State of California
THE RESOURCES AGENCY
Department of Fish and Game
Bay-Delta Project

Testimony on Wildlife in the San Francisco Bay for the State Water Resource Control Board's Bay-Delta Hearing

July, 1987

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SAN FRANCISCO BAY

Introduction

The San Francisco Bay area (Bay) includes San Pablo, Suisun, Grizzly and Honker bays (Figure 1). It extends about 85 miles from the east end of Chipps Island in the Suisun Marsh west and then south to the mouth of Coyote Creek, near the city of San Jose. The area encompasses approximately 435 square miles at mean tide and is characterized by a shoreline with a flat slope and consequently large intertidal zone. The Bay contains approximately 53 square miles of tidal marsh, 15 square miles of diked marsh and 55 square miles diked ponds (U.S. Fish and Wildlife Service and California Department of Fish and Game 1979).

Approximately 200 species of birds, and 40 species of mammals are supported in the Bay. Nine species of birds and 3 species of mammals are either listed or candidate species for listing as threatened or endangered (Table 1). In addition, there is 1 invertebrate species and 9 either listed or candidate plants recorded in the Bay.

Much of the tidal wetland habitat are narrow strips along exterior levees, the remnants of once extensive saline and brackish marshes. Noteable exceptions include the north east shore of San Pablo Bay, Fagan Marsh and Petaluma Marsh (USFWS and DFG 1984). Other wetlands generally consist of diked salt marsh, diked ponds and mudflats.

Figure 1

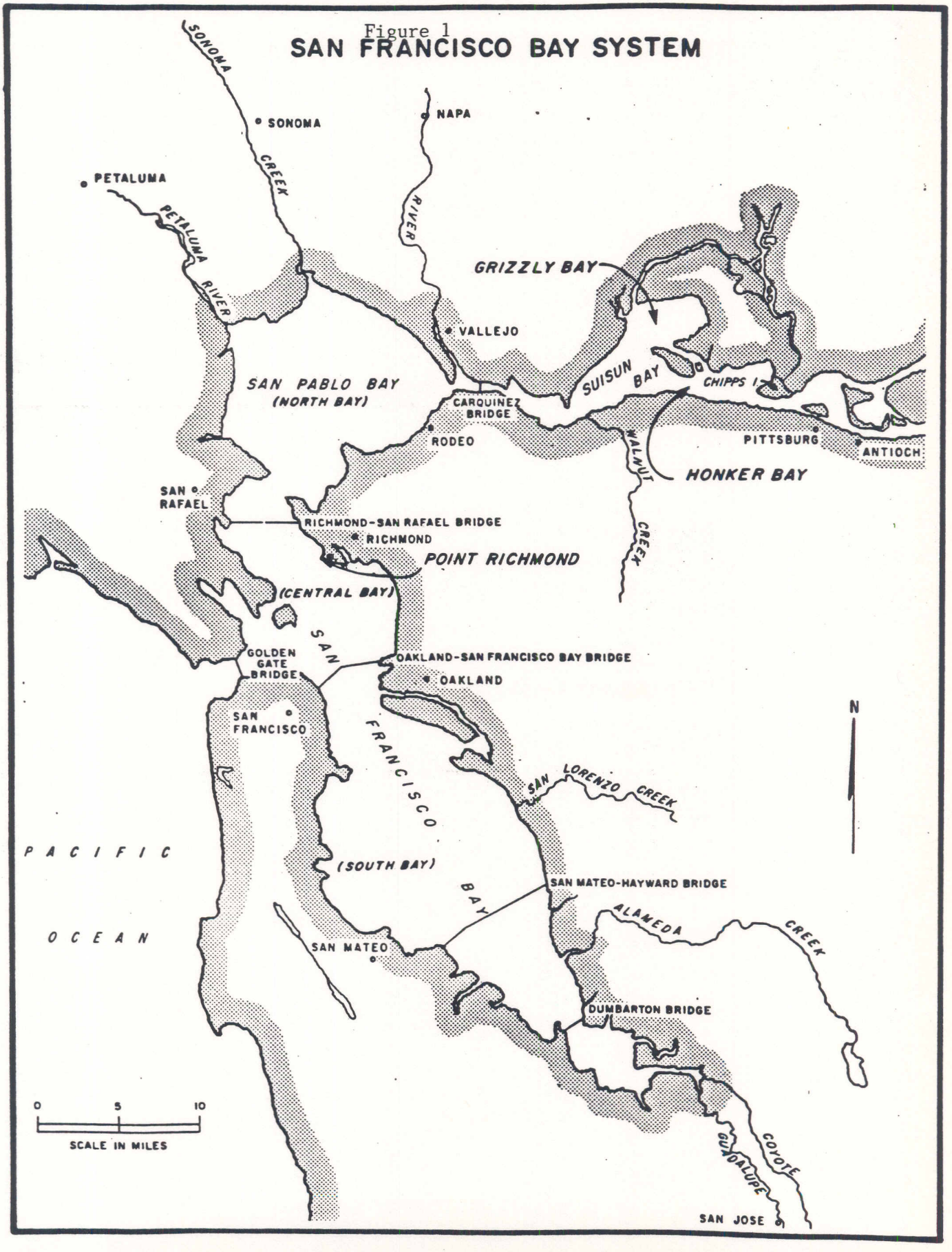
SAN FRANCISCO BAY SYSTEM
SONOMA CREEK
SONOMA
NAPA
RIVER
PETALUMA
PETALUMA RIVER
GRIZZLY BAY
VALLEJO
SAN PABLO BAY
(NORTH BAY)
SUISUN BAY
CHIPPS I.
CARQUINEZ BRIDGE
RODEO
PITTSBURG
ANTIOCH
WALNUT CREEK
HONKER BAY
SAN RAFAEL
RICHMOND-SAN RAFAEL BRIDGE
RICHMOND
POINT RICHMOND
(CENTRAL BAY)
SAN
GOLDEN GATE BRIDGE
OAKLAND-SAN FRANCISCO BAY BRIDGE
OAKLAND
SAN FRANCISCO
FRANCISCO
SAN LORENZO CREEK
PACIFIC
OCEAN
(SOUTH BAY)
BAY
SAN MATEO-HAYWARD BRIDGE
ALAMEDA CREEK
SAN MATEO
DUMBARTON BRIDGE
COYOTE
GUADALUPE
SAN JOSE
N
0 5 10
SCALE IN MILES

