts.

The longer-term case should include increased demands, but recognize that conservation and reclamation will be available to meet some of these demands. The longer-term case should also reflect the likely impact of CHD on new supply facilities in the Delta. All longer-term "base case" scenarios should include the BMPs, but the level of reclamation included in the base case will vary from region to region.

2. Level of Demand Assumed

While the Draft RIA presents urban water demand estimates for the years 1990, 2000, 2010 and 2020, there is no discussion of the level of demand used for determining economic impacts in the Draft RIA, or of the impact this assumption has on the results. Demand in the earlier years is less than in later years, which means that any given shortfall in water supply will be a higher percentage of total demand, and therefore have a greater impact on shortage costs. The Draft

RIA used a single value per acre-foot for shortages, which implies that this variation in shortage costs was not recognized in the analysis.

The Draft RIA uses an estimate of the welfare losses resulting from water shortages. "Welfare" is defined as "the economic well-being of those who live and work in the economy" (Leftwich, 1973, p. 10.) Therefore the welfare loss reflects the decrease in economic wellbeing arising from the increased water shortages to those who live and work in the economy. This welfare loss is reported in the Draft RIA to be equal to $1,600 per AF (or $1,612 as reported in Table 4-8). In fact, the level of shortage cost should vary according to the size of the shortage experienced. If the proposed standards impose a 10 percent shortage on an otherwise adequate system, the costs will clearly be different than if the same shortage is imposed on a system which is already experiencing recurrent shortages. It is not clear that this was recognized in the RIA analysis. There is no discussion of what level of demand or level of shortage resulted in the estimated welfare loss used in the RIA.

3. The Level of Water Supplies in the Base Case

An RIA must use a base case to reflect the "without regulations" scenario to compare to the "with regulations" scenario. The comparison to a base case is necessary to estimate the change in costs or economic activity which result from the regulations. The base case relied upon for the Draft RIA is incompletely described, and appears totally inadequate and inconsistently used.

There is no description of the water supply situation or level of agricultural production which is assumed to exist before the proposed regulations. Given the rapid changes in water supply regulation over the last few years, this is understandably difficult. However, these changes and the resulting uncertainty make it even more important to define clearly the base case which is used to determine the economic impacts. If the economic analysis in the RIA assumes that there is more water in the system than is truly available, the impact of reducing these supplies will be understated.

It is important, for example, that the base case agricultural production scenario be consistent with the base case water supply scenario. In the RIA analysis, there is no obvious linkage between the two situations. In fact, there is every reason to believe that the linkage is non-existent. The agricultural analysis is based on 1987 agricultural production data, which reflect a year when a plentiful supply of irrigation water was available. To develop a "base case" for agriculture, this data must first be adjusted to reflect changes which have occurred since then, such as the imposition of the CVPIA constraints on water supplies.

As the analysis is currently presented, it appears that the effect of the CVPIA is intended to be included in the base case because the CVPIA is assumed to supply 130 TAF towards meeting Delta water quality standards. In fact, as demonstrated in Table 2, data from 1987 and 1991 result in an estimate that approximately 700 to 880 TAF will be required over those allocated in previous years to meet the CVPIA requirements. However, in the RIA there is no discussion of the changes to agricultural production which will arise from <u>any</u> reduction in CVP deliveries as a result of the CVPIA. It appears that the "worst case" scenario, reflecting 800 TAF reduction to agriculture in the CVP delivery areas is, in fact, the nearest approximation to the base case for average years.

TABLE 2
Water Requirements of the
Central Valley Project Improvement Act
Thousand Acre Feet

Act requirements	Dry Year	Normal/Wet Year
Basic requirement	600	800
Trinity River/wetlands	500	500
Less historic deliveries to Trinity River/wetlands[1]	(408)	(420)
Total	692	880

[1] These are recorded deliveries for 1991 (dry year) and 1987 (wet/normal year.)

Source: USBR operations

The diversion restrictions to agricultural and urban users resulting from the winter-run salmon decisions should also be reflected in the base case. Agricultural production should be decreased, and transfers or shortages to urban users increased to reflect this change.

The restrictions from "take" limitations at the Delta should also be part of the base case. As yet no reliable method can estimate the limitations on transfers arising from these operational constraints, such as Delta smelt and winter-run "take" limitations arising from endangered species actions. State Department of Water Resources (DWR) staff have estimated the possible effects of these restrictions, and believe that the effect of the "take" limitations for winter-run salmon could be as high as 500 TAF in some years. These restrictions will affect pumping in February through April, which are normally high-flow months and have traditionally provided high delivery levels. The incremental impact from Delta smelt "take" limitations could be approximately 250 TAF per year. In addition, the uncertainty associated with "take" limitations will negatively affect agriculture. Farmers need to have early estimates of water availability to plan their planting and irrigation for the growing season ahead. Because of concerns over whether the pumps will be permitted to operate, these early estimates will be discounted to reflect this uncertainty. By the time it becomes clear what impact the "take" limits will have for the year's deliveries, planting decisions will have been made and implemented (Snow, private communication, 1994.) Thus, to develop an average year analysis, the base case should reflect at least 1 MAF reduction in agricultural water supplies and production from 1987 levels.

Because of the uncertainty associated with the restrictions on operations, a more-preferred approach would be to use a range of base-case water supplies. This will reflect the inherent uncertainty in the base case water supply situation. Only when the current conditions (prior to proposed standards) are fully reflected in the base-case can the effect of the proposed standards be modeled.

Some agricultural land will be fallowed and cropping patterns changed to meet these earlier restrictions on supply, and will no longer be available for fallowing for transfers as a result of the proposed standards. The cost of land-fallowing to meet the proposed standard will become higher if the least-cost options have already been used to meet the CVPIA requirements. As currently written, it appears that the Draft RIA allows the same water to be removed from agriculture twice: once to meet CVPIA requirements, and yet again to meet the water quality standards.

The amount of water lost to agricultural production as a result of the drought should also be more carefully chosen. Analysis of the 1991 experience shows that no agricultural deliveries were made to agriculture from the State Water Project (SWP), and very limited deliveries were made to CVP agricultural customers. In fact, as Table 3 demonstrates, in 1991 deliveries to agriculture were 3.3 MAF less than in 1987. In all, the economic analysis in the Draft RIA implicitly overstates the water available in the system during critically-dry years by approximately 4 MAF.

