ENVIRONMENTAL
DEFENSE FUND

Rec'd APRIL 26 1994

119

California Office
Rockridge Market Hall
5655 College Ave.
Oakland, CA 94618
(510) 658-8008
Fax: 510-658-0630

COMMENTS OF

THE ENVIRONMENTAL DEFENSE FUND

ON

U.S. ENVIRONMENTAL PROTECTION AGENCY

PROPOSED RULE:

Water Quality Standards For Surface Waters Of The Sacramento River, San Joaquin River, And The San Francisco Bay And Delta Of The State Of California

March 11, 1994

National Headquarters

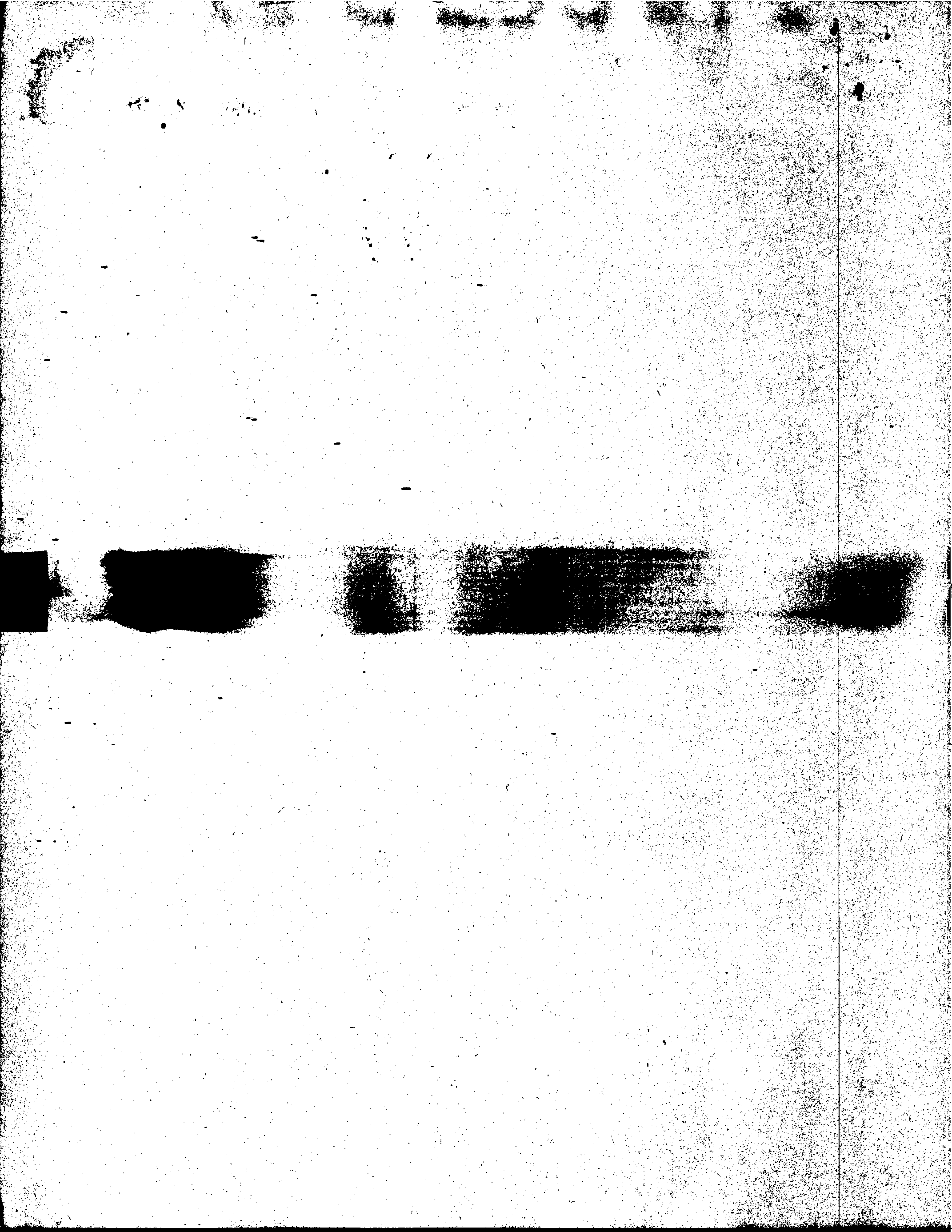
257 Park Avenue South
New York, NY 10010
(212) 505-2100

1875 Connecticut Ave., N.W.
Washington, DC 20009
(202) 387-3500

1405 Arapahoe Ave.
Boulder, CO 80302
(303) 440-4901

128 East Hargett St.
Raleigh, NC 27601
(919) 821-7793

1800 Guadalupe
Austin, TX 78701
(512) 478-5161



INTRODUCTION

The Environmental Defense Fund (EDF) strongly supports the adoption of improved water quality standards for the San Francisco Bay/Delta estuary, as proposed by EPA. The need for improved standards has been acknowledged by both federal and state regulators for well over a decade, yet adequate standards still have not been adopted. During this period of time, fish and wildlife resources in the estuary have plummeted to all time lows, while water diversions that deprive the estuary of essential freshwater flows continued to climb. It should be beyond dispute that prompt action to improve environmental protection for the fragile Bay/Delta ecosystem is needed, if we are have any hope of restoring and preserving the estuary's important environmental and economic values.[1]

These comments focus on several key points:

* EPA action is the result of state failure to adopt adequate water quality standards and is mandated by the Clean Water Act;

* There is a sound scientific basis for the proposed standards; however, additional protection is needed for the tidal marshes of Suisun Bay and areas downstream of Suisun Bay;

* Linking water quality standards to the conditions that existed in the late 1960s and early 1970s is not legally or factually sufficient to protect the designated uses of the estuary;

* Improved standards can be implemented in a way that greatly minimizes their economic impacts.

---

[1]EDF also generally supports the revised critical habitat designation for the Delta smelt proposed by U.S. Fish and Wildlife Service, subject to the same concerns expressed in these comments with respect to EPA's proposed estuarine habitat criteria.

EPA ACTION IS REQUIRED BECAUSE THE STATE HAS FAILED TO ADOPT ADEQUATE WATER QUALITY STANDARDS TO PROTECT THE BAY/DELTA ESTUARY

The operative water quality standards for the Bay/Delta estuary were adopted in 1978[2] and implemented through State Water Resources Control Board (SWRCB) Water Right Decision 1485. Even before these standards were adopted, however, it was apparent that they would not be sufficient to protect the fish and wildlife of the estuary. In comments on the 1978 standards, the U.S. Fish and Wildlife Service stated that the "four-agency agreement" on which the standards were based "ensures that fish and wildlife will not be maintained at their current level, but at a degraded level resulting from the effects of water development."[3]

Despite this criticism, the state adopted and EPA subsequently approved the 1978 standards, although EPA's approval was conditioned on the standards achieving the level of protection they promised. As chronicled in EPA's notice on the proposed standards, these conditions were not met, and even the state subsequently acknowledged that the standards were not adequate to protect the fishery resource. 59 FR 810, 811 (January 6, 1994). Despite this acknowledgement, however, the state still failed repeatedly to adopt adequate standards, leading finally to the present proposal by EPA. Since the 1978 standards have been in effect, virtually all of the estuary's major fish species have declined dramatically while water diversions have continued to increase. The Clean Water Act thus mandates that EPA exercise its authority under section 303(c) to promulgate adequate standards.[4]

---

[2]Water Quality Control Plan, Sacramento-San Joaquin Delta and Suisun Marsh (SWRCB 1978) (1978 Plan). The SWRCB adopted revised, and equally deficient, standards in May 1991, which were the standards EPA disapproved. These standards have never been implemented.

