The Bay Institute
of San Francisco

COMMENTS OF THE BAY INSTITUTE OF SAN FRANCISCO ON PROPOSED US EPA RULE: WATER QUALITY STANDARDS FOR SURFACE WATERS OF THE SACRAMENTO RIVER, SAN JOAQUIN RIVER, AND SAN FRANCISCO BAY AND DELTA

submitted by:

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March 10 , 1994

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THE BAY INSTITUTE OF SAN FRANCISCO
ON PROPOSED US EPA RULE:
DRAFT WATER QUALITY STANDARDS FOR
SURFACE WATERS OF THE SACRAMENTO RIVER,
SAN JOAQUIN RIVER, AND
SAN FRANCISCO BAY AND DELTA

These comments and attached supporting documents concerning the proposed rule by the U.S. Environmental Protection Agency (EPA) on water quality standards for surface waters of the Sacramento River, San Joaquin River, and San Francisco Bay and Delta of the State of California, published in the Federal Register on January 6, 1994, are submitted by The Bay Institute of San Francisco.

EPA's proposed rule will when implemented result in a significant improvement in water quality and an associated increase in protection for aquatic life and wildlife uses of the San Francisco Bay/Delta estuary. The proposed rule is necessary -- and long overdue -- because the Bay/Delta ecosystem has been and continues to be severely degraded by loss and alteration of spawning and rearing habitat, changes in estuarine circulation including the amount and timing of freshwater outflows, entrainment of aquatic organisms by water project diversion points, and other factors. Despite the clear evidence of ecosystem collapse, the State of California has consistently failed to meet its state and federal obligations to remedy these problems. In order to begin the process of restoring the ecological health of the estuary, The Bay Institute supports timely promulgation of the final rule by EPA.

We also believe, however, that a number of revisions and amendments are necessary to discharge EPA's responsibility under the Clean Water Act to fully protect beneficial uses of the estuary. The Bay Institute recommends that:

(1) an environmental baseline for water quality to protect aquatic life and wildlife uses which reflects earlier, more protective habitat conditions than those characteristic of the late 1960s and early 1970s should be adopted as the explicit general objective of the proposed rule. In addition, EPA should recognize that the level of protection provided by specific criteria may need to exceed any general objective referenced in the final rule where (i) establishing baseline conditions that meet the general objective does not achieve full protection of a beneficial use, or (ii) use of biological criteria requires achieving goals that reflect unimpaired or least impaired water quality conditions.

(2) compliance with the Estuarine Habitat criterion should be required at Roe Island for a period longer than 33 days in dry years, 0 days in critically dry years, and 0 days in years without a trigger event, in order to ensure adequate low salinity habitat in Suisun Bay and in San Pablo Bay. The absence of any required days at Roe Island in critically dry years or in years without a trigger event under the proposed rule is not sufficiently

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protective of aquatic resources. A new criterion should also be added at Middle Ground in order to provide a safety net when the Roe Island criterion is inadequately invoked.

(3) additional water quality standards should be promulgated to protect the Estuarine Habitat, Wildlife Habitat, Rare and Endangered Species and other beneficial uses of the brackish tidal wetlands of Suisun Bay.

(4) additional water quality standards should be promulgated to protect Estuarine Habitat and other beneficial uses of San Pablo Bay.

(5) additional water quality standards should be promulgated to protect Estuarine Habitat, Shellfish Harvesting and other beneficial uses of South San Francisco Bay.

(6) two separate standards to protect fall-run chinook salmon should be promulgated, including (i) Cold Freshwater Habitat: a temperature criterion of no greater than 65 degrees F. at Freeport on the Sacramento River and Vernalis on the San Joaquin River from April 1 to June 30 and from September 1 through November 30, and (ii) Fish Migration: revised salmon smolt survival indices to provide protection at the 1940 level of development in order to reflect least impaired conditions as required for biological criteria.

I. ENVIRONMENTAL BASELINE

In the Interagency Statement of Principles signed in June 1992, EPA, the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) recommended "a goal of restoring habitat conditions to levels which existed during the late 1960s and early 1970s ... because it is consistent with the mandates of State and Federal antidegradation requirements, and generally reflects conditions that occurred in the Delta before fish habitat and populations began to experience the recent significant decline." This goal is generally reflected in EPA's proposed rule, although the agency has adjusted its methodology in circumstances where it has concluded that provision of late 1960s, early 1970s habitat conditions would not be sufficient to protect beneficial uses (as in the case of fall-run chinook salmon) or that a longer-term dataset is more useful for formulating workable criteria (as in the case of the 1940-75 baseline used in developing the Estuarine Habitat standard).

It must be emphasized that federal (1975) and state (1968) antidegradation policies merely establish the floor for environmental baseline protections by requiring that existing beneficial uses at the time of the antidegradation milestone continue to be protected, as specified in EPA's water quality standards regulations on antidegradation: "existing instream uses and the level of water necessary to protect the existing uses shall be maintained and protected" [40 CFR 131.B.12 (a) 1]. Protecting beneficial uses that existed at the time of the antidegradation milestone is not to be understood as limiting the *level of protection* for existing beneficial uses to those conditions that existed at the time of the antidegradation milestone. According to EPA's Water Quality Standards Handbook, "water quality [for aquatic life and wildlife uses] should be such that it results in no mortality and no significant growth or reproductive impairment of resident species. Any lowering of water quality below this full level of protection is not allowed" (EPA, 1993: 4.4.2). If water quality conditions at the time of the

antidegradation milestones were not adequate to protect existing beneficial uses, then the Clean Water Act requires standards that provide water quality conditions which *do* fully protect those beneficial uses.

It is our position that full protection of the beneficial uses of the estuary will not be achieved using habitat conditions of the late 1960s and early 1970s as the environmental baseline. Although this period predates the trend toward, or experience of, population collapse characteristic of many estuarine and anadromous species beginning in the late 1970s and early 1980s, nonetheless significant alterations in estuarine habitat and accompanying major declines in species population levels were already beginning to occur in the late 1960s and early 1970s.

Delta export, which remained below 2 million acre-feet (MAF) in every year between 1951 and 1967, increased dramatically during the late 1960s and early 1970s as the State Water Project became operational and combined federal-state water project deliveries increased. In 1968, 2.6 MAF was exported from the Delta, twice the amount exported in the previous year; in 1969, 3 MAF; and in 1974, 4.4 MAF.