TABLE 1

Threatened, Endangered and Candidate Species in the San Francisco Bay Area

Species	Status
Birds	
California clapper rail	SE, FE
California brown pelican	SE, FE
California black rail	ST
California least tern	SE, FE
Bald eagle	SE, FE
American peregrine falcon	SE, FE
Salt marsh yellow throat	FC
Snowy plover	FC
Salt marsh song sparrow (3 subspecies)	FC 1/
Mammals	
Suisun shrew	FC
Salt marsh harvest mouse	SE, FE
Salt marsh wandering shrew	FC
Fishes	
Tide water goby	FC
Invertebrates	
San Francisco forktail damsel fly	FC
Plants	
Suisun thistle	FC
Mason's lilaeopsis	SR, FC
Tiburon paint brush	FC
Delta tule pea	FC
Suisun Marsh aster	FC
Soft bird's beak	SR, FC
Caper-fruited tropidocarpum	FC
Marin knotweed	FC
Pt. Reyes bird's beak	FC

S = State F = Federal T = Threatened E = Endangered

R = Rare C = Candidate

1/ Proposed for candidacy and expected to be in federal register by end of 1977.

These wetlands, along with the aquatic habitat of the Bay, support the diverse assemblage of wildlife described above.

The Bay's existing wetlands are affected by several environmental factors such as subsidence accompanied by increased water levels and by water salinities. Increased water levels and subsidence have increased the length of submergence resulting in an increase in lower marsh vegetation types such as cord grass (Spartina foliosa) and bulrush (Scirpus spp.) and decrease in the intermediate elevation marsh of pickleweed (Salicornia sp.) and alkali bulrush (Scirpus robustus). Future increases in diversions of fresh water upstream of the Bay could result in substantial increases in water salinity especially in dryer years. This higher salinity water could further affect the Bay's wetland plant species composition and impact the Bay's fish and invertebrate populations. Any significant adverse impacts on these plants and animals would indirectly impact many of the wildlife species dependent on those plants and animals for cover and food.