[3]Appendix: Summary of Public Comments on the Draft Water Quality Control Plan and Environmental Impact Report, Sacramento-San Joaquin Delta and Suisun Marsh, at p. V-4.

[4]Because EPA is carrying out a clear mandate of the Clean Water Act, and because the method of implementation of the proposed standards is left to the state, the promulgation is consistent with the policy statement in Section 101(g) of the Act. <u>See</u> <u>Riverside Irrigation District v. Andrews</u>, 758 F.2d 508 (10th Cir. 1985). Moreover, the state has consistently recognized EPA's

THE PROPOSED STANDARDS ARE GROUNDED ON SOUND SCIENCE

The adoption of an estuarine criteria such as that proposed by EPA is a critical step toward better protection of the estuary's fish and wildlife resources. The criteria focus on maintenance of habitat important to a broad range of estuarine species and represents an ecosystem-based approach to protection of the Bay/Delta's biological resources. As noted in EPA's notice of rulemaking, the proposal is based on the recommendation of a group of distinguished estuarine scientists who concluded that the location of 2 ppt bottom salinity was the best index for protection of estuarine habitat and was closely correlated with habitat conditions for estuarine resources at all trophic levels.[5] A particularly important conclusion of the group is that the benefits of downstream position of the 2 ppt isohaline are unconstrained; the further downstream the 2 ppt isohaline is located, the greater the abundance or survival of most species examined.[6]

The benefits of low-salinity habitat are well-documented in EPA's notice and are supported by testimony submitted to the SWRCB in its 1987 and 1992 hearings. (See, e.g., WRINT-DFG Exh. 6) Indeed, the 1978 plan states that "[s]alinity is the major water quality factor affecting beneficial uses of Delta supplies and is directly influenced by operations of project facilities". (1978 Plan at II-1; see also p. III-3 (striped bass); III-9 (Suisun Marsh)). A 2 ppt bottom salinity standard was first proposed to the SWRCB in 1987 as a means of locating the entrapment zone in Suisun Bay to

---

jurisdiction over water quality standards for the estuary by submitting the 1978 plan to EPA for approval and by conducting subsequent triennial reviews. See also United States v. State Water Resources Control Board, 182 Cal. App. 3d 82, 109 (1986) ("the federal act mandates certain planning responsibilities including formulation of water quality standards to provide salinity control").

[5] Managing Freshwater Discharge to the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: The Scientific Basis for an Estuarine Standard (SFEP 1993) at p. 9.

[6] Id., at p. 6.

maximize phytoplankton abundance. (CCCWA/EDF Exh. 1).[7] The work of the SFEP panel has since refined that knowledge, but it remains clear that salinity is an important factor controlling ecosystem health and "represents the response of the estuary to different combinations of river discharge, diversions and withdrawals, tidal regime, and basin geometry." (SFEP Report at p. 6).

EDF is concerned, however, that the estuarine habitat standard proposed by EPA is not sufficiently protective in that it fails to provide for sufficient placement of the 2 ppt isohaline at Roe Island in dry and critical years, and fails adequately to protect the tidal marshes of Suisun Bay[8] and habitat downstream of Suisun Bay. These concerns are addressed in more detail in the comments of the Bay Institute of San Francisco.[9]

LINKING WATER QUALITY STANDARDS TO THE WATER QUALITY CONDITIONS THAT EXISTED IN THE LATE 1960s AND EARLY 1970s DOES NOT ENSURE ADEQUATE PROTECTION OF DESIGNATED USES

A. Introduction

In support of standards which would restore habitat conditions that existed in the late 1960s/ early 1970s, EPA's Notice of Proposed Rule Making states, "[t]his period generally reflects conditions that occurred in the estuary before fish habitat and populations began to experience the most recent significant declines, and therefore serves as a useful definition of a healthy fishery resource." 59 FR at 819-820. While it may be appropriate to

---

[7]See also CCCWA/EDF Exh. 2 documenting the benefits of low-salinity habitat to prevent intrusion of marine benthic filter feeders.

[8]See "Comparison of Salinity at Martinez of Proposed EPA Standards with D1485 Standards and Historic Outflow" attached to these comments.

[9]EDF also supports the adoption of the proposed striped bass spawning standard as clearly supported by the evidence and the adoption of a salmon smolt survival standard, subject to the concern stated elsewhere in these comments that salmon populations were already in decline during the late 1960s/early 1970s period. Instead, salmon smolt survival indices should provide protection at the 1940 level of development in order to reflect least impaired conditions as required for biological criteria. In addition, EPA should adopt a separate temperature criteria of no greater than 65 degrees at Freeport and Vernalis from April 1 to June 30 and from September 1 through November 30. See Comments of Bay Institute of San Francisco.

establish water quality criteria to protect fish and wildlife uses that existed in the late 1960s, it does not follow, however, that providing the water quality conditions that existed during that period of time is legally or factually sufficient. The available evidence indicates that important fishery resources were already in decline by the late 1960s, and that water quality standards that attempt to replicate those conditions will not adequately protect these resources.

B. Legal requirements for setting water quality criteria

Water quality criteria must protect designated uses. Regulations implementing §303(c) of the Clean Water Act require that criteria must "be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use. For waters with multiple use designations, the criteria shall support the most sensitive use." 40 CFR §131.11(a)(1). Designated uses must include "existing uses". 40 CFR §131.10(h)-(i). Existing uses are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." 40 CFR §131.3(e).

Federal antidegradation policy requires at a minimum, protection of "existing instream water uses and the level of water quality necessary to protect the existing uses". 40 CFR §131.12(a)(1). Water quality above the fishable/ swimmable level must be maintained and protected "unless the State finds . . . that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully." 40 CFR §131.12(a)(2).

While "existing uses" are defined in federal regulations as those uses actually attained on or after November 28, 1975, 40 CFR §131.3(e), EPA must also set criteria consistent with the state's antidegradation policy, which dates back to 1968. State Board Resolution No. 68-16 (1968). Federal regulations provide that "in promulgating water quality standards, [EPA] is subject to the same policies, procedures, analyses, and public participation requirements established for States in these regulations." 40 CFR §131.22(c). The regulations also require that states adopt an antidegradation policy consistent with federal minimum requirements and incorporate this policy into their water quality standards. 40 CFR §131.12, 40 CFR §131.6(d). Since EPA is subject to the same policies and procedures established for the states, EPA must also incorporate the state's antidegradation policy into the federal standards.

Moreover, EPA's failure to incorporate California's approved antidegradation policy into federal water quality standards would be tantamount to an implied disapproval of the policy, and would be contrary to federal regulations. EPA may disapprove a state's water quality standard, including a state's antidegradation policy, only if it is inconsistent with any element listed in §131.6, including "[w]ater quality criteria sufficient to protect the designated uses" and "[a]n antidegradation policy consistent with §131.12." 40 CFR §131.5, 40 CFR §131.6. In this case, EPA has disapproved the state's standards due to inadequate criteria, but has not, and should not, disapprove the antidegradation provision. 59 FR at 810. Failure to set criteria consistent with the state's antidegradation policy would improperly nullify the state policy.

The state's antidegradation policy requires that EPA set, at a minimum, standards tied to maintaining the <u>designated uses</u> attained in 1968. However, EPA must base water quality <u>criteria</u> not on the conditions that existed at that time but rather on the "level of water quality that is necessary to protect the existing uses." 40 CFR section 131. 12(a)(1). Designated uses are tied to a particular time because they must include uses actually attained at that time, but criteria to protect those uses are not related to any particular period of time. Setting criteria to achieve water quality conditions that existed during the late 1960s and early 1970s period would be appropriate only if those conditions would protect the "existing uses". In this case, as discussed in a later section, they would not.