Concurrently, populations of striped bass and longfin smelt, natural production of winter, spring and fall-run salmon, and possibly other species experienced serious declines which began in the late 1960s and continued steadily through the early 1970s, at least partly as a result of increased salinities, reduced flows and other habitat alterations from expanded water project operations (Stevens et. al., 1985; CDFG, 1987; SWRCB, 1988, 1992; FWS, 1992b; see figures 1, 2 and 3). The degree to which conditions deteriorated in the Bay and Delta during this period is reflected in a finding by the SWRCB that adult striped bass abundance had declined from 3 million in the early 1960s to 1.7 million in the late 1960s (SWRCB, 1992). Furthermore, it seems likely that the accelerated rate of decline observed in many estuarine populations immediately following the 1976-77 drought reflects an increased vulnerability to stress as a result of the highly altered habitat conditions occurring previous to the drought, a situation which was then exacerbated by subsequent increases in Delta export levels and later by drought conditions.

Significant water quality degradation, aquatic habitat destruction and fishery population declines were occurring during the late 1960s and early 1970s. Using this period as the baseline contradicts EPA's own guidance that "no activity is allowable under the antidegradation policy which would *partially* or completely eliminate any existing use" (emphasis added; EPA, 1993: 4.4.2). We therefore recommend that EPA's explicit goal for the *general* level of protection to be achieved in its final rule be revised to more appropriately ensure habitat conditions that existed in the estuary prior to 1968. A general interim (see below) level of protection would at the least replicate habitat conditions during the 1940s, 1950s and early 1960s, when many fish species experienced more stable population levels over a long period of time. In some specific cases, even more protective baseline levels may be required (see discussion below of meeting Estuarine Habitat criteria at Roe Island).

We agree with EPA's conclusion that its proposed rule will not fully offset the impacts of water development on the biological communities of the estuary, and that such a goal is the appropriate level of protection for long-term measures to protect the estuary by the SWRCB and other agencies, as is consistent with the findings of the First California Court of Appeal in the consolidated Delta cases that the SWRCB's obligation to protect water quality

is not limited by existing water rights (*U.S. v. SWRCB* and seven other cases, 1986, also known as the "Racanelli decision"). EPA's final rulemaking will not relieve the state of its long-term responsibility to achieve this more stringent level of protection.

II. ESTUARINE HABITAT CRITERIA

The Bay Institute supports the promulgation of a standard that requires achieving near bottom salinities of 2 parts per thousand (ppt) or less at Roe Island, Chipps Island and the confluence of the Sacramento and San Joaquin Rivers between February 1 and June 30 in order to protect Estuarine Habitat in the critical nursery areas of Suisun Bay. Adoption of this standard will provide direct, evident benefits to a number of fish species which require low salinity habitat in the broad, shallow reaches of Suisun Bay, including those estuarine species which are largely restricted to brackish and freshwater environments, such as Delta smelt, and those anadromous species which utilize low salinity habitat as nursery areas, such as striped bass. Furthermore, the location of the 2 ppt bottom salinity isohaline is "closely associated with the population size of estuarine organisms at all trophic levels, as well as with the supply of organic matter to the food web from primary production and riverine loading" (SFEP, 1993). A substantial body of scientific evidence exists to confirm the food chain value of the entrapment zone, where these low near bottom salinities occur, and the importance of its location in the Suisun Bay shallows, regardless of the level of uncertainty as to the causal mechanisms involved. Near bottom salinity serves as the best available indicator of both the location and ecological value of the entrapment zone, as confirmed by a recent study: "...X2 has a clear and pervasive relationship with estuarine biological properties...(and) has unambiguous relationships with many habitat variables including the salinity distribution and net outflow from the Delta" (Jassby et. al., draft). The same study also concludes that "nowhere have the connections between river inflow or salinity distribution and estuarine resources been shown to be operative for so many types of organisms over such a long time period as in the San Francisco Bay/Sacramento-San Joaquin Delta estuary."

Compliance with a salinity-based Estuarine Habitat standard simply ensures that habitat conditions associated with acceptable levels of species abundance are provided. Obviously, other factors may affect species abundance and decrease opportunities to utilize available habitat, such as the effects of flow fluctuations on transport of eggs, larvae and juveniles and the direct entrainment of organisms at diversion points (Jassby et. al., draft ms.). Increases in river flows, decreases in upstream diversions and Delta export, and other measures not based on salinity may also be necessary to provide an adequate level of protection to estuarine and anadromous species. These management considerations in no way detract from the case for a salinity-based Estuarine Habitat standard. Adoption of the salinity-based standard, in conjunction with such complementary measures as requirements for increased flow and restrictions on export and diversions, can provide a more comprehensive framework for ecosystem management.

While supporting promulgation of this standard, we believe that a number of revisions and amendments are in order to ensure that EPA's responsibilities under the Clean Water Act to fully protect beneficial uses are discharged. The need to revise the proposed criteria to maximize provision of low salinity habitat in Suisun Bay is discussed below. Furthermore, in its September 3. 1991 letter to the SWRCB regarding the 1991 Water Quality Control Plan, EPA

disapproved the absence of salinity standards to protect fish and wildlife uses in the Suisun, San Pablo and San Francisco Bays and Suisun Marsh. However, the proposed rule would establish a salinity standard to protect Estuarine Habitat in Suisun Bay only. As noted above, the proposed criteria for Suisun Bay are of great value because they increase protection of the most critical nursery habitat for aquatic species in the estuary, and, in addition, provide substantial incidental benefits to other important habitat areas. Nonetheless, the extremely important ecological values provided to aquatic and wetland species by the provision of adequate Estuarine Habitat in San Pablo Bay, South San Francisco Bay and the brackish tidal wetlands of Suisun Bay will not be directly guaranteed under the proposed rule. In order to remedy the absence of existing protections for beneficial uses of these areas and therefore fully discharge its responsibilities under the Clean Water Act, EPA should in its final rulemaking promulgate salinity-based standards for San Pablo Bay, South San Francisco Bay and the Suisun Bay tidal marshes. Specific recommendations for these additional Estuarine Habitat criteria are also discussed below.

A. Environmental baseline

EPA did not formulate its Estuarine Habitat criteria to strictly replicate conditions of the late 1960s and early 1970s, but instead used a longer-term 1940-75 baseline period. While agreeing with EPA that a longer time period should be used as the baseline for calculating compliance with the standard, The Bay Institute does not agree that an adequate level of protection of Estuarine Habitat will be achieved by criteria that reflect habitat conditions which existed subsequent to 1967, as discussed earlier. In fact, protecting beneficial uses may require positioning the 2 ppt isohaline at Roe Island for a number of days in excess of that number which occurred in drier years using either the 1940-75 or 1940-67 baseline period, because of the current absence of suitable habitat in upstream areas (see comments below).

