State of California
The Resources Agency
Department of Water Resources
Environmental Services Office

SUISUN MARSH MONITORING PROGRAM

DATA SUMMARY REPORT

Water Year 1997

Submitted in Fulfillment of the
Suisun Marsh Preservation Agreement
Suisun Marsh Monitoring Agreement
San Francisco Bay Conservation and Development Commission
Permit Numbers 35-78 (M) and 4-84 (M)
and
United States Army Corps of Engineers
Permit Number 16223E58 Special Condition 1

December 1999

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Abstract

This report summarizes data collected in the Suisun Marsh during water year 1997 (1 October 1996 through 30 September 1997) as part of the monitoring programs mandated by the State Water Resources Control Board (SWRCB) Water Rights Decision 1485, the Suisun Marsh Preservation Agreement and the Suisun Marsh Monitoring Agreement. Data were collected by the California Department of Water Resources (DWR) and California Department of Fish and Game (DFG) and include continuous measurements of channel water specific conductance and tidal height fluctuation, waterfowl abundance surveys, and salt marsh harvest mouse special studies. Data on aquatic species were also collected and are reported in a separate report titled *Suisun Marsh Salinity Control Gates Fisheries Monitoring*. Background information on the DWR Suisun Marsh monitoring program is presented in a stand-alone reference guide, which is accessible via the Internet: http://iep.water.ca.gov/suisun. A printed copy of the reference guide is also available upon request.

Based on the water year classification system detailed in the SWRCB 1995 Water Quality Control Plan and Water Rights Order WR 95-6 (June 1995), water year 1997 was classified as wet, with a calculated index of 10.8 million acre-feet. These wet conditions resulted in low salinity levels in Suisun Marsh channels during most of the year. Suisun Marsh salinity standards mandated by Order 95-6 were met at all compliance stations during the Suisun Marsh water quality control season (1 October 1996 through 31 May 1997). The Suisun Marsh Salinity Control Gates (SMSCG), designed to control salinity levels in the marsh, were only operated from 13 through 27 November 1996. The removable flashboards, which work in conjunction with the gates, remained in place from 13 November 1996 until 3 February 1997, when DWR determined that further SMSCG operations would no longer be required to meet standards for the remainder of the control season.

As a permit condition for the dredging of the Morrow Island Distribution System (MIDS), salt marsh harvest mice were live-trapped, removed from the dredge spoil area, and translocated to a DFG set-aside area. In over 4,000 trap nights along the MIDS, 28 salt marsh harvest mice were captured, tagged, and translocated.

DFG conducted waterfowl population surveys in the Suisun Marsh from September through January 1997. During the mid-winter (January 1997) survey, 63,526 waterfowl were counted. Of these, 50,240 were ducks, including 6,105 mallards and 5,290 pintails.

Introduction

Suisun Marsh, about 35 miles northeast of San Francisco in southern Solano County (Figure 1), provides habitat for numerous species of plants, fish, and wildlife. The State of California recognized the biological importance of the marsh and passed a series of laws and regulations designed to protect it from urban encroachment. Water Rights Decision 1485 (D-1485), adopted by the State Water Resources Control Board (SWRCB) in 1978, was enacted to protect water quality in the Sacramento-San Joaquin Delta and Suisun Marsh. Condition 7 of D-1485 required the California Department of Water Resources (DWR) and the United States Bureau of Reclamation (USBR) to develop a plan to ensure compliance with water quality standards. In addition, Conditions 4 and 7 of D-1485 required development of a monitoring plan to measure various physical, chemical, and biological parameters in the marsh. Decision 1485 was amended in June 1995 by SWRCB Order WR 95-6 to make it consistent with the SWRCB 1995 Water Quality Control Plan.

This report summarizes data collected in the Suisun Marsh during water year 1997 (1 October 1996 through 30 September 1997) as part of the monitoring programs mandated by SWRCB D-1485, the Suisun Marsh Preservation Agreement, and the Suisun Marsh Monitoring Agreement. Data were collected by DWR and the California Department of Fish and Game (DFG) and include continuous measurements of channel water specific conductance and tidal height fluctuation, a waterfowl abundance survey, and salt marsh harvest mouse special studies. Data on aquatic species were also collected and are presented in a separate report titled *Suisun Marsh Salinity Control Gates Fisheries Monitoring*. Background information on the DWR Suisun Marsh monitoring program is presented in a stand-alone reference guide, which is accessible at the following Internet address: http://iep.water.ca.gov/suisun. A printed copy of the reference guide is also available upon request.