C. Protecting "existing uses" provides only the minimum level of required protection.

Protection of uses attained in 1968 is the minimum level of protection permissible under the state's antidegradation policy and the Clean Water Act. 40 CFR §131.6, 40 CFR §131.12. However, EPA is obligated to strive to achieve better than the absolute minimum level of required protection in establishing water quality standards. The objective of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the nation's waters," 33 U.S.C. §1251(a), and §303(c) of the Clean Water Act requires EPA to set water quality standards which will not only maintain but enhance water quality. 33 U.S.C. §1313(c). Thus, the primary objective of the Act is improvement in water quality, not merely maintenance of existing quality.

California policy also requires protection beyond the late 1960s and early 1970s level.[10] The 1978 Plan was intended to achieve "without project" levels of fish and wildlife (i.e. levels that would have existed in the absence of the CVP and SWP), and established a longer term goal of achieving "recent historical levels" (1922-67). Water Quality Control Plan for the Sacramento-San Joaquin Delta and Suisun Marsh, pp. VI-1-2 (1978).[11] As acknowledged by EPA, limiting protections to the late 1960s/ early 1970s is a retreat from the state's 1978 commitment. 59 FR at 819, n. 8. Moreover, EPA, NMFS, and USFWS have endorsed the late 1960s/ early 1970s level of protection

---

[10]Consideration of state policy is consistent with EPA's adherence to state standards more protective than federal minimum requirements in other contexts. See Arkansas v. Oklahoma, 112 S.Ct. 1046 (1992) (EPA issuance of NPDES permit).

[11] While the "without project" standards were invalidated by the court in U.S. v. State Water Resources Control Board, 182 Cal.App.3d 82 (1986), the court did so based on its holding that standards should not be limited to the impacts of the two projects. Setting standards that consider the impacts of all diverters in the Bay/Delta watershed should require more protective, not less protective, water quality standards.

only as an "interim" goal, acknowledging that additional protection is needed to fully restore and maintain estuarine habitat. WRINT-USFWS-10.

D. <u>Water quality conditions in the late 1960s and early 1970s were not sufficient to protect designated uses.</u>

There is considerable evidence that Bay/Delta fishery resources were already in decline by the late 1960s and early 1970s. A 1985 study of striped bass concluded that "the striped bass population declined steadily from the late 1960s to a low level in 1975."[12] This is confirmed by data presented in the SWRCB's Draft 1988 Salinity Control Plan that shows a consistent downward trend of the Striped Bass Index beginning in the late 1960s.[13] Similarly, Chinook salmon populations (for fall, late-fall, and winter runs) declined substantially during the same period.[14]

That water quality conditions in the estuary were already in decline during the late 1960s and early 1970s is not surprising, since most of the upstream dams that divert spring flows and result in higher salinities in the estuary were already in place by that time. This period was also characterized by increasing exports from the Delta as the State Water Project began deliveries. (1988 Draft Plan at B-8).

Declines in fishery resources were probably less severe during this period than they might have otherwise been because of an abundance of wet years and an absence of any dry or critical years. It is noteworthy that the decline of young-of-the-year striped bass was particularly severe in 1977 following the 1976-77 drought, with index levels being considerably below predicted levels since that time. (Stevens et al., 1985 at p. 19).

---

[12]D. Stevens <u>et al.</u>, The Decline of Striped Bass in the Sacramento-San Joaquin Estuary, California, <u>Transactions of the American Fisheries</u> 114:12-30, 15 (1985)

[13]Draft Water Quality Control Plan for Salinity, San Francisco Bay/Sacramento-San Joaquin Delta Estuary (October 1988) at p. 1-14 (1988 Draft Plan).

[14]<u>Id.</u>, at 4-16; 4-21.

Similarly, declines in the estuary's fishery resources were again steep during the recent 1987-92 drought. This evidence demonstrates the importance of adopting water quality criteria that adequately protect the estuary's biological resources over a full range of hydrologic conditions, and particularly during drought.

While EPA's use of a 1940-75 period to develop its proposed standard may in part compensate for the linkage of standards to late 1960s/early 1970s conditions, the inclusion of years in the late 1960s and early 1970s when fishery resources were clearly in decline biases the proposed criteria against adequate protection and is inconsistent with the state's antidegradation policy. Instead, criteria should be based on pre-1968 conditions when fishery populations were more stable and not already in obvious decline.

IMPROVED STANDARDS CAN BE IMPLEMENTED IN A WAY THAT GREATLY MINIMIZES ECONOMIC IMPACTS

EPA's Regulatory Impact Assessment correctly points out that the economic effects of the proposed standards on agricultural and urban water users can vary depending on how the standards are implemented. Implementation is largely the responsibility of the state. Moreover, the Clean Water Act requires that water quality criteria must be based "solely on data and scientific judgments on the relationship between pollutant concentrations and environmental and human health effects. Criteria values do not reflect considerations of economic or technological feasibility." 45 FR 79319 (November 28, 1980); 33 U.S.C. §1314(a)(1). Nevertheless, it is clear that improved standards can be implemented in a way that avoids or greatly reduces economic impacts on other uses.

The following section will discuss <u>first</u> how DWR's modeling analysis overstates the "water supply impacts" of the proposed standards, and <u>second</u> how water transfers and the use of restoration fund monies to acquire water for Bay/Delta protection will reduce the economic impacts of improved standards on agricultural and urban water uses and should be major components of any implementation strategy.

A. DWR's modeling analysis overstates the "water supply impacts" of improved standards.

1. Introduction

The water supply impacts of EPA's water quality standards have been estimated by the California Department of Water Resources' modeling group using DWRSIM, the Department's computer-based long term planning model. This model has been much improved from earlier versions but still does not have the ability to estimate impacts of the proposed standards to a reasonable degree of certainty. Moreover, model limitations show a clear bias toward exaggerating the impact of proposed protective standards.[15]

First, as a physical model, DWRSIM does not attempt to address the mitigating effects of alternative water supply options, such as water transfers. Simple calculations based on DWRSIM output can estimate the physical availability of water transfers.

Second, DWRSIM lacks adequate flexibility to simulate operation of all major reservoirs in the entire Central Valley watershed. The model was originally developed to analyze potential additions to the State Water Project. Central Valley Project facilities were included only because there was a need to model the effect of the Coordinated Operations Agreement (COA) on the SWP. DWRSIM has been used extensively over the last several years to estimate impacts of proposed protective standards for the San Francisco Bay-Delta and other parts of the Central Valley watershed. The argument that projects simulated by the model serve as surrogates for the entire system is valid only if each acre foot of water required by a protective standard must

[15]For further discussion of limitations of DWRSIM see WRINT-EDF 15 (Testimony of Spreck Rosekrans). The analysis done by DWR and discussed in this section focuses on both Study 1, the base simulation using D1485 standards, and Study 3, which incorporates EPA's proposed standards with changes in operations set forth in NMFS's 1993 biological opinion for winter-run Chinook salmon, as adopted by the Bureau of Reclamation and DWR.

be taken away from water deliveries, i.e. that water supply impacts cannot be reduced by operating reservoirs differently. The modeling studies do operate some reservoirs differently and show significant water supply benefits of such re-operation. However, the modeling studies do not show, and indeed DWRSIM is unable to show, the water supply benefits which might occur if the rest of the major reservoirs in the watershed were re-operated.

Third, controversy over DWRSIM's use of output tables from the MDO (Minimum Delta Outflow) model to estimate "carriage water" needs for maintaining salinity requirements is well documented. It is perhaps most egregious that DWRSIM's reliance on the carriage water tables totally ignores antecedent conditions[16]. Additionally, MDO results have been shown to overestimate consistently outflow requirements for salinity control.