Importance of the Bay to Wildlife

Waterfowl

The Bay's aquatic habitat serves as winter habitat for a large percentage of the diving ducks wintering in California. Species include Canvasback (Aythya valisineria), Lesser scaup (A. affinis), Greater scaup (A. marila), Redhead (A. americana), Surf scoter (Melanitta perspicillata) and white-winged scoter (M.

fusca). The Bay provides canvasback feeding and resting habitat for up to two-thirds of the wintering population in California and over 50 percent of the Pacific Flyway population. California Department of Fish and Game (DFG) biologists have counted over 38,000 scoters, 134,000 scaup and 55,000 canvasbacks using the Bay during DFG's mid-winter waterfowl inventory (DFG, unpublished waterfowl census records). Data recorded for these species since 1966 are shown in Table 2. Data are recorded separately under San Francisco Bay, which includes San Pablo Bay and the central and southern portions of the Bay and under Suisun Bay, which includes Grizzly, Honker and Suisun bays. The Bay also serves as an important staging area for scoters and scaup during spring migration. The eastern portion of the Bay such as Grizzly, Honker and Suisun bays provide important resting areas for puddle ducks, principally mallard (Anas platyrhynchos) and Northern pintail (Anas acuta). Puddle duck use in the remainder of the Bay is generally confined to the larger tidal marshes such as the Napa Marsh and the salt ponds near Napa and in the south bay. Pintail and northern shovelers (Anas clyptea) are the most common puddle ducks observed in this portion of the Bay. Most of the diked marshes are located in the south bay and around San Pablo Bay and are highly saline, supporting monotypic stands of pickleweed (USFWS and DFG 1979). Generally, monotypical stands of pickleweed provide less desireable wintering waterfowl habitat.

TABLE 2

Scoter, Scaup and Canvasback Use
in the San Francisco Bay Since 1966
Based on the Mid-Winter Waterfowl Inventory

	San Francisco Bay			Suisun Bay		
Year	Scoter	Scaup	Canvasback	Scoter	Scaup	Canvasback
1966	15,013	47,640	28,580	-	-	-
1967	37,565	18,930	44,120	20	-	6,360
1968	29,775	80,440	47,022	-	-	5
1969	16,360	34,490	31,595	-	170	1,840
1970	10,745	22,080	28,370	-	150	170
1971	6,010	33,610	23,260	-	650	1,775
1972	19,272	45,485	25,378	-	150	2,185
1973	27,819	85,876	31,315	-	100	5,980
1974	11,390	21,795	8,035	170	100	740
1975	25,326	30,760	19,086	50	-	11,705
1976	19,100	60,285	26,025	-	-	2,060
1977	7,235	37,865	22,160	515	5,535	33,380
1978	10,804	22,352	8,752	175	4,975	5,640
1979	21,265	45,410	11,735	-	-	15,945
1980	17,885	43,930	25,260	-	10	150
1981	27,850	42,990	7,700	80	85	8,505
1982	1,250	28,800	8,470	5	50	250
1983	9,865	38,110	12,910	-	-	600
1984	33,300	93,075	14,860	60	5,500	205
1985	24,610	61,970	33,555	200	4,600	425
1986	38,502	134,605	18,599	-	1,375	2,700
1987	18,134	33,282	13,265	25	510	700

Endangered Species

The salt marsh harvest mouse (Reithrodontomys raviventris), a state and federal endangered species, is dependent on dense cover composed of plant species such as pickleweed, fat hen (Atriplex patula) and alkali heath (Frankenia grandiflora). The tidal and diked wetland areas around the bay provide the bulk of this habitat type. When this habitat is present, the major limiting factor appears to be sufficient escape cover composed of upper zone peripheral halophytes. This escape cover is needed at the higher tides and during high outflow conditions.

The California clapper rail (Rallus longirostris obsoletus), also a state and federal endangered species, uses the tidal salt and brackish marsh areas dominated by pickleweed and cord grass which are adjacent to mud flats for feeding. As with the saltmarsh harvest mouse, higher elevation escape cover is also a necessity during high tides (Harvey 1980).

The Black rail (Laterallus jamaicensis coturniculus), State listed threatened, occurs in the tidal salt and brackish marshes of the Bay (Manolis 1977) dominated by picklweed and bulrush (Scirpus spp). Other listed wildlife species such as the California brown pelican (Pelecanus occidentalis californicus) and California least tern (Sterna antillarum browni) feed on fish in the Bay and the least tern nests at several locations in the Bay.