B. Roe Island standard

The Bay Institute is concerned that the proposed Estuarine Habitat criteria fail to require a sufficient number of days of compliance at Roe Island in dry and critically dry years, or when the standard is not triggered by a storm event, to ensure that adequate low salinity habitat is provided to protect aquatic resources. Roe Island is the most ecologically significant of the three compliance stations proposed by EPA for the Estuarine Habitat criteria. Because of Roe Island's central location in Suisun Bay, attainment of the Roe Island criteria is strongly linked to the maxima of low salinity habitat. Placing the 2 ppt salinity isohaline at Roe Island ensures that, as the entrapment zone and X2 fluctuate in position upstream and downstream in response to the tidal prism, low salinity habitat is maintained in the broad, shallow reaches of Suisun Bay and its sub-embayments, Grizzly and Honker Bays.

Attaining the maxima of low salinity habitat in central Suisun Bay provides both direct and indirect benefits to numerous aquatic organisms. Direct benefits are provided for species which have clear low salinity habitat requirements, such as Delta smelt. Suitable rearing habitat for Delta smelt occurs when the 2 ppt isohaline occurs in Suisun Bay, i.e., the area west of Chipps Island (FWS, 1994), and Delta smelt abundance has been found to be most closely correlated to the occurence of the 2 ppt isohaline in the reach from Roe Island to Middle Ground (Herbold, 1994). Indirect benefits are provided for species whose abundance is correlated to the location of low salinity

habitat. For most estuarine species except mollusks, abundance increases significantly as the location of X2 moves downstream of Chipps Island to central and western Suisun Bay. Abundances of so-called "estuary dependent" species (Crangon franciscorum, longfin smelt, starry flounder) remain low when the 2 ppt isohaline salinity isohaline is upstream of Roe Island for extended periods (SFEP, 1993; Jassby et. al., draft).

Meeting the criteria at Chipps Island alone in critically dry years or in years when the Roe Island standard is not triggered fails to ensure adequate habitat in Suisun Bay. Fluctuation of the 2 ppt isohaline in response to the tides means that the zone of low salinities will often be located upstream of Chipps Island in areas of unsuitable habitat. The abundance of most estuarine species decreases markedly as X2 moves upstream of Chipps Island (SFEP, 1993), and values for the relationship between 2 ppt isohaline location and Delta smelt abundance have been shown to be negative upstream of Chipps as well (Herbold, 1994).

Requiring compliance at Roe Island not only maximizes habitat placement in Suisun Bay, but also provides important corollary benefits to aquatic resources downstream. Failing to achieve 2 ppt near bottom salinities at Roe Island results in the loss of ecologically important brackish water habitat in San Pablo Bay. The Roe Island criterion therefore functions as a dual-purpose standard which protects Estuarine Habitat in both Suisun and San Pablo Bays. (We recommend that a complementary Estuarine Habitat standard for San Pablo Bay, correlated to the number of days the 2 ppt salinity isohaline is achieved at Roe Island, should also be promulgated; see our comments below on additional criteria to protect Estuarine Habitat in San Pablo Bay).

During the period before major water development and land conversion altered the estuary, peak flows in even critically dry years could reach substantial levels and position low salinity habitat in Suisun Bay for significant lengths of time. In other critical years, the occurence of severe, extended droughts undoubtedly caused the 2 ppt salinity isohaline to migrate or remain upstream of Suisun Bay during the critical spring spawning, migration and rearing period. At that time, however, suitable secondary habitat was available in the extensive wetlands and backwater sloughs of the Sacramento-San Joaquin River Delta. Subsequent diking and agricultural conversion of the Delta has resulted in the creation of islands and narrower, deeper river channels which are much less suitable as fishery habitat. Criteria which address Estuarine Habitat requirements of aquatic resources must reflect the loss of these upstream refugia.

EPA is properly concerned that the criteria should, as much as possible, reflect natural hydrological variability and respond to changing water-year conditions. Nonetheless, because of the critical importance of low salinity habitat near Roe Island to aquatic resources in Suisun and San Pablo Bays, and the complete absence of alternative habitat areas upstream, there is a limit to the extent to which requiring compliance with the criteria at Roe Island can be compromised. A level of water quality protection for aquatic life and wildlife uses must be maintained to avoid "mortality and...significant growth or reproductive impairment of resident species. Any lowering of water quality below this full level of protection is not allowed" (EPA, 1993: 4.4.2) -- even if it were to result in positioning the 2 ppt isohaline at Roe Island for periods of time exceeding those which occurred in a given baseline period for the criteria as a whole. The Roe Island criteria do not merely optimize habitat conditions for aquatic resources in the estuary, but ensure that appropriate conditions occur in the only suitable nursery habitat available.

There is also an inconsistency between the level of protection the Roe Island criteria are designed to achieve and the level of protection reflected by the triggering requirement, since spring flows have been reduced by increases in water storage and diversion subsequent to the baseline period (whether late 1960s-early 1970s or an earlier period is used). Preliminary analysis suggests that the 2 ppt salinity isohaline was present at or below Port Chicago in only 13 of 24 years in the period from 1968 to 1992 (Jones and Stokes, 1994). Whether the trigger requirement can be adjusted to better reflect baseline conditions should be considered by EPA. A possible alternative approach would be to establish criteria for invoking the Roe Island criteria without a trigger event under certain hydrological and/or biological conditions, for instance, the occurrence of a specified number of previous years during which the Roe Island standard had not been triggered. In any case, allowing noncompliance with the Roe Island standard in all years in which a trigger event does not occur is not sufficiently protective of aquatic resources.

We therefore recommend that compliance with the Estuarine Habitat criterion should be required at Roe Island for a period longer than 33 days in dry years, 0 days in critically dry years, and 0 days in years when the standard is not triggered by a storm event, in order to ensure adequate provision of habitat in central Suisun Bay under all hydrological conditions. The Bay Institute is not at this time prepared to recommend the exact number of days in excess of 33 in a dry year, 0 in a critically dry year and 0 in a year without a trigger event for which compliance with the Estuarine Habitat criteria at Roe Island should be achieved. We would be interested in working with EPA and others to determine a more protective level of compliance with the Roe Island standard.