All of these model limitations lead to overestimates of the impacts of the proposed standards. While transferred water does not affect the total amount available for agricultural and urban users, it can contribute significantly to reducing economic impacts. The incomplete representation of Central Valley reservoirs in DWRSIM does not allow it to re-operate projects other than the SWP and CVP, thus sacrificing real world flexibility which would allow the system to meet more protective standards with less impact on water supplies. Finally, due to greater late summer pumping in Study 3, DWRSIM shows significantly higher releases of carriage water from storage, erroneously contributing to needlessly high reductions in exports.

2. Transfers

DWRSIM does not attempt to measure the potential for water transfers to mitigate impacts to water users of more protective standards. The modeling studies show that there is considerable unused pumping capacity, especially in dry and critical years, which would be available for water transfers.

---

[16] DWRSIM does recognize the importance of antecedent conditions in its use of the San Francisco Estuary Project equation to estimate the X2 isohaline position.

While much attention has been given to so-called "north-to-south" transfers, water could be transferred from a user on the San Joaquin River to another south-of-delta user without triggering concerns over cross-Delta transfers and QWEST violations. Results from DWRSIM show a 71 year average availability such "south-to-south" transfers of 1239 TAF. The averages for dry and critical years are, respectively, 1138 TAF and 2791 TAF. Table 1 shows a summary by month and year type of available pumping capacity at the Banks and Tracy pumping plants.

Table 1

Unused Pumping Capacity (TAF)

Study 3 (EPA + NMFS)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
WET	176	56	31	85	150	269	0	0	0	4	38	70	877
AN	251	101	60	14	152	171	0	0	0	0	50	149	947
BN	228	109	123	48	93	77	0	0	0	0	23	165	866
DRY	231	179	108	85	127	62	2	0	0	33	83	229	1138
CRIT	342	325	254	108	243	208	38	11	103	301	436	423	2791
AVG	234	141	105	72	148	162	6	2	16	55	108	189	1239

Delta reverse flow requirements (measured by the "QWEST" variable) limit the availability of transferred water from the north. When the QWEST requirement is constraining, only that increment of Sacramento River water which would flow through the Delta cross channel could be exported without releasing additional water to meet this requirement. Assuming that no water which would require such additional releases is transferred, the average "north-to-south" transfer potential over the 71 year base period would be 952 TAF. This includes a potential for 816 TAF of transfers in dry years and 2023

TAF in critical years. Table 2 shows a summary of available pumping without violating the QWEST constraint.

Table 2

Pumping Available with QWEST Constraint (TAF)

Study 3 (EPA + NMFS)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
WET	176	22	31	85	137	209	0	0	0	4	38	70	771
AN	251	41	22	14	147	158	0	0	0	0	50	149	830
BN	228	40	46	34	50	34	0	0	0	0	23	165	618
DRY	231	80	44	40	41	31	2	0	0	33	83	229	816
CRIT	342	145	95	39	46	45	38	11	103	301	436	423	2023
AVG	234	60	46	49	85	102	6	2	16	55	108	189	952

Finally, water transfers to urban Southern California would be maximally limited in a worst-case scenario under which all transferred water would come from the north and be pumped directly to the urban Southern California service area without any possibility of interim storage in San Luis reservoir or any other site. Such transfers would be additionally restricted by pumping limitations at Edmonton pumping plant. In such a worst case the 71 year average availability for transfer water is 646 TAF, which includes 621 in dry years and 1313 in critical years. Table 3 shows a summary of additional pumping capacity under this scenario.

Table 3

Direct Pumping Availability from Sacramento Valley to Southern California (TAF)

Study 3 (EPA + NMFS)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANN
WET	123	18	20	36	66	98	0	0	0	4	34	68	467
AN	177	41	22	14	61	74	0	0	0	0	44	120	553
BN	162	40	43	19	30	27	0	0	0	0	19	139	479
DRY	157	73	43	31	32	23	2	0	0	28	61	170	621
CRIT	198	120	89	38	44	45	38	11	103	182	223	223	1313
AVG	157	53	41	29	47	56	6	2	16	36	68	136	646

3. Re-operation

A crucial element in the estimate of impacts is the capability of the DWRSIM model to simulate re-operation of system reservoirs in a way which efficiently meets environmental requirements. DWRSIM does have the capability to re-operate those reservoirs which are represented in its input data set, and operations studies show that this limited re-operation capability makes considerable difference. The ability of DWRSIM to meet this objective fully is limited in two ways: 1) only a subset of the available reservoirs for operation are included in the model; and 2) DWRSIM does not have clearly defined criteria for optimizing operation of the reservoirs which are included in the model.

The focus of the operations studies using DWRSIM is to simulate how the storage and pumping of water would operated under: 1) a fixed level of development and demand; 2) specified environmental constraints; and 3) a repeat of the hydrology from the period 1922-1992. Impacts are determined by the reduction in delta export capability from the base (D1485) simulation to the alternative simulation.

The DWR analysis shows a significant amount of re-operation of reservoirs, among *those reservoirs which are included in the model.* If there were no re-operation, impacts to delta exports as a result of the X2 standard would be higher. These higher impacts could be calculated by subtracting the additional outflow required to meet the new standards from the exports in the base simulation. However, the simulation of the proposed standards (Study 3) shows that the reduction in exports is not as great as the increase in outflow, and demonstrates that there is flexibility in operating reservoirs which can reduce the impact of proposed standards. Obviously, however, DWRSIM's ability to optimize reservoir operation and carryover storage is limited by those reservoirs which are modeled in DWRSIM.

DWRSIM simulations indicate that on average, delta outflow under the Study 3 scenario increases by 1058 TAF above D1485 levels in February-June. However, Study 3 also assumes an average of an additional 158 TAF are available from the San Joaquin River (to meet salmon and striped bass requirements), so only an additional 900 TAF is released from reservoirs modeled in DWRSIM to provide additional spring Delta outflow.

However, even though 900 TAF of additional water is released to meet the new standards, overall Delta exports are decreased only by an average of 534 TAF, and, as modeled, impacts to agricultural and urban users average only 692 TAF (reduced exports plus increased San Joaquin River inflow). This is less than 70% of the February-June increased outflow requirements. Increased outflow is not matched by equivalent export reductions because DWRSIM is able to make up for some of the lost exports by increasing exports in January, July, August and September (See Figure I). Similarly, DWRSIM offsets some of the increases in February through June outflow by reducing outflow between October and January.

DWRSIM thus shows that "re-operation" of reservoirs it models (mainly Shasta, Oroville, Folsom, Clair Engle, and San Luis) can lessen reductions in Delta exports resulting from the proposed standards. Re-operation of these reservoirs clearly indicate that water supply impacts of increased outflow requirements need not be as great as those requirements[17]. This strongly suggests that re-operation of other reservoirs in the watershed could further increase system flexibility in such a way that water supply impacts might be even lower. Unfortunately, DWRSIM does not model these reservoirs, but merely models "fixed" inflows from each of them. This limitation, and the resulting lack of flexibility, almost certainly results in DWRSIM overstating water supply impacts.[18]

4. <u>Carriage Water</u>

Normal use of DWRSIM includes calculations of "carriage water" necessary to supplement required Delta outflow in order to comply with salinity requirements. Carriage water tables are produced by the MDO (Minimum Delta Outflow) model and incorporated into DWRSIM. MDO estimates the Delta outflow necessary to reach salinity objectives at Rock Slough (and other points) principally as a function of the various inflows to the Delta and pumping exports at the Banks and Tracy pumping plants. The data represented by these curves have been shown not only to be incorrect but to overestimate the amount of water required to meet salinity objectives by two or three times[19].

DWRSIM uses the carriage water tables by checking export levels against Delta outflow. For a specified level of export (in a particular month and water type year), the carriage water table estimates a level of Delta outflow which is necessary to meet salinity objectives. If the minimum required Delta outflow is less than this value, then either carriage water from storage must be released or exports must be reduced.