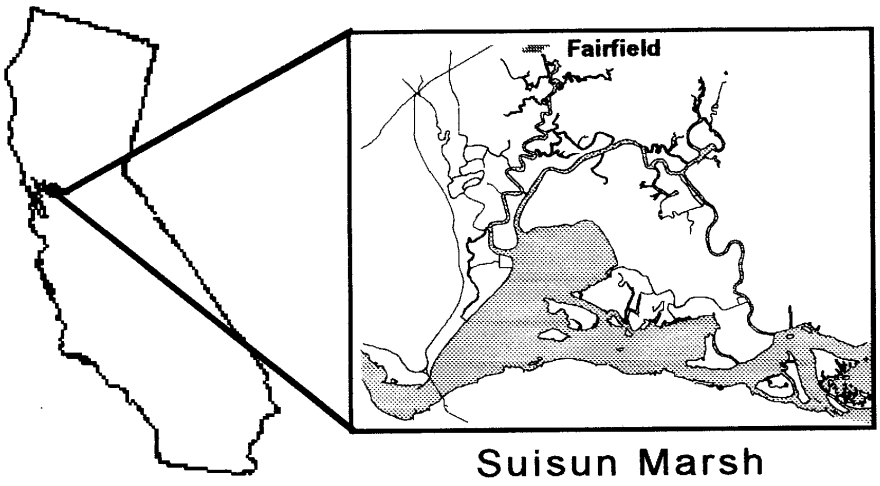

Figure 1 Location of Suisun Marsh

Monitoring Report Requirements

Annual reports are required by each of the following: The Suisun Marsh Monitoring Agreement; Bay Conservation and Development Commission (BCDC) Permit Number 4-84(m) for construction of the Suisun Marsh Salinity Control Gates (SMSCG) and Permit Number 35-78(M) for construction of the Roaring River Distribution System (RRDS); and the United States Army Corps of Engineers (USACE) Permit 16223E58 for construction of the SMSCG (BCDC 1991a, 1991b; USACE 1986). These annual reporting requirements have been met by consolidating the data into two annual reports: Suisun Marsh Monitoring Program Data Summary and Suisun Marsh Salinity Control Gates Fisheries Monitoring. Table 1 summarizes the monitoring information included and the regulatory or contract requirement fulfilled in each of the two reports.

Table 1 Contract and regulatory reporting requirements provided in annual reports

Information Included	*Data Summary Report*	*SMSCG Fisheries Report*	*Permit or Contract Requiring Information* [a]
Monthly Mean High Tide Salinity	x		SWRCB, SMMA
SMHM Surveys	x		USFWS BO
Triennial Vegetation Surveys [b]	x		SMMA
Waterfowl Population Surveys	x		SMMA
Routine Maintenance Performed	x		BCDC
Maintenance Scheduled for Next Year	x		BCDC
University of California Davis Fish Sampling		x	SWRCB [c], SMMA, USACE, BCDC
Larval Fish Survey		x	SMMA, USACE, BCDC
Striped Bass Tow-Net Survey		x	SMMA, USACE, BCDC
Phytoplankton and *Neomysis* Surveys		x	SMMA
Striped Bass Egg and Larva Survey		x	SMMA, USACE, BCDC
Juvenile Chinook Salmon Monitoring		x	SMMA, USACE, BCDC
Predator Sampling		x	SMMA, USACE, BCDC
Adult Salmon Migration Study		x	SMMA, USACE, BCDC
Water Quality Profiling Program		x	SWRCB [c]

[a] SMMA: Suisun Marsh Monitoring Agreement
USACE: United States Army Corps of Engineers Permit 16223E58.
BCDC: San Francisco Bay Conservation and Development Commission Permits 35-78(M) and 4-84(M).
USFWS: United States Fish and Wildlife Service Biological Opinion 1-1-81-F-131.
SWRCB: State Water Resources Control Board D-1485.

[b] Survey conducted and results reported every three years.

[c] Falls under D-1485 requirement to conduct special studies to develop a better understanding of the hydrodynamics, water quality, productivity, and significant ecological interactions of the marsh.