We also recommend that a new compliance station for the Estuarine Habitat criteria should be added at Middle Ground (69 km). Compliance at Middle Ground would not depend on a trigger event but would occur in all water year types. Middle Ground represents the eastern edge of the reach of Suisun Bay where occurrence of the 2 ppt isohaline is most closely correlated to Delta smelt abundance (Herbold, 1994). Furthermore, recent U.S. Geological Survey studies indicate that significant hydrological exchange may occur between Honker Bay and Grizzly Bay when X2 is located near Middle Ground (Burau, 1994), a relationship that does not appear to be strong when X2 is located further upstream near Chipps Island. Although requiring compliance with the criteria at Middle Ground would provide greater benefits for aquatic resources than at Chipps Island, <u>inclusion of a Middle Ground station would in no way serve as a replacement for the Roe Island standard, because of the latter's strong correlation to the maxima of low salinity habitat in Suisun and San Pablo Bays</u>. The Middle Ground criteria would simply serve as a safety net during those conditions in which the Roe Island standard is inadequately invoked.

C. Suisun Bay unmanaged brackish tidal wetlands

EPA's proposed Estuarine Habitat criteria will provide significant incidental benefits to the unmanaged brackish tidal wetlands of Suisun Bay. Analysis by the Environmental Defense Fund (EDF) and the Natural Heritage Institute (NHI) indicates that implementation of the criteria will result in marsh salinities below the numerical levels recommended by these groups for the critical January to April period in testimony to the SWRCB (Josselyn,

1992; Williams, 1992) except in some months (January and February) of dry and critically dry years (see analysis by EDF, included as appendix 1 to enclosure 1, "Narrative standards to protect Estuarine Habitat, Rare and Endangered Species, Wildlife Habitat, and other beneficial uses of the brackish tidal wetlands of Suisun Bay."). We support the findings of EDF and NHI, and encourage EPA to provide additional protections in January and February of dry and critical years. Because water quality requirements of brackish wetlands plants and animals may not be completely addressed by proposed numeric criteria, however, we are also recommending complementary narrative standards.

To protect Estuarine Habitat, Wildlife Habitat, Rare and Endangered Species, and other beneficial uses of the brackish tidal wetlands of Suisun Bay, The Bay Institute recommends that the following narrative standards should be promulgated in the final rule:

(1) water quality conditions sufficient to achieve a soil salinity gradient in the tidal marshes of Suisun Bay should be maintained within specific limits for the following biological parameters:

(a) populations (aerial extent and/or diversity) and stature of dominant plants of the brackish tidal marshes, including tules (Scirpus acutus and Scirpus californicus) and cattails (Typha spp.).

(b) populations (the number and size of populations, and their demographic stability) of the following rare or endangered plants which are vulnerable to impacts from increased soil salinity: California hibiscus (Hibiscus californicus), Mason's lilaeopsis (Lilaeopsis masonii; state-listed as rare), Jepson's lathyrus (Lathyrus jepsonii), salt marsh bird's beak (Cordylanthus mollis, subspecies mollis; state-listed as rare), and Suisun aster (Aster chilensis variety lentus).

(c) populations of the following sensitive animal species, which are vulnerable to changes in marsh vegetation from increased soil salinity: Suisun song sparrow, river otter, snowy egret, and black-crowned night-heron.

(2) salinity levels in tidal marsh channels should be maintained at sufficient levels to avoid significantly increased mortality to juveniles of animal species with low salinity tolerances (i.e., mallard, northern pintail, cinammon teal, northern shoveler, gadwall and ruddy duck).

For a discussion of the basis for this recommendation, see Bay Institute Enclosure 1, "A salinity standard to protect Estuarine Habitat, Rare and Endangered Species, Wildlife Habitat and other beneficial uses of the brackish tidal marshes of Suisun Bay."

D. Low salinity habitat conditions in wetter years

EPA has invited comments on the proper level of protection that should be provided during wetter periods. See our recommendations below on salinity standards for San Pablo Bay and South San Francisco Bay.

E. San Pablo Bay

(1) Brackish water habitat

EPA observes in the Federal Register notice that:

> ...when near bottom salinities are at or below 2 ppt near Roe Island in Suisun Bay, salinities downstream over the large shallow flats of San Pablo Bay are characteristically less than 18 to 22 ppt... In years when the position of the near bottom 2 ppt isohaline moves downstream at least at far as Roe Island in the spring, the area of low salinity expands into the large shallows of San Pablo Bay and [estuary-dependent] species are more abundant. These areas of San Pablo Bay provide greatly increased habitat within the salinity ranges preferred by juveniles of these species.

Extensive evidence collected by the California Department of Fish and Game (CDFG) and the Interagency Ecological Studies Program for the Sacramento-San Joaquin Estuary demonstrate that brackish water nursery habitat in San Pablo Bay is critical for so-called "estuary dependent" species. For Crangon franciscorum, the habitat index equals the sum of shallow (<10 feet), brackish (1.6-21.6 ppt) water area available from April to June. For longfin smelt, increased abundance has been strongly correlated with increased volume of brackish water habitat, and approximately 90 percent of juvenile longfin smelt were collected over bottom salinities less than 18 ppt. For starry flounder, successful recruitment is linked to increases in brackish water nursery habitat, and over 90 percent of juveniles were collected from shallow areas with bottom salinities less than 22 ppt. Near bottom salinities in San Pablo Bay, which typically range from 0 to 28 ppt, generally remained above 20 ppt during the drought. As a result, these estuary-dependent species were unable to utilize San Pablo Bay as nursery habitat, and concentrated in upstream areas where much less shallow water habitat is available than in San Pablo Bay. All three species have experienced serious population declines since the 1970s and early 1980s (CDFG, 1992b).

In consideration of the critical brackish water habitat requirements of these species utilizing San Pablo Bay, the attainment of lower bottom salinities in San Pablo Bay when the 2 ppt salinity isohaline is located at Roe Island needs to be formally recognized and secured, rather than simply regarded as an incidental benefit. To protect Estuarine Habitat in San Pablo Bay, The Bay Institute recommends that criteria should be promulgated in the final rule requiring that near bottom salinities of no greater than 18 to 22 ppt be achieved in the shallow reaches of San Pablo Bay, for a number of days correlated to the attainment of the 2 ppt salinity isohaline at Roe Island. Alternatively, the Roe Island criteria could be formally adopted by EPA in its final rule as both a component of the Estuarine Habitat criteria for Suisun Bay and as a separate Estuarine Habitat standard for San Pablo Bay.