For some comparative operation studies, the argument that any such error is inconsequential may have some validity, but this example clearly does not apply in

---

[17] There is no guarantee that either the D1485 or alternative simulations are optimized within the context of the model or that either simulation shows a reasonable representation of system operations under either set of criteria.

[18] This analysis also shows that spreading the responsibility for meeting Bay/Delta standards among all water users in the watershed will not only result in lower proportionate water supply impacts on users but also will lead to lower <u>overall</u> impacts.

[19] WRINT-CCWD-9 and WRINT-CCWD-10

this case. Errors do apply in all studies, but are significantly greater in those studies involving EPA's proposed criteria. Annual average carriage water releases from storage in Study 3 are 313 TAF, compared to 127 in the D1485 case. Figure 2 illustrates the projected increase in "Carriage Water from Storage" on a month by month basis. DWRSIM estimates these greater carriage water requirements in the alternative case because spring pumping restrictions defer pumping to the July 15-September 30 period where Delta outflow requirements are smaller than in the spring and DWRSIM's carriage water curves are more often binding. Of the 313 TAF which might not need to be released from storage, 287 TAF are in the July-September period and 91 TAF could be directly exported without violating QWEST constraints or pumping limits. The remainder would be kept in storage, increasing carryover for reliability and temperature benefits and possible future deliveries. Thus, by overestimating carriage water needs, the DWRSIM analysis further overstates likely water supply impacts of the proposed standards.

B. <u>Use of water transfers and environmental water acquisitions financed by restoration fund monies can greatly reduce the economic costs of new standards.</u>

The analysis of economic impacts on agricultural and urban water users in EPA's Regulatory Impact Assessment (RIA) is generally sound, especially in its reliance on the use of water transfers to reduce those impacts.[20] The analysis presented in the preceding section demonstrates that there will be significant physical capacity available for transfers under project operations to meet the proposed standards. Such transfers can be an economically efficient way of reallocating water supplies to help meet improved Bay/Delta standards at the lowest cost to existing water users.

Evidence presented to the State Water Resources Control Board during both its 1987 and 1992 hearings demonstrates the role that water transfers can play to reduce

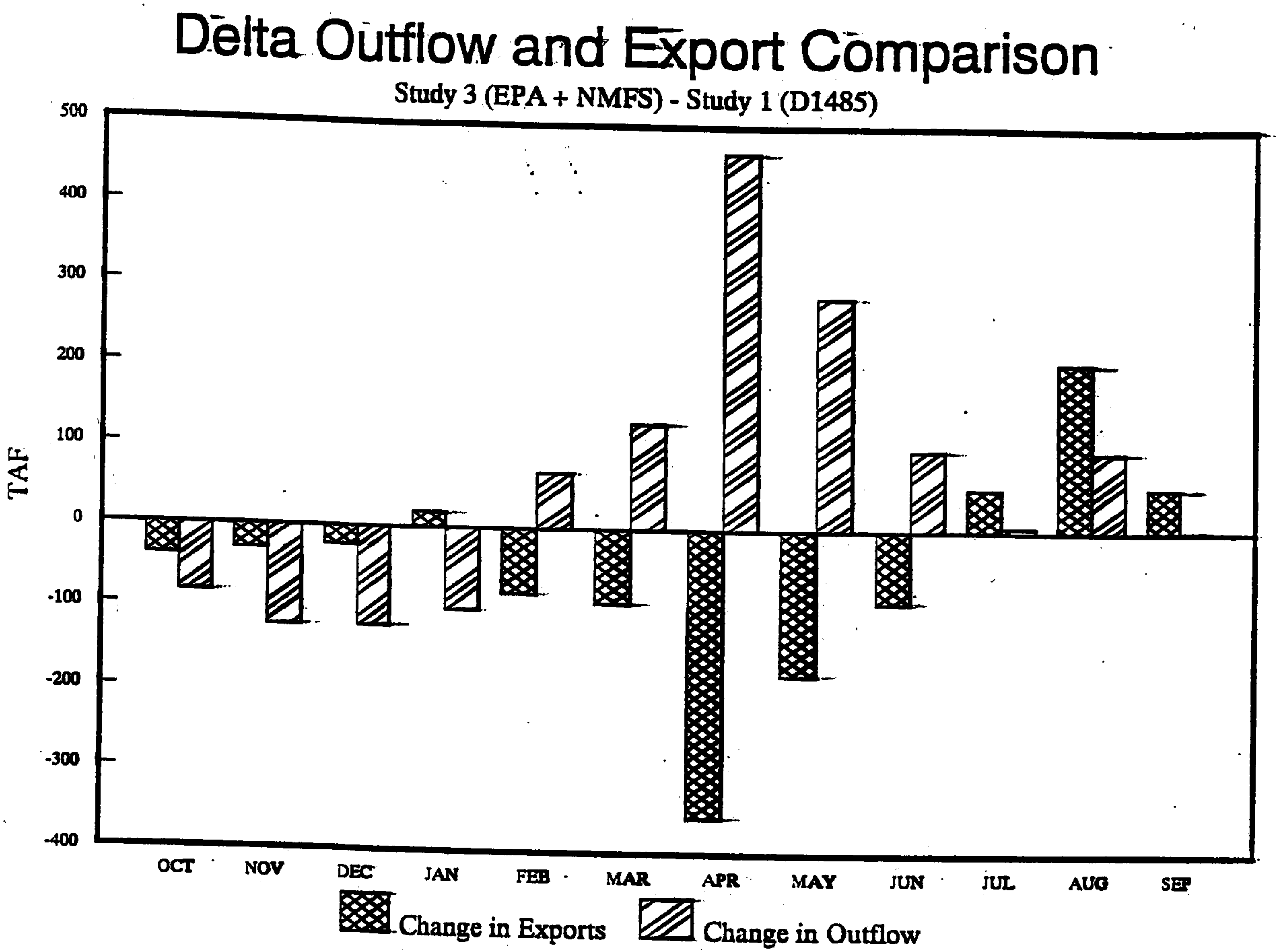
[20]Due to the availability of transfers to urban agencies, the RIA's Scenario 1 for estimating urban impacts, which assumes that urban agencies obtain <u>no</u> transferred water to make up for any supply reductions, is completely unrealistic (even assuming <u>arguendo</u> that the high per acre-foot value for lost consumer surplus used in the analysis is correct).

economic impacts on consumptive uses by helping to ensure that the higher valued uses important to the state's economy are maintained. See EDF Exhs. 6,7 (1987) (Testimony of Dr. Richard Howitt); WRINT-EDF-6, 8. (1992) (Testimony of Dr. Howitt). In particular, experience with the 1991 drought water bank confirmed the significant potential and economic benefits associated with transfers, and indicates that transfers would be an effective mechanism for water users to respond to improved Bay/Delta standards in a cheap and efficient manner. See WRINT-EDF-6 at pp. 6-8; WRINT-EDF-8. The potential and benefits of transfers were again confirmed in 1993 when Westlands Water District was able to secure over 200,000 af of transferred water to help make up for reductions in Central Valley Project deliveries.[21]

An additional mechanism for helping to achieve low-cost implementation of improved standards is to use monies from the Restoration Fund created under the Central Valley Project Improvement Act to acquire water for Bay/Delta protection purposes. Using restoration fund monies would help target lower-valued uses as the source of water to meet new standards and would reduce impacts on consumptive users. This approach would also have the additional benefit of not being restricted by any conveyance limitations (for example when QWEST restrictions might otherwise limit north-to-south transfers) because water could be transferred to meet outflow needs. Creation of a state restoration fund analogous to that created by the CVPIA could provide additional benefits by augmenting the money available for environmental needs.