3.1 Water Transfers

The RIA analysis should also address the level of transfers required in the base case. Water planners throughout the State are relying on water transfers to ease future supply problems which were expected <u>before</u> the proposed regulations. The base case used for the RIA must include these water transfer requirements. Once again, if agricultural land will be fallowed to meet demand for transfers without the proposed standards, the same land cannot be assumed to be fallowed to mitigate the effects of the proposed standards.

Furthermore, before transfers can be assumed available to mitigate the effect of the proposed standards, some examination should be made of the constraints on transfers from conveyance capacity and existing or proposed regulatory limitations. Analysis performed by DWR for Bulletin 160-93 indicates that considerable transfer capacity is available to Southern California during normal years, but none to the San Francisco Bay area. In dry years there is greater capacity because of reduced project deliveries. However, previously planned transfers are also higher in these years.

During 1991, transfers were available to urban areas (with the partial exception of San Francisco.) Based on this experience, DWR assumed that approximately 600 TAF would be available for dry-year transfers (DWR, 1993, p. 305.) However, since that time additional water has been withdrawn from the system to meet CVPIA and winter-run salmon requirements. In dry years this extra water amounts to approximately 1.3 MAF. This should be expected to

Table 3
Reduction in Water Dlversions to Agriculture With and Without EPA Standards

Additional water required for:	(MAF) Dry Year (1991)	Wet Year (1987)
CVPIA	0.692	0.880
Winter–run	0.526	0.133
Drought reductions to agriculture[2]	3.275	0.000
Drought reductions to others	0.650	0.000
Total change in water deliveries from 1987 experience		
W/o EPA Standards	5.143	1.013
W/EPA standards	6.243	1.613
Total change in water deliveries to agriculture from 1987 experience		
W/o EPA Standards	4.388	0.986
W/EPA standards	5.268	1.466

Used by RIA:	(MAF) Dry Year	Wet Year
W/o EPA Standards	1.000	0.000
W/EPA standards	2.100	0.600
Difference between water assumed in RIA economic analysis and likely reductions	4.143	1.013

[1] The reduction in agricultural deliveries from 1987 to 1991.

	1987	1991	Difference
CVP	6.078	3.824	2.254
SWP	1.034	0.012	1.021
Total	7.112	3.836	3.275

Sources: DWR, USBR public information offices.

reduce the amount of water available for transfers.

In addition, further restrictions have been placed on Delta pumping operations because of requirements concerning reverse flows and "take" limitations resulting from listing of the Delta smelt and winter-run salmon as endangered species. These limitations were not considered in the Bulletin 160 analysis, and will limit the ability of the system to transport any likely transfers which are available.

Ignoring the effects of "take" limitations, the DWR estimate would suggest that sufficient remaining capacity exists for transfers to be used to the extent they can be obtained. However, with many agencies searching for transfers to meet base-case requirements, there may be limited amounts of transfer water available. The level of required transfers in the longer-term base case is difficult to determine, and depends largely on the assumption of whether a "Delta fix" is possible. For example, planners at Metropolitan Water District of Southern California believe that some form of facilities improvement in the Delta will allow maintenance of the Delta habitat while firming Delta water exports. If this belief is fulfilled, the long-term effects of the proposed standards are likely to be somewhat mitigated by the availability of transfers. MWD planners believe that with a "Delta fix" assumption, by the year 2020 the base case level of transfers through the SWP to MWD will be approximately 400 to 500 TAF in dry years. It should be stressed that this is a preliminary estimate, and has not been reviewed through the Integrated Resource Planning process currently being conducted by MWD (Rodrigo, personal communication, 1994.) Other agencies are planning to obtain between 150 and 200 TAF of transfers (Agencies, personal communication, 1994.) This will come close to exhausting the level of transfers identified in Bulletin 160-93 as likely to be available for transfers. Transfers are even less likely to be available to mitigate the effects of these proposals if cross-Delta transfers are limited.

However, it is not clear that the "Delta fix" is possible -- it may be ruled out by the Critical Habitat Designation (CHD) that is part of this RIA. If the new facilities cannot be built, planners expect that they would require more transfer capacity than is currently available to meet "base-case" conditions. In this case, the cost of the proposed standards would not be mitigated by transfers, and would likely consist largely of increased shortages during all year-types, or reliance on expensive reverse osmosis or desalination facilities. In any case, the cost would likely be in the range of $1,500 to $2,000 per AF. The range of possible long-term costs to the urban economy is therefore very great, and depends largely on issues associated with the CHD which have not been addressed as part of the CHD analysis.

This discussion indicates that the analysis which the Draft RIA describes as Scenario 3, where all shortages are assumed to be made up from water transfers, is optimistic, particularly in later years. The higher-cost options of Scenarios 1 and 2 are more likely to reflect the lower-bound impacts of the proposed standards.

4. Level of Water Supply Reductions from the Proposed Standards

The Draft RIA assumes an estimated level of water supply reductions equal to 540 TAF in normal years and 1.1 MAF in dry years. Other hydrologic studies (DWR, 1994) suggest that the range of possible water supply reductions for the combined winter-run salmon and these proposed standards could be as high as 1.1 MAF in average years to 3 MAF in dry years if operators maintain a "margin of safety" to ensure compliance with the proposed standards. Given this large range of uncertainty, a sensitivity analysis appears to be required to determine the possible range of economic impacts.

To determine the economic impacts of the proposed rule, reductions in water supply resulting from the proposed standards must also be considered in the context of other reductions in supply which should be explicitly included in the base case. The economic analysis within the RIA appears to assume implicitly that the only change to water supplies in the years since 1987 are the proposed standards. The analysis must recognize that the proposed reductions are taking place at the same time as other actions are affecting water supplies from the Delta. The Draft RIA cannot rely on actions to reduce the economic impacts of the proposed standards if these actions will already be required absent the standards (for example, to meet demand growth, or as a result of CVPIA.)