(2) Phytoplankton abundance

To protect Estuarine Habitat and other beneficial uses of San Pablo Bay, The Bay Institute recommends that, when runoff has moved the 2 ppt near bottom salinity isohaline downstream of Benicia (51 km) for one or more days in wet, above normal and below normal water years, the 14 day running average of the 2 ppt near bottom isohaline be maintained at Middle Point in Honker Bay (69 km) continuously from April 1 to June 30 in order to maximize phytoplankton abundance in San Pablo Bay:

Water year type	Middle Point (69 km)
Wet, above normal and below normal	91 days

For a discussion of the basis for this recommendation, see Bay Institute Enclosure 2, "A salinity standard to protect Estuarine Habitat and other beneficial uses of San Pablo Bay."

F. South San Francisco Bay

To protect Estuarine Habitat, Shellfish Harvesting and other beneficial uses of South San Francisco Bay, The Bay Institute recommends that the 2 ppt near bottom salinity isohaline be maintained continuously at the following locations for the number of days indicated during the month of April in specified water-year types in order to maximize phytoplankton abundance in the South Bay:

Water-year type	Benicia (53 km)	Benicia-Martinez bridge (56 km)	Point Edith (61 km)
Wet	21 days		
Above normal		2 periods of 7 days (during neap tide)	
Below normal			7 days (during neap tide)

Alternative criteria using a salinity stratification index (i.e., >2 ppt/meter) could be used to measure compliance using salinity meters at one or more monitoring stations in South San Francisco Bay itself. The X2 criteria proposed here are intended to maintain an average stratification index of approximately 0.2 ppt/meter, and never less than 0.1 ppt/meter, through: 21 days in April of wet years measured at the San Mateo Bridge; for two periods of 7 days in April of above normal years measured at the San Mateo Bridge; and through 7 days in April of below normal years measured at the San Bruno shoal.

For a discussion of the basis for this recommendation, see Bay Institute Enclosure 3, "A salinity standard to protect Estuarine Habitat, Shellfish Harvesting and other beneficial uses of South San Francisco Bay."

G. Drought relaxation

EPA has invited comments on whether it is necessary to promulgate special criteria to deal with the issue of consecutive dry or critical years or extended drought. The Bay Institute is opposed to allowing relaxation of the standards in consecutive dry or critically dry years. Collapse of aquatic populations has occurred in large part precisely because the existence of low salinity conditions in Suisun Bay has been reduced in frequency and duration. EPA's proposed criteria are not a return to unimpaired conditions where peak flows in even critically dry years were significant and could position low salinity habitat in Suisun Bay for substantial periods, but only represent an attempt to attain viable conditions for fishery resources by restoring minimum habitat conditions. Relaxation assumes a margin for downward adjustment which does not exist in the proposed criteria. In fact, as argued above, the criteria may not be protective enough in dry and critical years. Therefore, relaxation of the standards would fail to provide the minimum acceptable level of protection to aquatic resources.

In the event of extended, severe drought conditions occurring over a period of time greater than two critically dry years, phased relaxations might

be considered if implemented in small increments each succeeding year of drought after the first two years (i.e., a 5 percent relaxation in the third year, a 10 percent relaxation in the fourth year, etc.), if Delta export operations were limited to meeting critical public health and safety needs and restricted to prevent entrainment, and if jeopardy to species protected under the Endangered Species Act would not result. A return to the full standard or some level of restored protection every third year after relaxations began to occur, along the lines suggested by Moyle (1992), would be appropriate.

The same overall effect could also be achieved by the use of a sliding scale function which gives appropriate weight to the hydrology of previous years. Periodic restoration of full or partial protections would have to be factored into such a function.

III. FISH MIGRATION AND COLD FRESHWATER HABITAT CRITERIA

The Bay Institute supports promulgation of a fall-run chinook salmon smolt survival index to protect Fish Migration. We are concerned, however, that the environmental baseline contained in this standard is not protective enough to meet the requirements of the Clean Water Act. In addition, we recommend that a separate temperature criterion to protect Cold Freshwater Habitat also be promulgated in the final rule.

A. Environmental baseline

As noted earlier, salmon populations in the estuary were already experiencing declines during the period of the late 1960s and early 1970s, and EPA therefore does not strictly adhere to this baseline in its salmon smolt survival indices but instead has proposed more protective target values in drier years and less in wetter years.

While appreciating EPA's attempt to remedy the inadequacy of the proposed rule's general baseline to protect fall-run salmon, The Bay Institute is concerned that EPA's approach still falls short of Clean Water Act requirements for promulgating a biological criterion. The Act mandates restoration and maintenance of the "biological integrity of the nation's waters." EPA guidance documents on biological criteria state that "existing aquatic communities in pristine environments not subject to anthropogenic impact exemplify biological integrity and serve as the best possible goal for water quality"; where pristine populations do not exist, description of least impaired systems should be combined with analysis of historic distribution and abundance. "The best representation of biological integrity for a surface water should form the basis for establishing water quality goals for those waters" (EPA, 1993, Appendix C). In other words, biological criteria are to be designed by EPA to reflect the condition of biological resources exisitng where water quality is unimpaired or least impaired. EPA's proposed salmon smolt survival indices do not in any sense mirror conditions of unimpaired or least impaired water quality. We therefore recommend that EPA promulgate salmon smolt survival indices which incorporate FWS recommendations for achieving a 1940 level of development goal, since these recommendations represent the best available data on least impaired conditions for fall-run salmon (FWS, 1992a). The recommended salmon smolt survival indices are:

	SACRAMENTO RIVER	SAN JOAQUIN RIVER
Wet	.76	.58

Above normal	.81	.50
Below normal	.77	.52
Dry	.63	.47
Critical	.44	.39
MEAN	.68	.49

B. Temperature criteria

In its September 3, 1991 letter regarding the SWRCB's 1991 Water Quality Plan, EPA disapproved the Plan's criteria for Cold Freshwater Habitat for fall-run chinook salmon of 68 degrees F. at Freeport and Vernalis in April, May, June, September, October and November and for winter-run chinook salmon of 66 degrees F. at Freeport in January, February and March. EPA properly noted that the best available scientific evidence indicated that temperatures in excess of 65 degrees F. resulted in stress effects and increased mortality, and that in addition no scientific basis for the winter-run temperature criterion was provided. EPA's proposed rule does not contain a more protective temperature criterion, however, but substitutes a requirement to achieve specific levels of fall-run salmon smolt survival on the Sacramento and San Joaquin Rivers. Criteria to protect other salmon runs are not included.