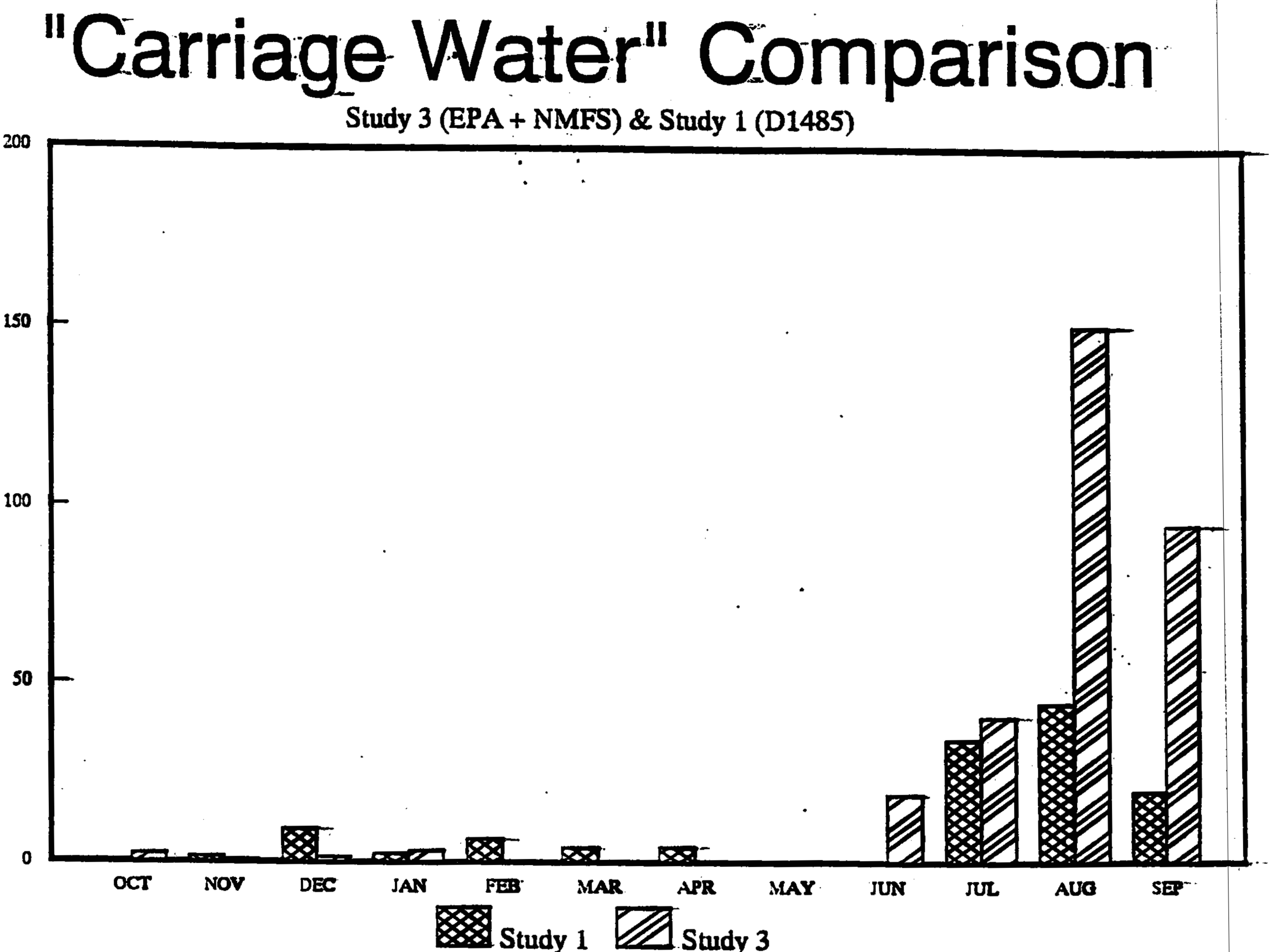
[21]<u>See</u> The Westside Water Report, July 1993, which documents at least 145,000 acre-feet of transfers at that time. The SWRCB subsequently approved additional transfers, including one from Merced Irrigation District for up to 60,000 acre-feet (SWRCB Order dated August 19, 1993) and one from the Department of Water Resources for up to 92,500 acre-feet (SWRCB Order dated September 9, 1993).

Figure 1



Delta Outflow and Export Comparison
Study 3 (EPA + NMFS) - Study 1 (D1485)
500
400
300
200
100
0
-100
-200
-300
-400
TAF
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
Change in Exports
Change in Outflow

Figure 2



"Carriage Water" Comparison
Study 3 (EPA + NMFS) & Study 1 (D1485)
200
150
100
50
0
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
Study 1
Study 3

Comparison of Salinty at Martinez
of Proposed EPA Standards
with D1485 Standards and Historic Outflow

Prepared by Spreck Rosekrans, EDF
March 10, 1994

The attached graphs show the differences between predicted salinities which would be achieved at Martinez under a repeat of the hydrologic period 1922-1992 under 1) D1485 standards and 2) EPA proposed standards with estimates based on actual delta outflow from the period 1940-1975. The predicted salinities are based on total delta outflow as estimated in DWRSIM studies 1 (D1485 standards) and 2 (EPA standards) as conducted by the California Department of Water Resources modeling staff. The actual salinities are based on historic delta outflow as reported in DWR Exhibit 27 (1987 SWRCB Bay Delta Hearings).

Estimated salinities, measured in terms of electroconductivity (EC), are first calculated by using the Delstat formula to convert monthly mean outflow in cubic feet per second to micromhos/cm at mean tide. Mean tide salinities are then converted to mean high tide salinities using a linear adjustment[1].

The Delstat formula computes EC as follows:

$EC = e^x * cfs1^y * cfs2^z$ where

$e = 2.71828...$

$x = 13.38$ for flows below 15,000 cfs and 18.64 for flows above 15,000 cfs

cfs1 = current month's average outflow in cfs

$y = -.204$ for flows below 15,000 cfs and $-.616$ for flows above 15,000 cfs

cfs2 = last month's average outflow in cfs

$z = -.189$ for flows below 15,000 cfs and $-.320$ for flows above 15,000 cfs

Mean high tide salinity is computed from mean tide salinity by the linear adjustment:

$EC2 = m * EC1 + b$ where

EC2 = mean high tide salinity

EC1 = mean tide salinity

---

[1] The linear adjustment is based on the chart "mean Tide to Mean High Tide Relationship", 7/2/92, Philip Williams & Associates