Suisun Marsh Hydrology

1997 Water Year Conditions

A new water year classification system, detailed in the 1995 Water Quality Control Plan, went into effect in water year[1] 1996. The new system uses the following equation to determine water year type:

$$INDEX = 0.4X + 0.3Y + 0.3Z$$

Where:

- X = The current year's April through July Sacramento Valley unimpaired runoff (4.36 million acre-feet in water year 1997)
- Y = The current October through March Sacramento Valley unimpaired runoff (20.23 million acre-feet in water year 1997)
- Z = The previous year's index (10.0 in water year 1997—this is the maximum allowable value)
- *INDEX* = 10.8 in water year 1997 (values greater than 9.2 denote a wet year)

Above normal precipitation was recorded throughout California in water year 1997. The Sacramento Valley Four River Index was 25.4 million acre-feet or 141% of the long-term average in 1997 (Table 2).

Table 2 Water year classifications from 1988 through 1997

Water Year	*Classification* [a]	*Sacramento Valley Four River Index Water Year Runoff (million acre-feet)*
1988	Critical	9.2
1989	Dry	14.7
1990	Critical	9.2
1991	Critical	8.4
1992	Critical	8.9
1993	Above Normal [b]	22.4
1994	Critical	7.8
1995	Wet	33.9
1996	Wet	22.2
1997	Wet	25.4

[a] Based on the State Water Resources Control Board 1995 Water Quality Control Plan classification system.
[b] Year Following Critical Year.

1. Water years begin 1 October and continue through 30 September of the following calendar year. For example, water year 1997 begins 1 October 1996 and ends 30 September 1997.

Precipitation

Suisun Marsh precipitation data were collected at the DFG headquarters on Grizzly Island. The majority of rainfall for the year (71%) occurred during December 1996 and January 1997 (Table 3).

Table 3 Precipitation at Grizzly Island during water year 1997

Month and Year	*Rainfall (inches)*
October 1996	1.08
November 1996	2.35
December 1996	6.36
January 1997	6.36
February 1997	0.57
March 1997	0.26
April 1997	0.08
May 1997	0.30
June 1997	0.25
July 1997	0.02
August 1997	0.22
September 1997	0.04
Measured Total	17.89

Delta Outflow

Large amounts of precipitation occurring early in water year 1997 resulted in high Delta outflow throughout the year. The Net Delta Outflow Index (DOI) is an estimate of freshwater flow from the Delta. The mean monthly DOI peaked in January 1997 at 259,536 cubic feet per second (cfs), compared to a mean monthly maximum of 126,720 cfs in water year 1996, also classified as a wet year (Table 4). DOI, however, was significantly lower for the remainder of the water year.

Suisun Marsh Salinity Control Gates Operations

During water year 1997, the SMSCG was operated from 13 through 27 November 1996, in response to rapidly increasing channel water salinity. However, because of substantial November storms, high DOI, and decreasing channel water salinity, the gates were raised on 28 November 1996, and were kept open for the remainder of the control season. The removable flashboards were installed on 13 November 1996 and remained in place until 3 February 1997, when DWR determined that SMSCG operations were no longer needed to meet standards for the remainder of the control season.

Table 4 Mean monthly Net Delta Outflow Index during water years 1996 and 1997

	Net Delta Outflow Index (cubic feet per second)	
Month	*Water Year 1996*	*Water Year 1997*
October	11,400	4,625
November	8,384	8,625
December	27,710	82,007
January	32,016	259,536
February	126,720	117,070
March	88,994	33,157
April	42,050	13,566
May	46,098	12,038
June	15,373	8,143
July	9,249	9,352
August	9,697	8,623
September	7,359	3,958