The continuing declines in the Sacramento and San Joaquin River populations of fall-run salmon (as opposed to the earlier declines from the historical loss of spawning habitat) are occurring as a result of two main Delta-related factors, in addition to problems in upstream areas: 1) elevated water temperatures in the Delta, which cause stress effects and increase mortality, and 2) changes in Delta outflow and circulation as a result of federal and state water project export operations, which cause increased entrainment at in-Delta diversions and project facilities and increase exposure to adverse factors, including elevated temperatures (FWS, 1992).

EPA's proposed salmon smolt survival index may serve as an appropriate tool to measure the success of efforts to reduce the effects of changes in Delta flow and circulation on Fish Migration, including exposure to increased temperatures, and thereby avoid the negative impacts of Delta fish passage for salmon. Unlike the more complicated inter-relationships between flow, export and other factors which affect Fish Migration, however, temperature is clearly and uncontrovertedly a water quality characteristic which directly affects Cold Freshwater Habitat for salmon. Achieving adequate temperatures in the Delta ensures that the positive habitat values of Delta fish passage, i.e., continued growth and increased fitness, are preserved for salmon. This is consistent with the directive in EPA's Water Quality Standards Handbook that "water quality should be such that it results in no...significant growth...impairment of resident species" (EPA, 1993: 4.4.2). Separate criteria are necessary to address these important differences between the requirements of the Cold Freshwater Habitat and Fish Migration beneficial uses, and between the causes of the degradation of these beneficial uses, i.e., increases in Delta temperatures and changes in Delta flow and circulation. Promulgation of both a temperature criterion to protect Cold Freshwater Habitat and a salmon smolt survival index to protect Fish Migration is therefore justified.

The Central Valley Salmon and Steelhead Restoration and Enhancement Plan (CDFG, 1990), which incorporated the findings of a number of earlier studies, determined that "rearing temperatures for salmon must be maintained below 65 degrees F." A criterion of no greater than 65 degrees F. at Freeport and Vernalis from April 1 to June 30 and from September 1 through November 30 (Moyle, 1992), in order to ensure continued growth of juvenile fall-run salmon and avoid stress effects, should be promulgated by EPA in its final rule.

EPA states in the proposed rule that it is not issuing a temperature criterion at present "because historic temperature levels have been highly variable ... and because there is insufficient information on the effectiveness and feasibility of various methods of lowering temperature." We agree that uncertainties concerning state strategies to achieve this criterion exist, but believe that they should be addressed by the SWRCB in planning for implementation of the standard. Pending the development by the SWRCB of a workable implementation plan which reflects natural variabilty in temperature and which incoporates all applicable measures, including reductions in agricultural drainage, flow augmentation and restoration of riparian vegetation, the salmon smolt survival index could serve as a short-term surrogate standard for the protection of Cold Freshwater Habitat.

Finally, EPA should also reaffirm that the need for salmon smolt survival indices and/or temperature criteria to protect other salmon runs be addressed at the next triennial review of standards by the SWRCB.

IV. FISH SPAWNING CRITERIA

The Bay Institute supports promulgation of EPA's proposed salinity criteria to protect striped bass spawning in the lower San Joaquin River. Uncontroverted evidence exists, as cited in the Federal Register notice, that freshwater at 0.44 mmhos/cm EC represents the upper boundary of spawning habitat for striped bass. Upstream salt loading from agricultural drainage has caused river salinities to occur in excess of this boundary level. As a result, spawning habitat has been reduced by one-third of the area normally utilized by striped bass (Hedgpeth and Mortensen, 1987).

The earlier concern expressed by the SWRCB and others that improved spawning conditions would lead to increased entrainment of juvenile striped bass at the state and federal project export facilities in the south Delta does not now appear to be warranted. In testimony to the SWRCB during the interim water rights hearings in 1992, CDFG not only acknowledged the inadequacy of the 1.5 mmhos/cm EC standard for striped bass at Antioch contained in the SWRCB's 1991 Water Quality Plan, but also affirmed the effectiveness of more protective salinity-based criteria:

> ...we now believe that a more stringent standard is warranted to encourage spawning in the lowermost 10 km reach of the San Joaquin River... An appropriate *salinity* or outflow standard to encourage spawning in this reach would not only assure protection for striped bass spawning, but it would also help reduce the impact of entrainment losses to water exports (CDFG, 1992a; emphasis added).

Further reductions in any potential impacts from entrainment would be achieved through a SWRCB implementation regime to achieve the fish spawning criteria which adequately integrates agricultural source control measures to reduce salt loading to the San Joaquin River; upstream reservoir releases; and restrictions on export pumping levels.

V. SUISUN MARSH MANAGED WETLANDS

In 1978, the SWRCB adopted salinity standards to protect fish and wildlife uses of Suisun Marsh which were to be met by October 1, 1984. The implementation schedule was subsequently revised and monitoring stations in the western Marsh eliminated by the SWRCB in its Order of December 5, 1985. As EPA correctly noted in its 1991 notice of disapproval,

> These changes were made without the benefit of a public hearing or environmental review, and were never adopted or submitted to EPA as formal revisions to the 1978 Delta Plan. Since the State Board has not formally amended this component of the 1978 Delta Plan, the 1978 Delta Plan objectives...continue to be the water quality objectives in the Suisun Marsh...

Therefore, the failure of the state and federal water projects to achieve full compliance with D-1485 standards for all stations in Suisun Marsh constitutes an ongoing violation of the federal Clean Water Act. EPA should reaffirm in its final rule the SWRCB's responsibility to implement the D-1485 Suisun Marsh standards without delay, and to reinstate monitoring stations in the western Marsh.

Adoption of revised water quality objectives which incorporate alternative, less protective deficiency standards proposed in the Suisun Marsh Preservation Agreement, as contemplated by the SWRCB, is also subject to the same requirements of public comment, environmental review and formal submission to EPA.

Setting aside the question of its legal standing, the schedule for deferred implementation of Suisun Marsh standards approved in 1985 by the SWRCB has yet to be complied with by the state and federal water projects. Under the revised schedule, compliance at two stations (S21 and S97) in the western Marsh was to be achieved by October 1, 1993. The project operators requested, and on February 17, 1994, the SWRCB approved, a resolution allowing potential violations of salinity standards to occur.