$m = 1.011235$

$b = 1461$

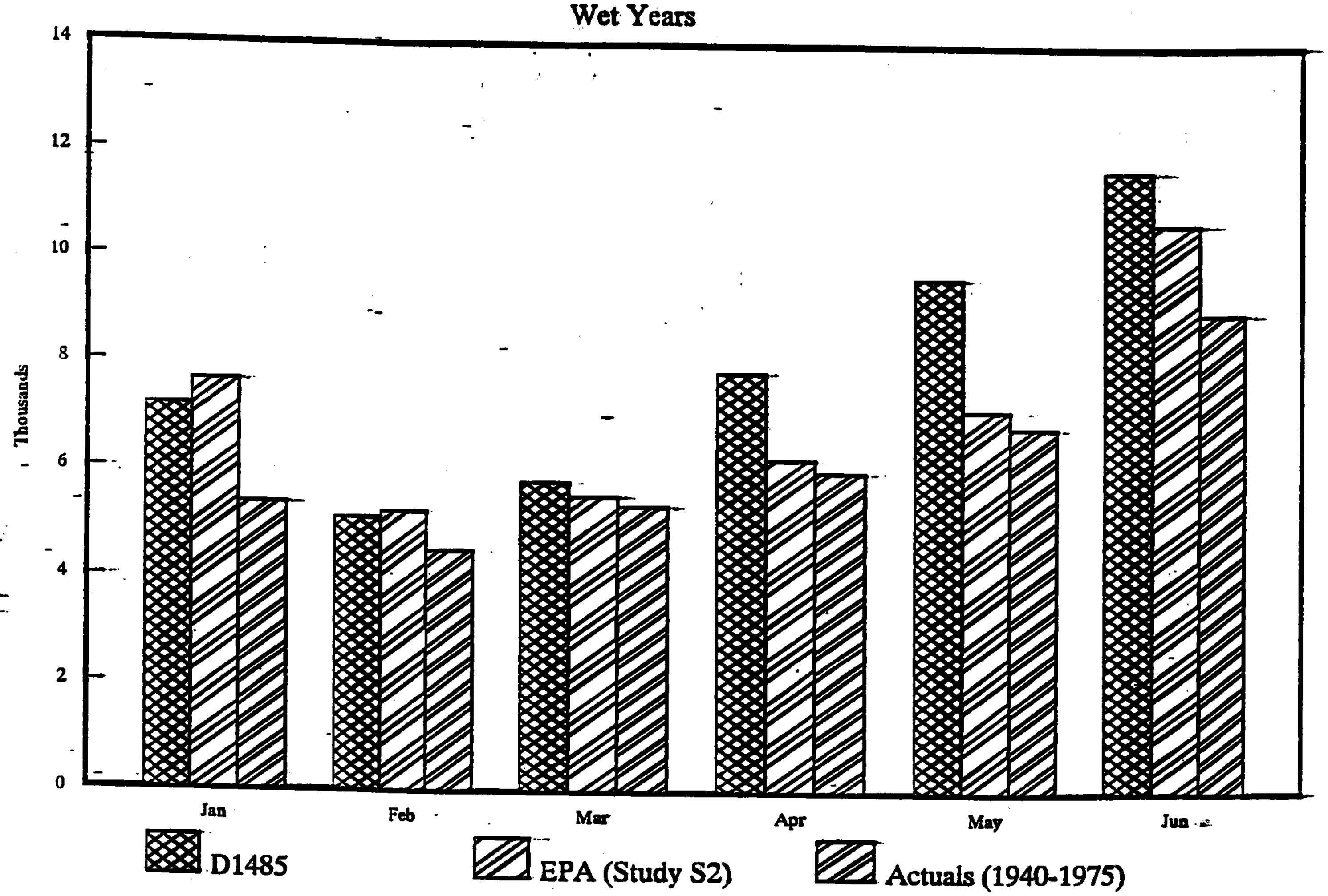
Five graphs are attached, representing the five water year types (Wet, Above Normal, Below Normal and Critical) based on the river index using the 40-30-30 criteria. Each graph shows average salinities for the specified year type in the months January through June. Note that there were no Critical Years in the 1940-1975 period.

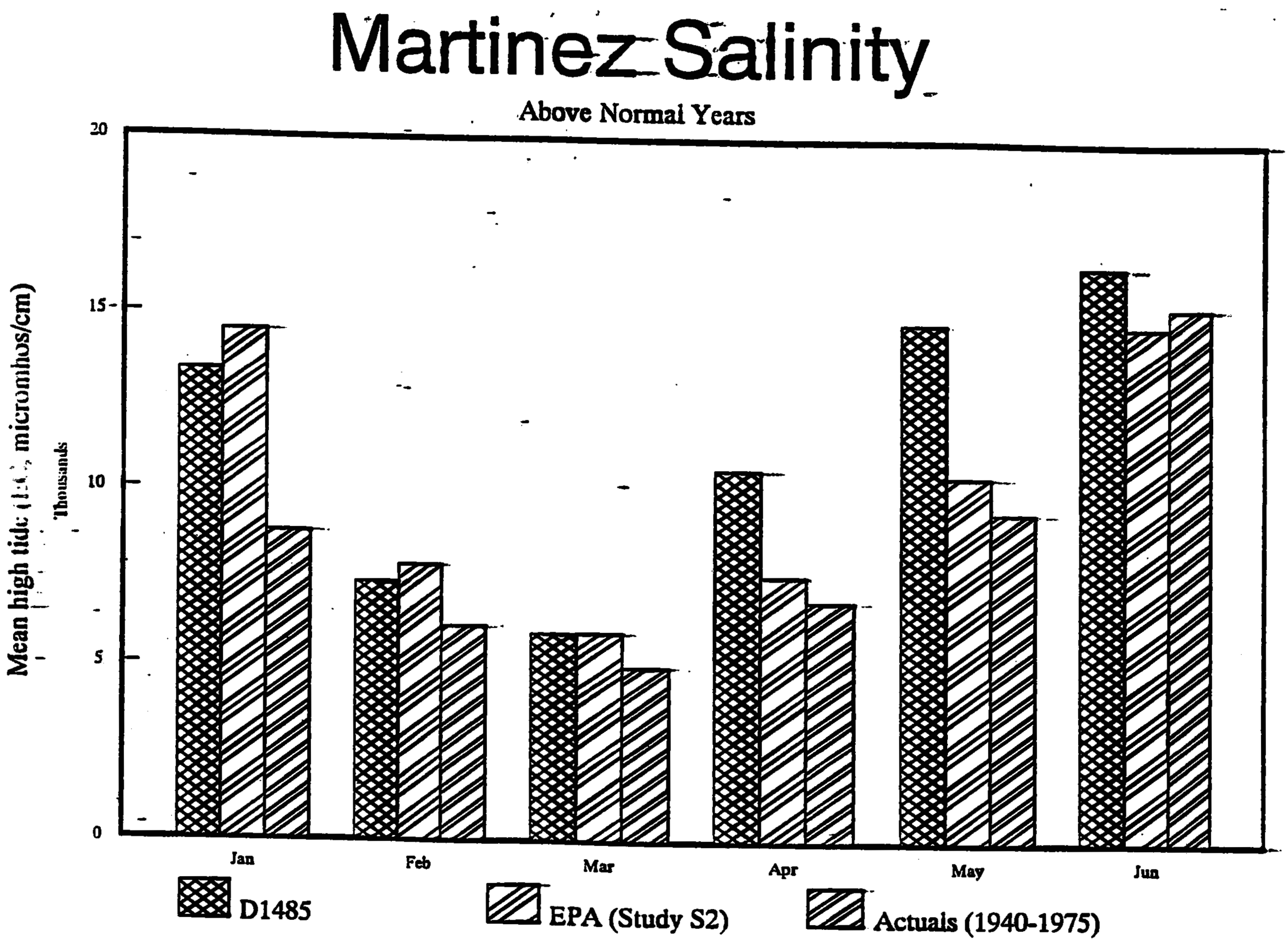
In general the graphs show that EPA standards will help to meet the actual salinity levels from the 1940-1975 period for the months February through June, but that the actual levels will not be attained by the EPA proposed standards. A notable exception is that in June of Above Normal, Below Normal and Dry years, the salinity under EPA would be lower than in the historic period.