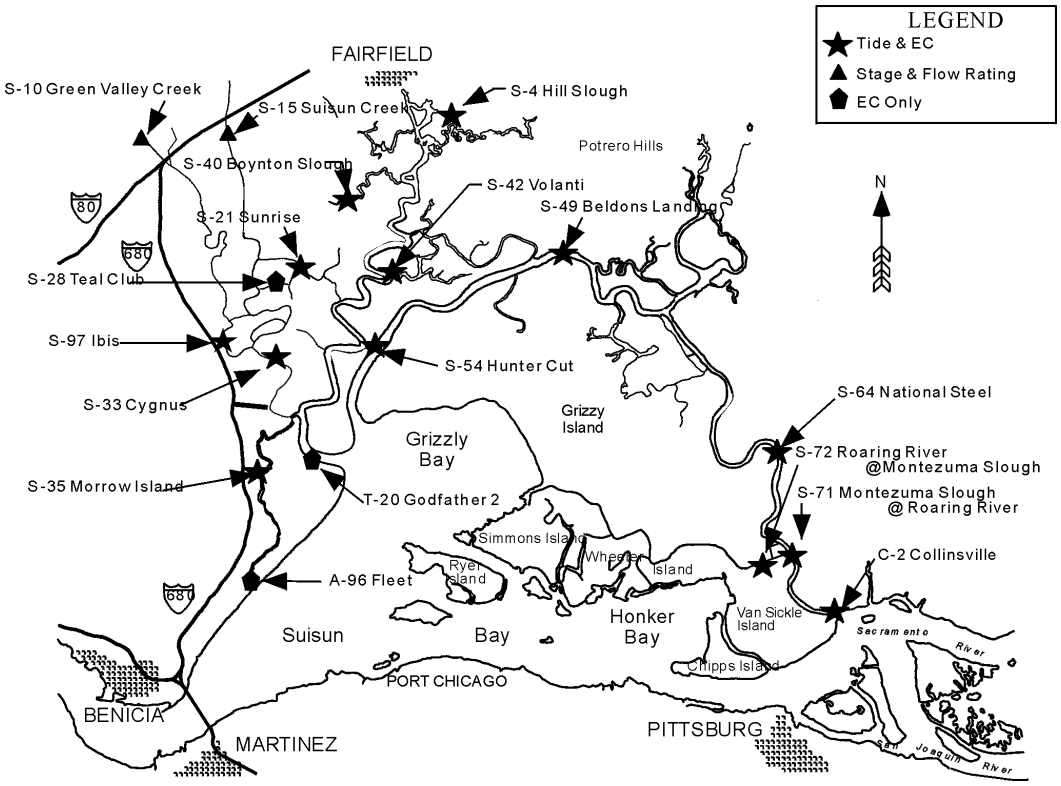

Figure 2 Suisun Marsh compliance and monitoring stations from 1 October 1996 through 31 May 1997

Suisun Marsh Monitoring

Water Quality

Background

Suisun Marsh channel water salinity standards, specified for a compliance period of 1 October through 31 May of the following year, were mandated by the SWRCB Order WR 95-6. These standards were in effect at four compliance stations during water year 1997. Standards vary according to month and water year type. Three of these compliance sites, National Steel (S-64), Beldons Landing (S-49), and Sunrise (S-21) are located within the Marsh (Figure 2). The fourth, Collinsville (C-2), is located in the western Delta. Three additional monitoring stations identified in SWRCB Order WR 95-6, Suisun Slough at Volanti (S-42), Morrow Island (S-35), and Ibis duck club (S-97), did not have standards in effect during water year 1997. Data from these stations are, however, included in this report. Data from the eleven other water quality monitoring stations operated in the marsh during water year 1997 are not included here, but are available from the monitoring program.

Water quality compliance is determined by comparing monthly standards for channel water specific conductance with the mean monthly high tide specific conductance measured at each compliance location. Specific conductance is a measure of the charged particle composition of water (the water's electrical conductivity) standardized to 298 Kelvin and one atmosphere of pressure. Specific conductance is therefore an indirect, but reliable measure of salinity concentration. Specific conductance was chosen as a measure of salinity because continuous monitoring equipment for actual salinity concentration is less reliable.

A progressive mean of the specific conductance at high tide is calculated for each month by averaging the current daily mean specific conductance at high tide with the daily means observed on all previous days of the month. Measures of daily progressive means start at the beginning of each month. For example, the mean monthly specific conductance at high tide equals the progressive daily mean of the specific conductance at high tide calculated from the first through the last day of each month.

Methods

Time series data about specific conductance, tidal stage, or both were collected at 15-minute intervals using data recorders consisting of either data loggers (EnviroLab DL-150 or DL-800) or paper tape recorders (Fisher-Porter or Stevens). Data recorders were housed in secure units, protecting them from vandalism and the elements. Tidal stage measuring equipment was housed in closed float well systems anchored within the channel.

Specific conductance and tidal stage data from stations S-21 and S-49 were telemetered hourly by DWR to the California Data Exchange Center (CDEC) in Sacramento

where they were made available to the public as preliminary data. The USBR also telemetered hourly specific conductance and tidal stage data from station C-2 to CDEC.

Creek elevation data were also collecte at the two monitoring stations: Green Valley Creek (S-10) and Suisun Creek (S-15) (see Figure 2). Elevations were obtained at 15-minute intervals using a pressure transducer or float well and recorded with Enviro-Lab DL-800 data loggers. Data were then converted to estimates of flow rates (in cubic feet per second) using flow rating curves developed by the United States Geologic Survey. Actual flow measurements were taken monthly from the creeks to calibrate the rating curves. In January 1997, station S-15 was washed out by high flows. Therefore, data from this station are not available for February through September 1997.