5. The Allocation of Water Supply Reductions

Once an estimate of the water supply reductions has been determined, assumptions concerning the allocation of these reductions will be necessary. Federal agencies do not have control over water allocation issues. Rather, water allocation issues fall under the State of California's water rights authority. However, to estimate the level of economic impacts of the proposed regulations, assumptions must be made. The Draft RIA assumes that 80 percent of the reduction in water supplies will affect agricultural users, while 20 percent will affect urban interests. This assumption likely underestimates the impact on urban water users. Without the results of water rights proceedings, a better assumption is difficult to propose to replace the assumption used in RIA, and so this was adopted in our analysis.

However, it must be recognized that urban impacts could be larger than this. To the extent that EPA can develop alternative allocation scenarios based on information from the Bureau of Reclamation and the Department of Water Resources, we urge them to do so. This is another area of the analysis where the uncertainty is such that a sensitivity analysis would be preferred.

6. Alternative Water Supplies

Prior to consideration of urban sector economic impacts resulting from the proposed standards, the Draft RIA makes reference to baseline conditions for urban water agencies. However, while the presented baseline conditions include current and future demands for water and costs of water per acre-foot (AF), there is no consideration of the existing plans for future water supplies. An analysis cannot be made of the added cost of alternative water supplies, or indeed what alternatives are possible, without an understanding of the underlying base-line conditions.

The Draft RIA assumes that any additional supplies will be obtained from water transfers and reclamation projects. To the extent that water supply reductions resulting from the proposed regulations can be replaced by alternative supplies, the economic cost of the standards will be equal to the increased cost associated with the alternative supplies. However, the Draft RIA does not closely examine the viability of these options as alternative water supplies. These options are already a major part of urban water agencies' existing plans for future supplies, and it is necessary to reflect the incremental nature of the additional supplies required to mitigate the water supply reductions arising from the proposed federal standards.

6.1 Water Transfers

As discussed earlier, it has not been clearly demonstrated to what extent transfers will be available to mitigate the effect of the proposed water quality standards. In the short run, the absence of a working water market will limit the amount of water transfers available. Constraints in the Delta, including "take" and reverse-flow limitations may also restrict the capacity available for transfers.

Availability of transfers in the longer term is more problematic. Absent a "Delta fix", it is difficult to determine whether transfer capacity will be available in sufficient quantity to mitigate the proposed standards. Even with additional facilities in the Delta, availability may be limited because of current plans to rely on Delta transfers to meet future water demands.

The price paid for any transfers achieved should at least equal the cost to MWD of the transfers from the Areias Dairy Farms. This contract identifies amounts and frequencies of water transfers over a fifteen-year period, and is one of the first long-term transfers to be developed. Therefore it is the most reasonable basis to project future water transfer contracts. If and when expanded water markets develop, prices may increase or decrease from this level, but at this time the direction of change cannot be foretold. When payments to the Dairy are added to environmental mitigation charges, the cost of this transfer will approximate $200 per AF, plus pumping charges. If restrictions in the Delta mean that transfers are constrained to be between water users south of the Delta, transfer costs could be expected to increase. The assumption of higher cost dry-year transfers as proposed in the Draft RIA also appears reasonable.

6.2 Water Reclamation

The Draft RIA recognized that the less-expensive options for reclamation will be developed by the urban water agencies without the proposed standards. The authors therefore suggested that the cost of future reclamation projects should be taken from the upper level of those currently under consideration. This assumption is reasonable. Future reclamation projects should be available in Southern California at an approximate cost of $705 per AF. Costs in other areas may be higher, due to local constraints on specific projects, or lack of a market for non-potable supplies.

However, the availability of reclamation is subject to question. MWD's service area is already water-short, and has embarked on an aggressive program of water reclamation to overcome this problem. It also plans to rely heavily on reclamation to meet future growth requirements. There must be some doubt as to when and if an additional 200 TAF of water reclamation capacity will be constructed. According to DWR, (DWR 1993, p. 321) approximately 220 TAF of fresh water will be displaced by new reclamation plants by the year 2000. Therefore, in order to meet the assumptions of Scenarios 1 and 2 by that time, the already-aggressive reclamation program will need to be doubled. The DWR report also states that in fact, reclamation plant construction has been slowed by the recession and budget constraints.

The Draft RIA analysis was in error in assuming that the costs avoided by reduced deliveries of SWP water would be approximately equal to MWD's current cost of water at $322 per AF. In fact, the major part of this cost reflects the fixed costs of the SWP. These costs must be charged regardless of the amount of water delivered to the urban agencies from the SWP. If deliveries to MWD are reduced because of the proposed standards, MWD rates per AF would increase to reflect the spreading of the fixed costs over a smaller volume of delivered water. Instead of being equal to today's average cost of water, the avoided cost is the reduction in MWD variable costs, which include pumping and variable operations and maintenance. This is much less, and is estimated to be approximately $46 per AF. Therefore the appropriate incremental cost for reclamation plants is approximately $660 per AF, rather than the $383 used by the RIA. When this correction is made, the costs for Scenarios One and Two will be considerably higher than estimated in the Draft RIA.

The authors of the Draft RIA also makes a conceptual error when they state that it assumes that 200,000 AF of reclamation is available to replace the reduced diversions. "Available" is the wrong term to use for reclamation; reclamation is either constructed and used, or it is not constructed. If it is constructed, then it will be used in all year types, and the associated costs will have to be paid in all year-types. A water agency cannot decide whether or not to make payments on bonds raised to finance construction, or whether or not to take delivery of the waste water it is treating on the basis of water available from other sources.

Given the simplicity of the Draft RIA analysis, we are restricted to assuming that the reclamation plant will lead to a reduction of groundwater used in all year types. Where groundwater is available this is the most likely reaction, but response will differ from region to region. In fact, the situation is more complex, and should be modeled using an integrated supply simulation program such as exists in the Economic Risk Model (DWR, 1990) or planning models used by the individual agencies. Assuming groundwater pumping reductions, and a groundwater pumping cost of $150 per AF results in an estimate of incremental costs for reclamation not used to replace Delta water of $555 per AF.

In addition, the reclamation cost assumptions are somewhat dependent on the "Delta-fix" scenarios described in the discussion of base-case water transfers, or on the availability of markets for non-potable water. If there is no "Delta fix", then reclamation projects of the type discussed in the RIA will be required to meet growing demand. Alternatives available to mitigate the proposed standards may be limited to reverse osmosis. This would be much more expensive, and is typically estimated to cost between $1,500 and $2,000 per AF.