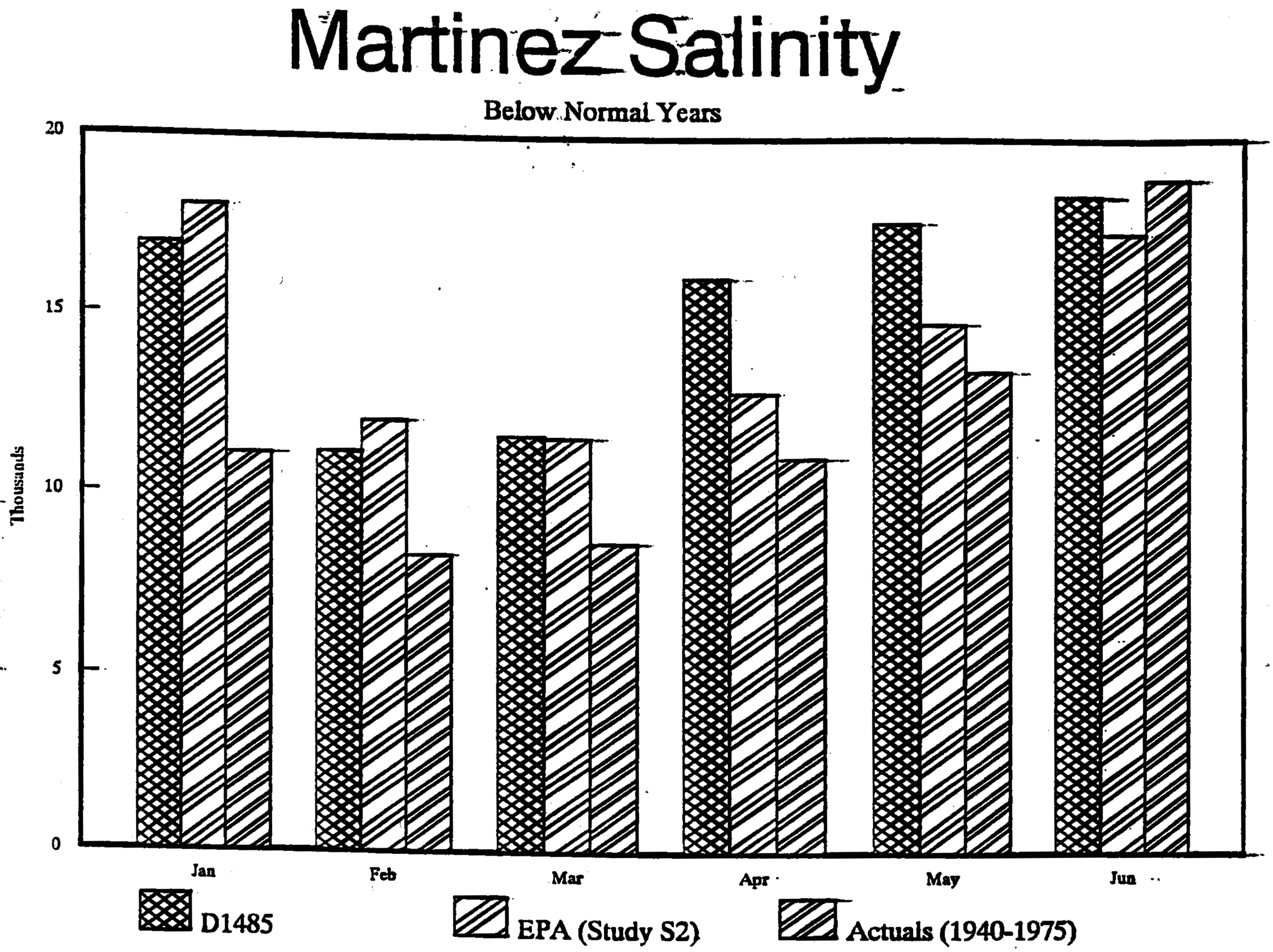
In January of all year types, the proposed EPA standards would result in higher salinities than those under D1485 standards, as EPA's X2 standard is not implemented until February and reservoirs are modeled to minimize releases until that month.

Martinez Salinity

Wet Years

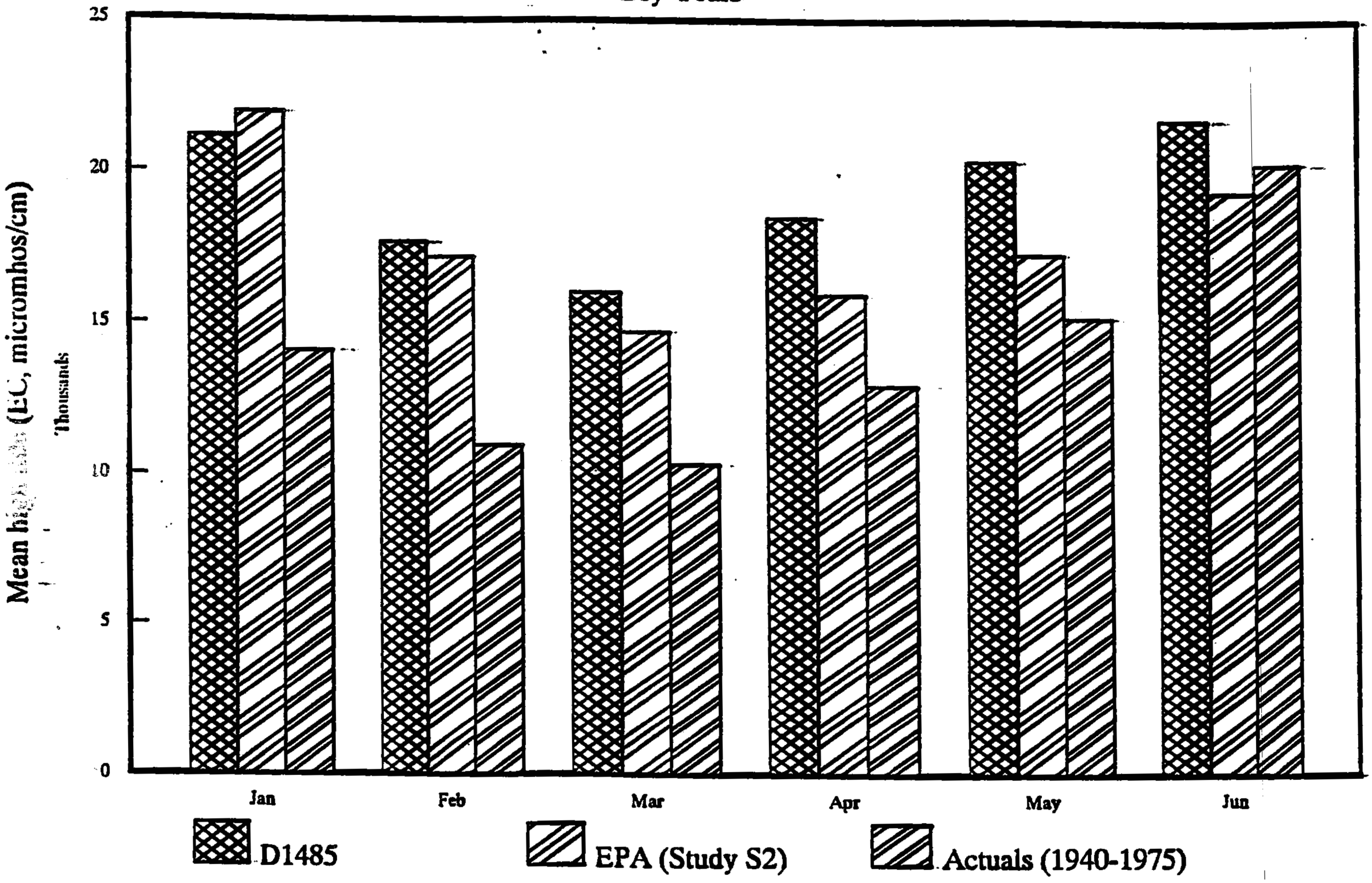



Martinez Salinity
Above Normal Years
Mean high tide (EC, micromhos/cm)
Thousands
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
D1485
EPA (Study S2)
Actuals (1940-1975)


Martinez Salinity
Below Normal Years
20
15
10
5
0
Thousands
Jan
Feb
Mar
Apr
May
Jun
D1485
EPA (Study S2)
Actuals (1940-1975)

Martinez Salinity

Dry Years



Martinez Salinity