List of Bay Institute enclosures:

1: Narrative standards to protect Estuarine Habitat, Rare and Endangered Species, Wildlife Habitat and other beneficial uses of the brackish tidal marshes of Suisun Bay

2: A salinity standard to protect Estuarine Habitat and other beneficial uses of San Pablo Bay

3: A salinity standard to protect Estuarine Habitat, Shellfish Harvesting and other beneficial uses of South San Francisco Bay

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FIGURE 1 (SWRCB, 1988)

Total Sacramento Basin fall run spawning Chinook salmon. Light bars are estimates of natural production, dark bars are estimates of production from Feather and American River hatcheries. Production from Coleman National hatchery is not included. (after DWR, 559,78, Figure VI-1)

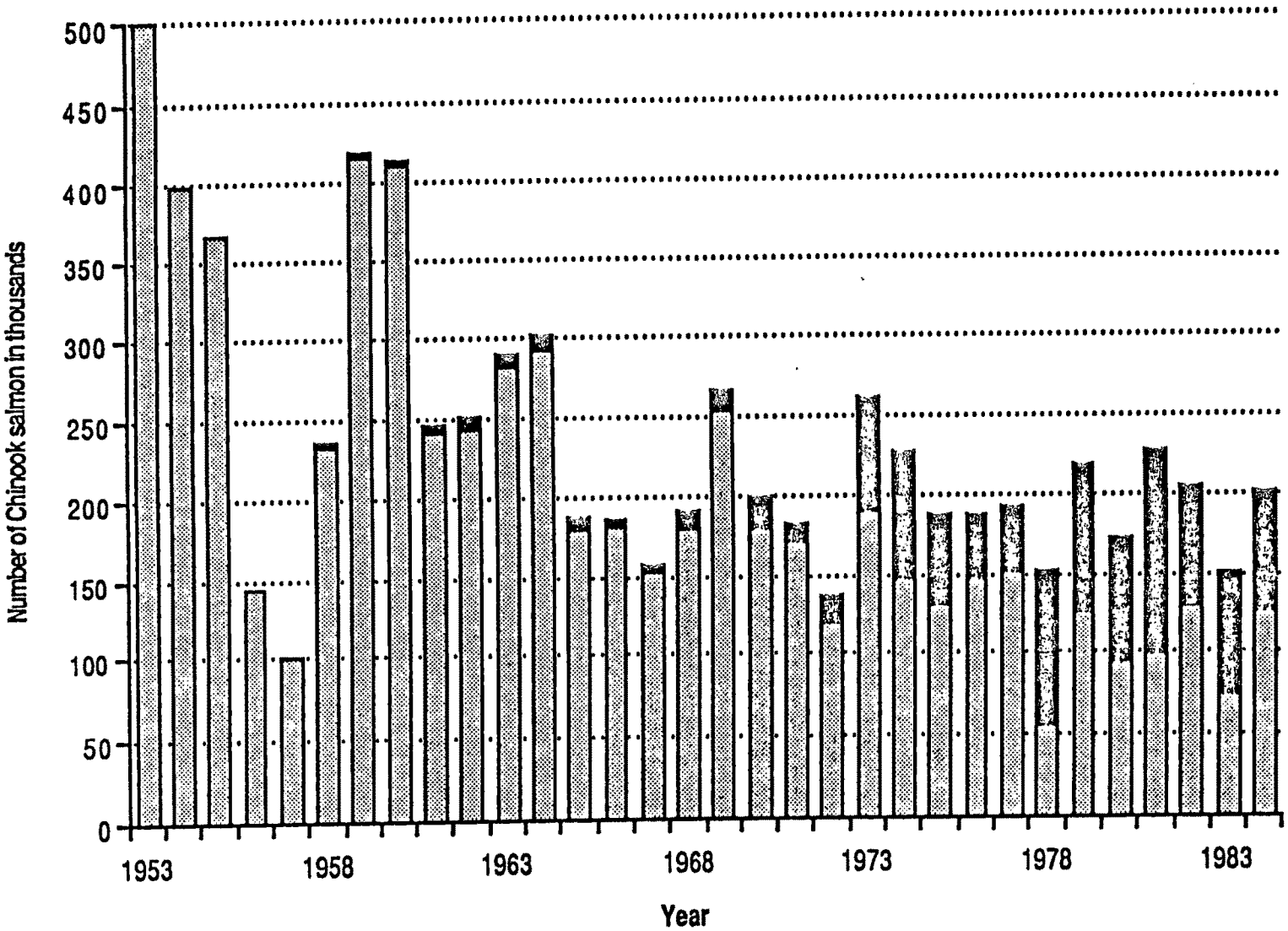

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FIGURE 2 (CDFG, 1987)