6.3 Impacts on Other Proposed Projects

The proposed standards may also have an effect on future projects which are currently planned to improve water supply. For example, planned facilities such as Los Banos Grandes Reservoir and the Kern Water Bank are undergoing reevaluation as a result of possible Delta pumping restrictions. If these facilities are judged uneconomical as a result of the regulations, there could be even greater restrictions on future supplies than currently considered.

7. Cost of Urban Shortages

Reductions in water supply to urban uses will vary according to the total reduction experienced, and the allocation of those reductions. Once again, the economic impact estimated in the Draft RIA should recognize this uncertainty inherent in any analysis of the proposed standards.

With or without water markets, future urban Californians will likely face more frequent water shortages. The proposed standards, combined with pumping restrictions and "take" limitations will make these shortages more frequent and more severe. The ability to transfer water either through drought banks or through long-term option contracts may be able to reduce this impact, to the extent that transfer water is available and can be transported through the Delta.

Increased water reclamation will also contribute toward meeting future demands. However, the results from DWR Bulletin 160-93 indicate that it may be beyond the year 2000 before the needed reclamation plants could be completed. The RIA does not provide the date by which it expects these reclamation plants to be built, and does not address the costs incurred as a result of the proposed standards in the years before the reclamation plants are constructed. Between then and now, the reductions in water supply can only be dealt with by transfers or water shortages. If transfers are not available, the result will be increased shortages.

Whatever mitigation is possible, some level of increased shortages to urban users are bound to occur. The costs of these shortages are discussed below.

7.1 Cost of Industrial Water Shortages

California's manufacturing industries are of major importance in national, and even global terms. Table 4 compares the value added by California's industry output to those of other important manufacturing states, and the nation as a whole.

TABLE 4 COMPARATIVE SIZE OF INDUSTRIAL BASE		
	Value Added ($ Billion, 1987)	Employment (Million, 1989)
UNITED STATES	1,167.0	19.61
CALIFORNIA	134.0	2.16
Six Southern Counties*	78.9	1.38
NEW YORK	79.3	1.19
OHIO	71.7	1.12

* Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura

Source: California Statistical Abstract, 1990.

California's strength depends largely on three key manufacturing industries -- Computers, Electronic Components, Aircraft and Aerospace. Each of these produced 1990 shipments valued between $15 and $21 Billion. These industries employ an average of 14 to 16 workers per AF of water consumed. It is estimated that in 1990 these California industries produced shipments valued at an average of $2 to $3 million dollars per AF consumed (CUWA, 1991.) The cost of water shortages to these industries are extremely high.

The California Urban Water Agencies (CUWA) surveyed large water-using industry groups in 1990-1991. This survey estimated that a hypothetical 30 percent water supply shortage would result in a reduction in value of shipments of $11.8 billion, based on estimates of 1990 levels of production. Over time this value would be expected to increase as output from these industries increased. Seventy-one percent of the estimated direct production losses due to such a one-year water shortage are projected to occur in four industry groups shown in Table 5.

The largest production losses would be concentrated in Los Angeles and Santa Clara counties. Overall, the six counties in Southern California would sustain $7.4 billion in production losses; the northern six Bay Area counties would sustain losses estimated at $4.4 billion.

These estimates translate to billions of dollars of economic losses to California industry associated with industrial water shortfalls which range between 50 and 100 TAF per year -- less than 2 percent of total urban water requirements. With billions of dollars at stake for small water increments, it makes sense that urban water agencies would do their best to shield industrial customers from water shortages, as assumed in the Draft RIA. Obviously, it is better to do without landscape than to do without jobs. However, it must be recognized that there are political limits to the agencies' ability to protect industry.

TABLE 5 LARGEST INDUSTRY PRODUCTION LOSSES DUE TO HYPOTHETICAL WATER SUPPLY SHORTAGE (Based on 1990 Production Levels)		
SIC CODE	**Industry Groups**	**Direct Losses: 30% Supply Shortage Scenario**
291	Refining	$ 3.2 Billion
357 & 367	Computer and Electronics	2.2 Billion
208	Beverages	1.6 Billion
20	Combined Other Food Industry Groups	1.3 Billion
Subtotal		8.3 Billion
Percent of Total Direct Losses of Surveyed Industry Groups		71%
Source: Table 7-3, CUWA (1991)		

7.2 Cost of Uncertainty in Water Supply

An additional cost of unreliable water supply results from erosion of business confidence that California can provide the necessary infrastructure. This loss of confidence will occur even if industry is protected, but believes that its future supplies may be in doubt. The economic impact of this loss of business confidence has not been quantified.

The CUWA investigation reported that many companies believed plant expansion in the State could be threatened because of concerns over future water supplies. Both the CUWA study and an earlier study conducted for the State Water Contractors (SWC 1987) provided anecdotal evidence to support this concern. Both studies reported that local plants which were part of national or international companies are required to compete with alternative locations for corporate investment for any needed plant expansion. For firms using high levels of water, uncertainty over future water supply reliability is an important factor in these decisions. An example was cited in the earlier study of an electronic firm considering relocation to Portland or to San Diego. As part of the relocation study, future reliability and cost of water were compared. San Diego was judged to have significant potential problems in these areas, so the electronics firm chose to relocate to Portland. The firm stated that water supply reliability was the primary issue determining their choice.

Other firms reported that the long-term impact of water supply shortages would be to concentrate future investments away from California. Plant managers reported that threats of water shortages would make the operation of local plants less likely to be sustained through economic downturns. If a parent company was forced to move production to alternative plant locations during times of water shortage, this could affect corporate decisions over long-term investments in local production facilities. Others expressed concern that limited-duration water shortages could cause long-term loss of market share. In the later CUWA survey, similar responses were given, but with more specific mention made of water shortages leading to plant expansion being likely to occur overseas.