Other Wildlife

One of the most significant groups of wildlife species using the Bay are shorebirds. The common shore birds of the Bay include

the Long-billed dowitcher (Limnodromus scolopaceus); Marbled godwit (Limosa fedoa), the Long-billed curlew (Numenius americanus); American avocet (Recurvirostra americana); Black-necked stilt (Himantopus mexicanus); Greater yellowleg (Tringa melanoleuca); Wilson's phalarope (Phalaropus tricolor); Dunlin (Calidris alpina), Least sandpiper (Calidris minutilla), and Western sandpiper (Calidrus mauri); and Blackbellied plover (Pluvialis squatarola). The principal habitat type provided in the Bay for shorebirds is mudflats. Mudflats provide critical feeding and resting areas. DFG biologists conducting shorebird surveys from 1981 through 1984 in the Bay in roost areas south of the San Mateo Bridge recorded a seasonal high of approximately 250,000 Western sandpipers, the most common shorebird in the Bay (Paul Kelly, DFG biologist, pers com.). The Snowy plover (Charadrius alexandrinus), a federal candidate species, nests in the Bay with the largest breeding population being in the South Bay.

Vegetative Composition of the Bay

Emergent species such as, cattail, (Typha sp.) and bulrush, including alkali bulrush are common along the edges of the bays in the eastern Bay such as Suisun Bay. The eastern portions of the Bay also contain submergent aquatics such as sago pondweed (Potamogeton pectinatus) and wigeon grass (Ruppia maritima). In the western portions of the Bay, cord grass and pickleweed are more extensively found. Pickleweed is especially abundant in the

diked wetland areas. A more detailed description of the Bay's vegetative composition is available in a report prepared for the San Francisco Bay Conservation and Development Commission on the Bay's marshes (Harvey et al. 1977). The Bay's vegetation also includes a wide variety of rare plants some of which are included in Table 1.

Wildlife Food Habits

Most of the wildlife food in the Bay is provided by submergent aquatic plants and animal matter. For example, a large part of the diet of many diving ducks is composed of animal food (Kortright 1943). Much of the animal food includes aquatic organism such as fish, molluscs, crustaceans, and annelid worms. Data gathered on scaup and canvasbacks in the western bay indicated that from 90 to 98 percent of the total volume of food eaten was molluscs (DFG, Food Habits Laboratory, unpublished data 1959). One of the most important species of mollusc for canvasback was the clam (Macoma balthica). Recent data indicates that the softshell clam (Mya arenaria) and mussel (Musulus senhousia) are also used extensively (Hofmann, DFG biologist pers com.) In the eastern portions of the Bay, asiatic clams (Corbicula sp.) are used. The value of these same molluscs to the clapper rail has been documented (Moffett 1941; USFWS and DFG 1979) along with ribbed horse mussel (Ischadium demissum), shore crabs (Hemigrapus sp. and Pachygrapsus crassipes), spiders (Lycosidae sp), clam (Macoma balthica) and soft shell clam.

Submergent aquatics such as sago pondweed and wigeon grass are also used extensively by canvasbacks when available. These two species are generally found in the eastern most areas of the Bay with wigeon grass occurring in areas with slightly higher water salinities.

Peterson (1961) found that the major food items of shore birds are plankton, crustaceans, arthropods, annelid worms and other marine and estuarine invertebrates. This food supply is available to the birds in or on the mud in shallow water and exposed mudflats.

Potential Impacts of Salinity on the Bay's Plants and Wildlife

Salinity increases in the Bay as a result of decreased outflows to the Bay may have an adverse effect on aquatic organisms important as food for diving ducks. The extent of these effects however, is uncertain. Several factors indicate that increases in salinity would result in species composition changes of cover and food species but that the resulting condition would continue to provide adequate food supplies and cover for many of the wildlife species using the Bay.

Organisms, such as molluscs, exhibit tolerances to salinity similar to those described for plant species. There are those which can exist only in fresh water situations, those that require sea water, and groups that exist in various ranges of salinities in between the two extremes. Optimum population development is

generally found at one specific range for each species. Their development diminishes accordingly as salinity conditions increase or decrease from the optimum range (Reid, 1961). For example, the food supplies of the clapper rail and diving ducks in the east bay are made up of species more common in the brackish waters of this part of the estuary while clapper rails and ducks in the south bay use more salt tolerant species. Therefore, adequate food supplies are expected to remain for the majority of the wildlife using the Bay under conditions of decreased outflow.