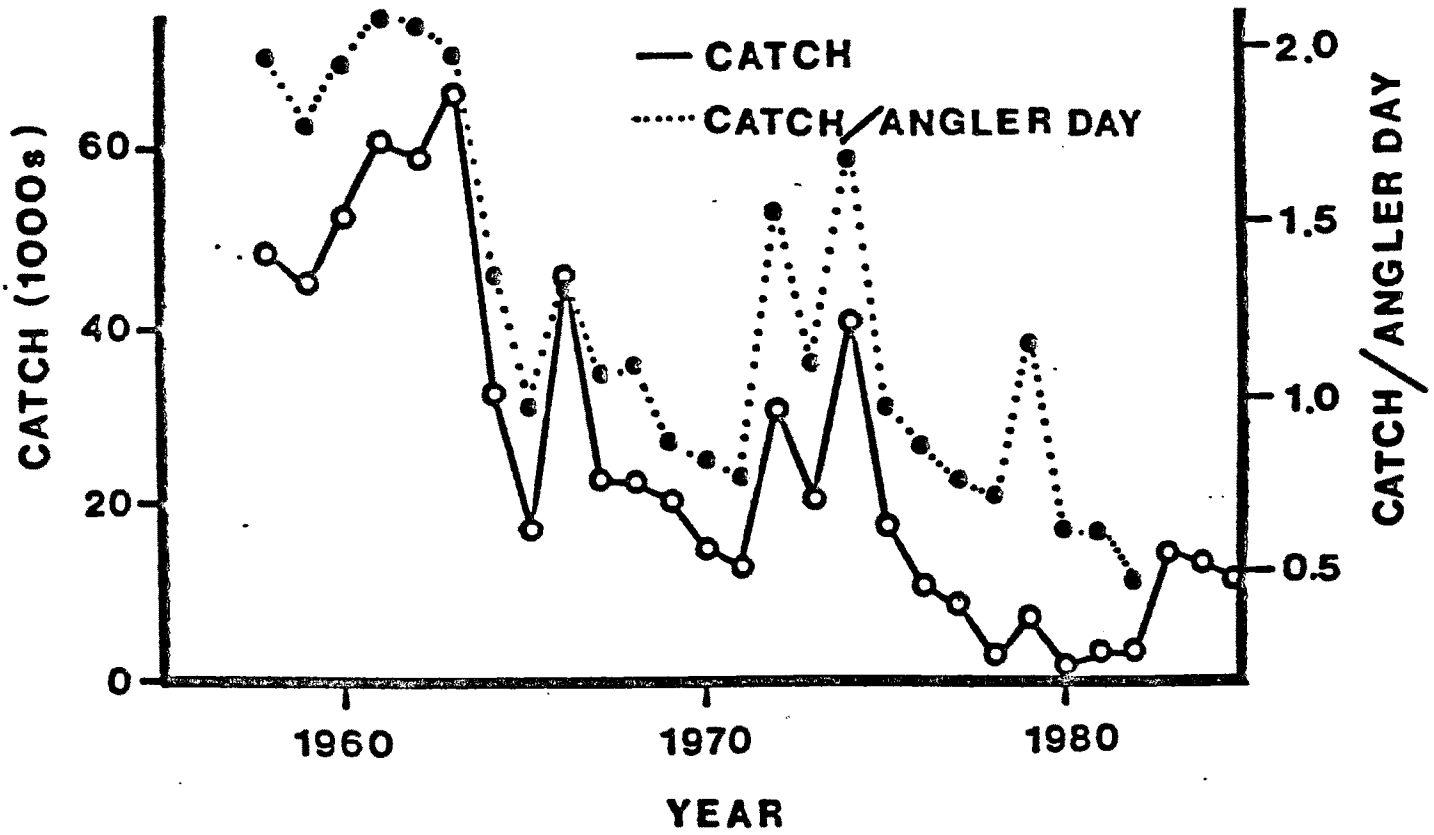
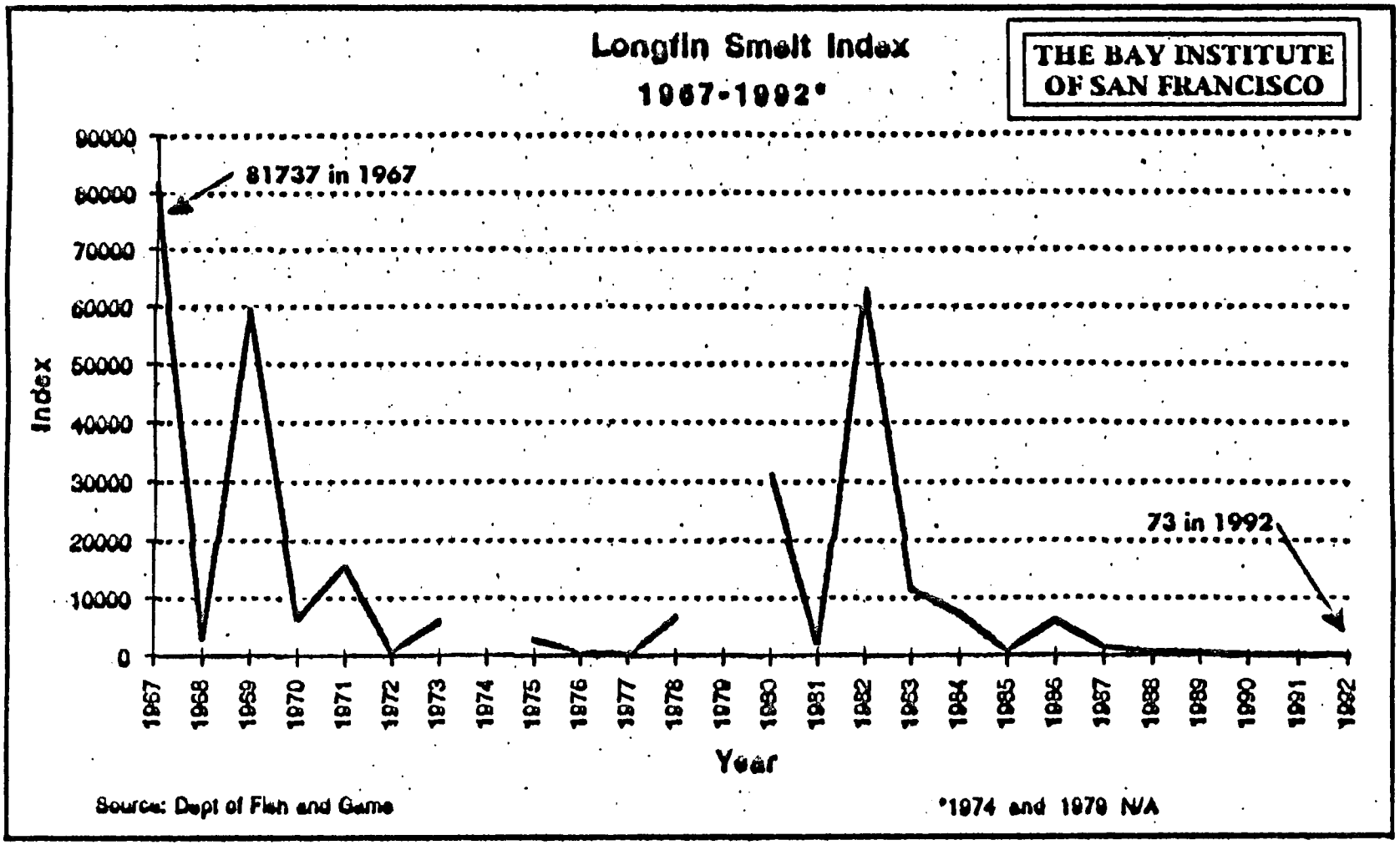


Figure 2. Trends in striped bass catch and catch per angler-day reported by charter boats in the San Francisco Bay area. Catches have been particularly low since 1976 reflecting a decline in angler success and decreased fishing effort associated with the generally poor fishing. While reduced effort may have caused the total catch on charter boats to decline more severely than the catch for the striped bass fishery as a whole, there is no question that the decline in the charter boat fishery reflects the seriousness of the decline in striped bass fishing in general.

FIGURE 3



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