7.3 Shortages to Residential Customers

As suggested by the Draft RIA, any water supply shortages to urban users will largely be borne by residential customers. This is in fact what occurred during the 1991 water shortages. The economic cost of these shortages is measured by the "welfare loss" experienced by those residential customers -- that is, the reduction in " the economic wellbeing of those who live and work in the community." To estimate the welfare loss associated with water shortages resulting from the proposed standards, the Draft RIA relied on an estimate of welfare losses. The welfare loss estimate was based on an analysis by David M. Griffith and Associates, consultants retained by the City of Los Angeles' Blue Ribbon Committee on Water Rates.

The goal of the Griffith study was to determine a "market clearing" price -- that is, what price would Los Angeles Department of Water and Power (LADWP) be required to charge to reduce residential water demand sufficiently to respond to a given level of shortage. There are many reasons to believe that the results of that study underestimate these price levels. The theoretical approach is unexceptional, but the assumptions used to develop the analysis are inherently unrealistic.

The study looked at a sample of individual residential customers' water consumption. These customers had incurred a penalty rate for excessive consumption which LADWP had instituted during the most-recent drought. The study looked at water bills for September 1990, and September 1991, which reflect water use in July, August and September of those years. The investigators assumed that all of the decrease in water consumption was in response to the penalty rates instituted by LADWP during that period.

This latter assumption is extremely important. If there were reasons other than price which contributed to the reductions in water use, the analysis will overstate the effect of price; that is, the study would conclude erroneously that consumers were prepared to give up a significant amount of water in return for a small price, when other factors were responsible for much of the consumption change. If the other factors were taken into account, a smaller consumption decrease would result from the price increase. Therefore, ignoring the additional factors would lead to an underestimate of the value of water to consumers.

In fact, during the 1990-1991 time-period there were many other factors which would influence consumers to lower their water use. These include that the 1991 summer period was much cooler than that of 1990. In addition, during 1991 there was extensive news reporting of the growing water-supply emergency, with public appeals from political and water agency leaders for conservation and public sacrifice to reduce water use. During the period under study, LADWP spent over $4 million on advertising to encourage conservation, and MWD spent a similar amount during 1991. If any of these other factors reduced water use during the 1991 period, then the price response assumption results in an underestimate of the value of water to consumers. Similarly, any estimate of welfare losses relying on the Griffith study would also be too low.

Despite the shortcomings of the Griffith study, the Carson/Mitchell analysis resulted in similar estimates of average shortage costs for shortages in the 10 to 20 percent range. So either result could be used for this study. It should be stressed, however, that the Griffith study results are a conservative (low) estimate of the cost of water shortages.

An important factor that appears to have been overlooked in the Draft RIA analysis is that, if residential customers bear the full brunt, or even the major share of the shortage, the level of shortage incurred by householders will be higher than that endured by the system as a whole. For example, 1990 sales to residential customers comprised 75 percent of total MWD water sales. Therefore, assuming residential customers absorb the full brunt of the shortage, the relevant shortage to residential customers cost would be one third higher than the cutback in total supplies.

In addition, in critically-dry years, the urban users will endure additional water shortages. The RIA analysis assumes that the reclamation plants are not available in dry years, and that shortages experienced by urban users increase from zero to 15 percent. This is probably not what is intended. It is likely that the RIA was meant to reflect use of the water from the reclamation plants plus a change in urban shortages from a planned 10 percent in the base case to 15 percent in the impact case. This results in an apparent assumption that 100,000 AF is approximately 5 percent of urban water use. Because the RIA does not specify what base forecast was used, this cannot be verified. However, it should be stressed that the percentage impact will vary greatly among agencies, depending on the allocation of reductions in diversions, and the alternative water supplies available to the individual agencies. Any reasonable estimate of economic impacts should recognize this variation. To obtain a reasonable degree of accuracy in impact estimation requires the individual modeling of the major urban agencies.

The RIA analysis has further misspecified the shortage cost. The assumptions in the RIA specified that residential users will bear the brunt of any shortage. However, the analysis does not appear to reflect that if this occurs, the shortage experienced by the residential consumers will be considerably greater than that experienced by the system on average. In MWD's case, a 10 percent system shortage translates approximately to a 13 percent shortage to residential consumers. Similarly, a 15 percent system shortage translates to a 20 percent shortage to residential consumers. Therefore the shortage of 80,000 TAF assumed in Scenario 1 should be assumed to increase the level of residential shortages from 13 percent to 19 percent, rather than the 10 to 15 percent which appears to have been the aim of the RIA analysis. Because higher shortage levels produce higher shortage costs, the correct shortage costs are higher than those used in the RIA. Based on the Griffith analysis as used in the RIA, the corrected shortage level is estimated to cost an average of $1,998 per AF. The RIA analysis assumes that only 80 percent of these costs result from the proposed standards. Responsibility for the remaining 20 percent appears to be assigned to winter-run salmon. After reducing the total costs by 80 percent to reflect the share of EPA and USFWS actions, these calculations result in an estimated cost of the proposed standards of $117 million per year.

Table 6 presents a revision of the urban cost estimates presented in the Draft RIA. It should be stressed that the cost estimates in Table 6 differ from those presented in the RIA only because of three corrections to the EPA's calculations: the correction to the incremental cost of reclamation plants; the recognition that reclamation plants do not appear and disappear according to water year type; and the correction to reflect the fact that if a water shortage is borne entirely by residential customers, the water shortage to those customers is higher than that to the system as a whole. Table 6 reports increases over estimates presented in the RIA of 50 to 100 percent.

If other assumptions are varied, the cost estimates diverge even further from the estimates presented in the RIA. Table 7 reflects the RIA analysis with the corrections as used in Table 6, but varying the water restrictions to reflect the DWR "margin of safety" or buffers to ensure the water quality standards are met. It should be stressed that, because the water shortages used in the buffer case were not identified other than for average and critical year-types, Table 7 uses the same relationships between urban and total restrictions as used in Table 4-8 of the RIA. This changed water impact assumption leads to costs that are four to five times those reported in the RIA, and double those reported in Table 6.

Implicit in existing water supply plans, and in the RIA analysis, is the assumption of some form of "Delta fix." The RIA should also examine a scenario where a "Delta fix" is assumed not to be available, and the reclamation options available are restricted to reverse-osmosis facilities producing water at a cost of $1,500 per AF. This scenario is presented in Table 8. It should be stressed that this is not an impact that is likely in the near future. However, it is a possible long-term outcome of the combination of the proposed standards and CHD. This would result in an estimated economic impact which is three to four times higher than that presented in the RIA. This scenario is not presented as a probable outcome. However, it does reflect the importance of a "Delta fix" to the future of California's urban water supplies. Given the importance of the "Delta fix", the RIA analysis must investigate whether it remains a viable option under the proposed regulations.