Salinity increases would adversely affect the submergent aquatics such as sago pondweed and to a lesser extent wigeon grass in the eastern bay. Emergent vegetation throughout the Bay may also be adversely impacted. The significance of this impact to endangered wildlife is expected to be minor especially in the eastern portions of the Bay. Tidal wetland areas adjacent to Grizzly, Honker, and Suisun bays currently provide little habitat for the salt marsh harvest mouse. Should channel salinities increase significantly due to decreased outflow, habitat conditions could improve for the mouse in these tidal areas. Regardless, adequated escape cover during high tides will be required and unless nearby higher elevation refugia with dense vegetation are available, mice will not be expected to use these tidal areas. In addition, conditions for the California clapper rail are expected to improve in these areas if the species composition of the habitat becomes more like the tidal areas around San Pablo and San Francisco bays. Clapper rails use the tidal marshes in these areas which are dominated by pickleweed,

cordgrass and gumplant (Grindelia spp). Cordgrass has been identified as the preferred nesting habitat of the clapper rail (Gill 1979).

Although no Black rails were observed south of the Richmond-San Rafael Bridge (Figure 1), salinities did not appear to be a factor effecting the distribution of black rails in the Bay (Manolis 1977). Instead, a lack of suitable habitat, especially higher marsh habitat in the Bay to the south, was felt to be the reason. Potential changes to the plant species composition of this bird's range are not expected to significantly impact the Black rail in the Bay since pickleweed will remain as a common component of the vegetation.

Impacts on Brown pelican and least tern will result only if significant changes occur in their food supplies. Since fish such as the northern anchovey (Engraulis mordax) are used by these species, the impacts on their food supply should be considered. Food habits studies of least terns at a nesting colony at the Alameda Naval Air Station indicated that topsmelt (Atherinops affinis) and northern anchovey were the first and second most commonly used prey respectively (Paul Kelly, pers. com.). The California Department of Fish and Game will present testimony during these hearings addressing issues regarding these species of fish and how they may be impacted by decreased outflows through the Bay. Outflow condition will not impact least tern nest sites.

Wildlife that commonly use cattail and bulrush marshes may be adversely impacted. Black-crown night heron (Nycticorax nycticorax) which roost and nest in these areas could be impacted.

Species such as marsh wren (Cistothorus palustris) and Red-winged black birds (Agelaius phoeniceus) could also be impacted if emergent vegetation is reduced significantly.

Impacts on rare plants are possible. However, several species such as the Delta tule pea (Lathyrus jepsonii jepsonii) and Mason's lilaeopsii (Lilaeopsis masonii) are distributed from the Delta west through portions of the eastern Bay. The Delta tule pea has been found in north San Pablo bay. Populations of these species in the eastern Bay are not expected to be impacted. The status of populations in other portions of the Bay is unknown. Little information on salt tolerance is available for any of the rare plant species listed on Table 1. However, studies on the Salt marsh bird's-beak (Cordylanthus maritimus spp maritumus), found in coastal salt marshes of southern California, have indicated that reduced water salinities of less than 12 ppt (19 mmhos EC) are needed during the early spring for germination (USFWS 1985).

One additional issue regarding the significance of salinity increases in tidal marshes is the affect on productivity. While the more saline marshes in the Bay south of San Pablo Bay are less productive than brackish marshes around Suisun Bay from the vascular plant standpoint, productivity is still extremely high. Floating algae, principally diatoms, and flagellates, provide approximately 20 times the production of vascular plants in the Bay. (Atwater et al. 1979)

Recommendations

Water quality or outflow standards adopted to protect aquatic organisms as food supplies for anadromous fish and other fish species should provide the protection needed to assure continued food supplies for the waterfowl, shorebirds and endangered wildlife species using the Bay. Furthermore, no specific standards are expected to be required for most plant species found in the eastern Bay. Channel salinities are not expected to increase soil water salinities significantly above the annual salinity ranges for several emergent marsh plants in the eastern Bay. For example, narrow-leaf cattail (Typha angustifolia) has a range up to 27.2 ppt (42.5 mmhos EC) and alkali bulrush 32.5 ppt (50.8 mmhos EC). The most important limiting factor appears to be the length of submergence or existence of high, stable soil moisture levels (Mall 1969). Submergence conditions are not expected to change significantly in the tidal wetland areas of the Bay. Hardstem bulrush (Scirpus acutus), California bulrush (Scirpus californicus) and common cattail (Typha latifolia) cannot withstand the salinities tolerated by alkali bulrush particularly during the late spring and summer (Pearcy 1982). Therefore, some shift in plant composition is likely with alkali bulrush becoming more common and hardstem bulrush, California bulrush and cattail less common in the tidal areas of the eastern Bay and San Pablo Bay. The vegetative composition changes possible due to significant increases in channel salinities are likely to improve conditions for some species of wildlife such as the endangered California clapper rail and salt marsh harvest mouse.

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