If transfers or reclamation are not available, particularly in the near-term adjustment period water consumers are likely to face increased shortages. Using the apparent assumptions in the

Table 6
Revision of RIA Table 4–8
Estimated Urban Water Supply Impacts and Associated Costs
Resulting from Implementation of Proposed Federal Actions
No Allowance for Buffer Requirements

	Type of Water Year						
	Critically Dry	Dry	Below Normal	Above Normal	Wet	Weighted Average [a]	EPA and USFWS Actions
Water supply reduction to urban users (af)	280,000	200,000	100,000	80,000	80,000	NA	
Economic Impact of Proposed Federal Standards							
Scenario 1: no drought water bank, drought–management techniques, water reclamation and no transfers.							
– Reclamation Assumed	200,000	200,000	200,000	200,000	200,000		
– cost per af with Delta cost avoided	659	659	659	659	659	NA	
– cost per af with groundwater avoided	555	555	555	555	555		
– reclamation cost (annual $1000)	131,800	131,800	121,400	119,320	119,320		
– shortage	80,000						
– shortage cost	$1,998						
– welfare losses from shortage (annual $1,000)	$159,872						
Total welfare losses (annual $1,000)	$291,672	$131,800	$121,400	$119,320	$119,320	$145,675	$116,540
– Times RIA estimate							148%
Scenario 2: smaller drought water bank, some drought–management techniques and water reclamation.							
– Reclamation Assumed	200,000	200,000	200,000	200,000	200,000		
– cost per af with Delta cost avoided	659	659	659	659	659	NA	
– cost per af with groundwater avoided	555	555	555	555	555		
– reclamation cost (annual $1000)	131,800	131,800	121,400	119,320	119,320		
– shortage	80,000						
– water bank	$250						
– water bank costs (annual $1,000)	$20,000						
Total costs (annual $1,000)	$151,800	$131,800	$121,400	$119,320	$119,320	$126,681	$101,345
– Times RIA estimate							195%

Note: Drought water pricing provides estimates of welfare losses, which exceed out–of–pocket water expenses, based on drought studies.

[a] Weighted average of varying water–year types by historical occurrence.

[b] Does not subtract monetary benefits to agriculture of income transfers to urban users

Per AF cost of groundwater assumed: $150

Table 7
Revision of RIA Table 4–8
Estimated Urban Water Supply Impacts and Associated Costs
Resulting from Implementation of Proposed Federal Actions With Buffer

	Type of Water Year						EPA and
	Critically Dry	Dry	Below Normal	Above Normal	Wet	Weighted Average [a]	USFWS Actions
Water supply reduction to urban users (af)	600,000	429,000	157,000	126,000	126,000	NA	
Economic impact of federal proposal (1990 dollars)							
Scenario 1: no drought water bank, drought–management techniques, water reclamation, no trading.							
– Reclamation Assumed	400,000	400,000	400,000	400,000	400,000		
– cost per af with Delta water avoided	$659	$659	$659	$659	$659	NA	
– cost per af with groundwater avoided	$555	$555	$555	$555	$555		
– reclamation cost	$263,600	$263,600	$238,328	$235,104	$235,104		
– shortage	200,000	29,000					
– shortage cost	$3,073	$1,357					
– welfare losses from shortage (annual $1,000)	$614,547	$39,353					
Total welfare losses (annual $1,000)	$878,147	$302,953	$238,328	$235,104	$235,104	$336,906	$303,216
– Times RIA estimate							384%
Scenario 2: smaller drought water bank, some drought–management techniques and water reclamation.							
– Reclamation Assumed	400,000	400,000	400,000	400,000	400,000		
– cost per af	$659	$659	$659	$659	$659	NA	
– cost per af with Delta water avoided	$555	$555	$555	$555	$555		
– cost per af with groundwaterwater avoided	$263,600	$263,600	$238,328	$235,104	$235,104		
– shortage	200,000	29,000					
– water bank	$250	$200					
– cost of water bank (annual $1,000)	$50,000	$5,800					
Total costs (annual $1,000)	$313,600	$269,400	$238,328	$235,104	$235,104	$253,389	$228,050
– Times RIA estimate							457%

Note: Drought water pricing provides estimates of welfare losses, which exceed out–of–pocket expenses, based on drought studies.

[a] Weighted average of varying water–year types by historical occurrence.

[b] Does not subtract monetary benefits to agriculture of income transfers to urban users

Per AF cost of groundwater assumed $150

Table 8
Revision of RIA Table 4-8
Estimated Urban Water Supply Impacts and Associated Costs
Resulting from Implementation of Proposed Federal Actions
Reverse Osmosis Facilities/No Buffer Requirements

	Type of Water Year						EPA and
	Critically Dry	Dry	Below Normal	Above Normal	Wet	Weighted Average[a]	USFWS Actions
Water supply reduction to urban users (af)	280,000	200,000	100,000	80,000	80,000	NA	
Economic impact of federal proposal (1990 dollars)							
Scenario 1: no drought water bank, drought-management techniques, water reclamation and no trading.							
– Reclamation Assumed	200,000	200,000	200,000	200,000	200,000		
– cost per af with Delta cost avoided	$1,454	$1,454	$1,454	$1,454	$1,454	NA	
– cost per af with groundwater costs avoided	$1,350	$1,350	$1,350	$1,350	$1,350		
– reclamation cost (annual $1000)	$290,800	$290,800	$280,400	$278,320	$278,320		
– shortage	80,000						
– shortage cost	$1,998						
– welfare losses from shortage (annual $1,000)	$159,872						
Total welfare losses (annual $1,000)	$450,672	$290,800	$280,400	$278,320	$278,320	$304,675	$243,740
– Times RIA estimate							309%
Scenario 2: smaller drought water bank, some drought-management techniques and water reclamation.							
– Reclamation Assumed	200,000	200,000	200,000	200,000	200,000		
– cost per af with Delta cost avoided	$1,454	$1,454	$1,454	$1,454	$1,454	NA	
– cost per af with groundwater costs avoided	$1,350	$1,350	$1,350	$1,350	$1,350		
– reclamation cost (annual $1000)	$290,800	$290,800	$280,400	$278,320	$278,320		
– shortage	80,000						
– water bank	$250						
– water bank costs (annual $1,000)	$20,000						
Total costs (annual $1,000)	$310,800	$290,800	$280,400	$278,320	$278,320	$285,681	$228,545
– Times RIA estimate							439%

Note: Drought water pricing estimates consumer surplus losses, which exceed out-of-pocket expenses, based on drought studies.
[a] Weighted average of varying water-year types by historical occurrence.
[b] Does not subtract monetary benefits to agriculture of income transfers to urban users
Per AF cost of groundwater assumed: $150

RIA concerning percentages of shortage, without alternate supplies urban shortages would likely increase from 10 percent to 24 percent in critically-dry years. This would result in shortages to residential customers increasing from 13 to 32 percent. Extrapolation from the Griffith study used by the RIA would result in an estimated average cost of this level of shortage of $2,460 per AF. Based on a critically-dry year shortage of 280 TAF, this results in an estimated cost of $700 million for those years. In addition, shortages would be more likely to occur in dry years, as well as in critically-dry years. The extent of these shortages cannot be determined without additional study. Separate modeling of the individual major urban agencies would be the preferred method to determine likely impacts.

Taken together, these analyses show both that the urban impacts in the RIA are underestimated, and that the range of possible estimates of economic costs vary greatly according to the underlying assumptions concerning Delta facilities and the necessity for a "margin of safety" to ensure compliance with the proposed standards. This, in turn, stresses the need for sensitivity analyses.

7.4 The Reality of Residential Shortage Costs

The cost of water shortages to residential customers has been discounted in some forums as being a "psychic" cost, rather than a true cost. Shortage costs are experienced in part as extra labor for using gray water for valued plants, and inconvenience and discomfort from shorter showers and fewer toilet flushes. These costs are real reductions in households' quality of life and should not be discounted. In addition, a high proportion of the costs of residential water shortages arise from the loss of landscape. The cost to replace this lost landscape is an out-of-pocket dollar cost which would be paid by householders.

A study of the effect of water shortages in areas of Santa Barbara County (SWC 1993) resulted in estimates of high dollar losses for urban landscapes. The cost of replacing lost landscape within the City of Santa Barbara was estimated at $36.6 million dollars. This value was derived after excluding the cost to replace lost mature trees. The replacement cost of these trees is so large that few households would incur this expense. The number of households in the City of Santa Barbara at the time of this study was estimated to be 34,300. In the same year, the number of households in MWD's service territory was estimated to be 5.1 million. A simple extrapolation suggests that losses in MWD's service territory under a similar shortage would be over $5 billion.

It should be cautioned that this result is not a valid estimate of losses in MWD's service area. The City of Santa Barbara has more low-density housing, and so therefore one could expect the losses in that area to be higher than in the MWD service territory. Offsetting that, however, the climate over much of MWD's service area is hotter and more arid, so on this basis, landscape losses from water shortages could be expected to be greater in MWD. The $5 billion dollar estimate ignores both of these potential effects. The City of Santa Barbara results do indicate that landscape losses resulting from a Santa Barbara-style water shortage in MWD's service area would result in very large economic costs to replace lost landscapes.

7.5 Effects of Water Shortage on Urban Employment

Although the impact of a water shortage may be concentrated on residential users, this water shortage will still have a negative effect on urban employment and incomes. In particular, during times of drought households reduce or eliminate entirely their purchases of new landscape plantings. This causes a reduction in nursery and grower sales, and a corresponding drop in employment and income in those activities. While nurseries and growers can be protected from reductions in water to their production process, they cannot be protected when their market collapses. Landscape maintenance and architects are also likely to experience some loss in business, although to a certain extent this may be offset by households installing more efficient irrigation technologies. Some of the loss in green industry sales is temporary, and may be recovered at the end of the shortage as households replace dead landscape. However, sales of annual plantings are a permanent loss, and cannot be regained.

During the 1991 water shortage year, an investigation was performed to identify lost jobs and sales as a result of the shortage (Foster, forthcoming). This resulted in a minimum estimate of 3,000 lost jobs and $54 million in lost wages and salaries, with a further 10,000 jobs and approximately $180 million in income lost through a combination of water shortage and the economic recession. For these additional losses, the relative importance of the two effects could not be determined.

Other economic impacts are likely to result from water supply shortages. The tourism industry in Southern California is estimated to account for $20 billion in sales, more than 500,000 jobs, and contributes $340 million to local government revenues. The inevitable result of urban water shortages is a decline in the quality of urban landscapes, which could threaten California's ability to attract tourists.

8.0 Measurement of Agricultural Economic Impacts

The RIA seriously underestimated the economic impact on agriculture by overlooking the need to correct the base-case agricultural production level to reflect an appropriate base-case water supply to agriculture. In addition, the analysis underestimated the effect of critically-dry years on the availability of water to agriculture under the base case. As discussed earlier, the RIA economic analysis resulted in an over-estimate of available water of 4 MAF during critically-dry years, and 1 MAF in average years.

The RIA did not develop the appropriate base case for agricultural production. The level of agricultural production used as a base case in the RIA reflected 1987 patterns, when plentiful water supplies were available. The combination of the water supply reductions since then results in a total reduction to agriculture of 1 MAF in average years under the base case. The Draft RIA reductions will be incremental to these reductions, so that total reductions to agriculture in average years will range upward from 1.4 MAF. The newly proposed standards would be responsible for the last and most expensive reduction in agricultural water use in normal years.

Using similar reasoning, it can be determined that the dry-year reductions in water available to agriculture in the base case will total 4.9 MAF (including approximately 500 TAF for transfers to urban users.) An additional 900 TAF (80 percent of the total 1.1 MAF) will result from the newly-proposed standards. By ignoring the reduction in water supplies which have occurred since 1987, the Draft RIA significantly underestimates the likely effects on agriculture of the reduction due to the proposed standards. To the extent low-value crops have been fallowed to meet other restrictions, they will no longer be available to mitigate the effect of these proposed standards.

To develop an approximate measure of the underestimate of the agricultural impacts, we have estimated agricultural impact curves from the results reported in the RIA. This is not a replacement for more in-depth analysis, but gives some approximate idea of the order of magnitude of costs which could be expected. The results of these estimates are reported in Table 9. This table indicates that a corrected base case would result in impacts to agriculture which are approximately 50 to 140 percent higher than those estimated in the RIA.

The proposed water quality standards would also increase the variability in water supplies to agriculture. Since many farm production costs cannot be avoided in the short run, this will increase risk. It may also reduce the types of crops planted by farmers. For example, tree crops will be less likely to be planted under the more-variable supply scenarios. These crops require considerable up-front investment and lead time before sustained harvest is attained. An uncertain water supply outlook should discourage production of these high-value crops. The Draft RIA provides no analysis of the variation in water supplies and increased risk under the proposed standards.

In addition, the use of Roe Island as the measuring-point for the X-2 standards may require large upstream releases, leading to the flooding of farmland along the Yolo and Sutter bypasses. This flooding would lead to loss of crops, and if it occurred with sufficient frequency, could permanently deter agriculture in those areas.

9. The Critical Habitat Designation Analysis

Analysis of the cost of critical habitat designation (CHD) appears to assume that no water is required for the Delta smelt habitat requirement. In 1993, 400 TAF were allocated to Delta smelt (DWR, 1994). The Draft RIA should explain why none of the water requirement from these standards is assumed to be allocated to the critical habitat requirements of the Delta smelt.

The Draft RIA acknowledges only that the designation of critical habitat will result in the restriction of some economic activities within the designated habitat, but no economic costs are calculated. It appears that it was assumed that these costs were minimal. Other types of activities may be restricted. These other activities are not mentioned, and therefore are also not quantified. It is possible that the restrictions from CHD will prevent all aspects of Delta water management plans. These proposed facility improvements within the Delta are aimed at maintenance of water exports from the Delta while protecting habitat. If the Delta water

Table 9

Revision of RIA Table 4–4. Annual Changes in Producers' Surplus (Net Revenues) by Type of Water Year for Two Scenarios (Millions of 1990 Dollars) (No Buffer Requirements)

Type of Water Year	Scenario 2 (larger area, trading)	Scenario 3 (entire Central Valley, trading)
Average annual water supply impacts[a]		
Without standards	23	10
With standards	40	19
Difference	17	9
Critically dry years		
Without standards	238	154
With standards	329	220
Difference	91	66
Weighted average of proposed EPA & USFWS actions)	29	19
Presented in RIA data	20	8
Times RIA estimate	146%	237%

[a] The estimates pertaining to average water supply were modeled using 80 percent of a 600 TAF reduction.

management plans are prevented by the CHD, and the "Delta fix" option has been ruled out of the State's water supply planning, this will have serious economic consequences which must be addressed.

Other possible restrictions, such as reduced dredging and maintenance for navigation should be addressed. The impact of the CHD on the operation of the shipping channels, including any limitations on future dredging in these channels should be fully specified and discussed. In summary, no economic costs are calculated and important potential economic costs of designation are not quantified or even mentioned. Therefore, exclusion analysis on areas of critical habitat cannot be conducted as required by the law; there is no basis by which to determine if any area of critical habitat should be excluded based on costs and benefits to the species.

10. General Critique of the Draft RIA

The major shortcomings of the RIA have been addressed above. The Draft RIA also has several additional shortcomings. Other important issues which have been overlooked include:

- hydropower impacts from changed reservoir operations;
- lack of analysis of reservoir recreation impacts, both in Northern and Southern California reservoirs; and,
- adverse impacts on wildlife refuges from reduced water flows in the export areas.

Another problem with the analysis is lack of consistency between cost and benefit analyses in the estimation of indirect effects. The benefits analysis as reported in the Draft RIA includes both forward and backward-linked indirect benefits in the commercial fishing industry. These benefits include gains in processing, retail and other sectors, and benefits from induced spending of households who participate in salmon harvest.

There are similar economic linkages to the net costs estimated for agriculture, but these are not included in the Draft RIA. The commensurate net costs are the profits lost due to water shortages in food processors, wholesalers and retailers. To be consistent, the same level of economic linkages must be addressed in both the cost and benefit estimates. These linkages are not present in the urban sector, because the shortage impacts are assumed to be restricted to residential consumers. If the shortages were to become large enough to impact industrial customers, similar linkages would need to be considered.

Citations

Printed References

California Urban Water Agencies, *The Cost of Industrial Water Shortages*, report by Spectrum Economics, Inc., 1991.

Department of Water Resources, "Appendix E: Economic Risk Model", in *Los Banos Grandes Facilities Draft EIR*, 1990.

________________, *California Water Plan Update*, Draft Bulletin 160-93, 1993.

________________, Testimony of George Barnes in the Mono Basin Hearings before the State Water Resources Control Board, 1994.

Foster Associates, *The Impact of Water Shortage and Recession on California's Green Industry*, for Metropolitan Water District of Southern California and the Council for a Green Environment, forthcoming.

Leftwich 1973. *The Price System and Resource Allocation*, Richard Leftwich, The Dryden Press, Hinsdale Illinois, 1973.

State Water Contractors, *Economic Value of Reliable Water Supplies for Industrial Water Users*, SWC Exhibit 57 in the State Water Resources Control Board's Bay/Delta hearings.

________________, *The Economic Costs of Drought-Induced Urban Greenery Losses*, Exhibit 21 in the State Water Resources Control Board's Bay/Delta hearings.

Personal Communications

Agencies. Personal communications with the following personnel and agencies.

T. Berliner, San Francisco
E. Thornhill, MWD
D. Okido, Solano
A. Nelson Contra Costa Water Agency.
J. Ryan, Santa Clara Valley Water District
D. Masnada, Central Coast Water Agency
B. Sorsen, Napa

Department of Water Resources, personal communication with Alan Jones, Public Information office.

Rodrigo, 1994. Personal communication with Dan Rodrigo, Metropolitan Water District of Southern California.

Snow, 1994. Personal communication with Jim Snow, State Water Project Operations.