Continuously recorded data were downloaded weekly from the data recorders onto floppy disks and brought to the office for analysis, summary, and permanent storage. Data about operational checks on the monitoring equipment and calibration materials were also collected during each visit for data quality assurance and control (QA/QC). Data collection and telemetry equipment were checked for proper functioning twice weekly during the compliance season and once weekly during the non-compliance period (1 June through 30 September).

Specific conductance and tidal stage data were stored as Statistical Analysis Software (SAS) files after being analyzed by a series of programmed QA/QC checks in addition to visual inspection. Only those data passing QA/QC are included in this report. These same data have also been exported to the Interagency Ecological Program's file server where they are available at Internet address http://www.iep.water.ca.gov.

Results and Conclusions

Changes in marsh salinity were primarily a function of Delta outflow. Mean monthly high tide specific conductances at the beginning of the compliance season were above 10 milliSiemens per centimeter (mS/cm) at all compliance stations except C-2 (Tables 5 and 6, Figures 3 through 9). Operation of the SMSCG in November 1996 controlled salinity levels in the marsh until heavy rains, beginning in November, followed by rapid increases in Delta outflow, substantially reduced them. Following November, monthly mean high tide specific conductance at all stations remained well below standards throughout the remainder of the compliance season.

Mean monthly high tide salinity levels were lower at eastern rather than at western marsh stations during all months (see Tables 5 and 6 and Figures 3 through 5). This was due largely to the proximity of eastern marsh stations to the Sacramento River and Delta. Eastern marsh stations are identified as those east of the confluence of Cutoff and Montezuma sloughs (S-64 and S-49) and those on the Sacramento River at the confluence with Montezuma Slough (C-2) (see Figure 2). Western marsh stations are those located west of the confluence of Cutoff and Montezuma sloughs (S-42, S-21, S-97, and S-35).

Differences in mean monthly high tide salinities among eastern Marsh stations also corresponded to Delta proximity (see Table 5 and Figures 2 through 5). The station closest to the Delta (C-2), had the lowest mean monthly high tide salinity levels

throughout the year. Mean monthly high tide salinity levels at S-49, the westernmost of the eastern marsh stations, were consistently higher than at either C-2 or S-64.

Mean monthly high tide salinity levels at the western marsh stations, S-35 and S-97, were the highest observed anywhere (see Table 6 and Figures 3 through 9). This was probably due mainly to their proximity to Suisun Bay and their extreme westernmost positions in the marsh (see Figure 2) where influence from Delta outflow is lowest. Relatively lower salinity levels at S-97 and S-21, compared to S-35, may have also been due, in part, to increased inflow from Green Valley and Suisun creeks, respectively, during periods of rainfall. Mean monthly high tide salinities at S-21 may also have been influenced, in part, by increased surface runoff and outflow in Suisun Slough.

Table 5 Mean monthly high tide specific conductance (mS/cm) at eastern marsh stations from 1 October 1996 through 31 May 1997

Month	*C-2*	*S-64*	*S-49*	*Standard* [a]
October	6.71	10.04	12.74	19.0
November	6.82	8.40	11.00	15.5
December	0.79	1.90	5.36	15.5
January	0.09	0.23	0.44	12.5
February	0.14	0.34	0.63	8.0
March	0.15	1.00	1.24	8.0
April	0.50	2.23	3.43	11.0
May	1.58	3.98	5.37	11.0

[a] Water quality standards for specific conductance specified by SWRCB Order WR 95-6.

Table 6 Mean monthly high tide specific conductance (mS/cm) at western marsh stations from 1 October 1996 through 31 May 1997 [a]

Month	*S-42*	*S-21*	*S-97*	*S-35*	*Standard* [b]
October	13.32	13.48	14.48	15.43	19.0
November	12.35	12.38	13.55	15.07	16.5
December	5.93	5.17	6.52	6.49	15.5
January	1.01	1.01	1.91	1.71	12.5
February	1.28	1.31	2.66	2.27	8.0
March	1.65	1.51	2.71	1.91	8.0
April	4.04	4.21	4.88	5.42	11.0
May	NA[c]	6.16	6.93	7.49	11.0

[a] S-42, S-97, and S-35 were monitoring, but not compliance, stations during this period.
[b] Water quality standards for specific conductance specified by State Water Resources Control Board Order WR 95-6.
[c] Not available.

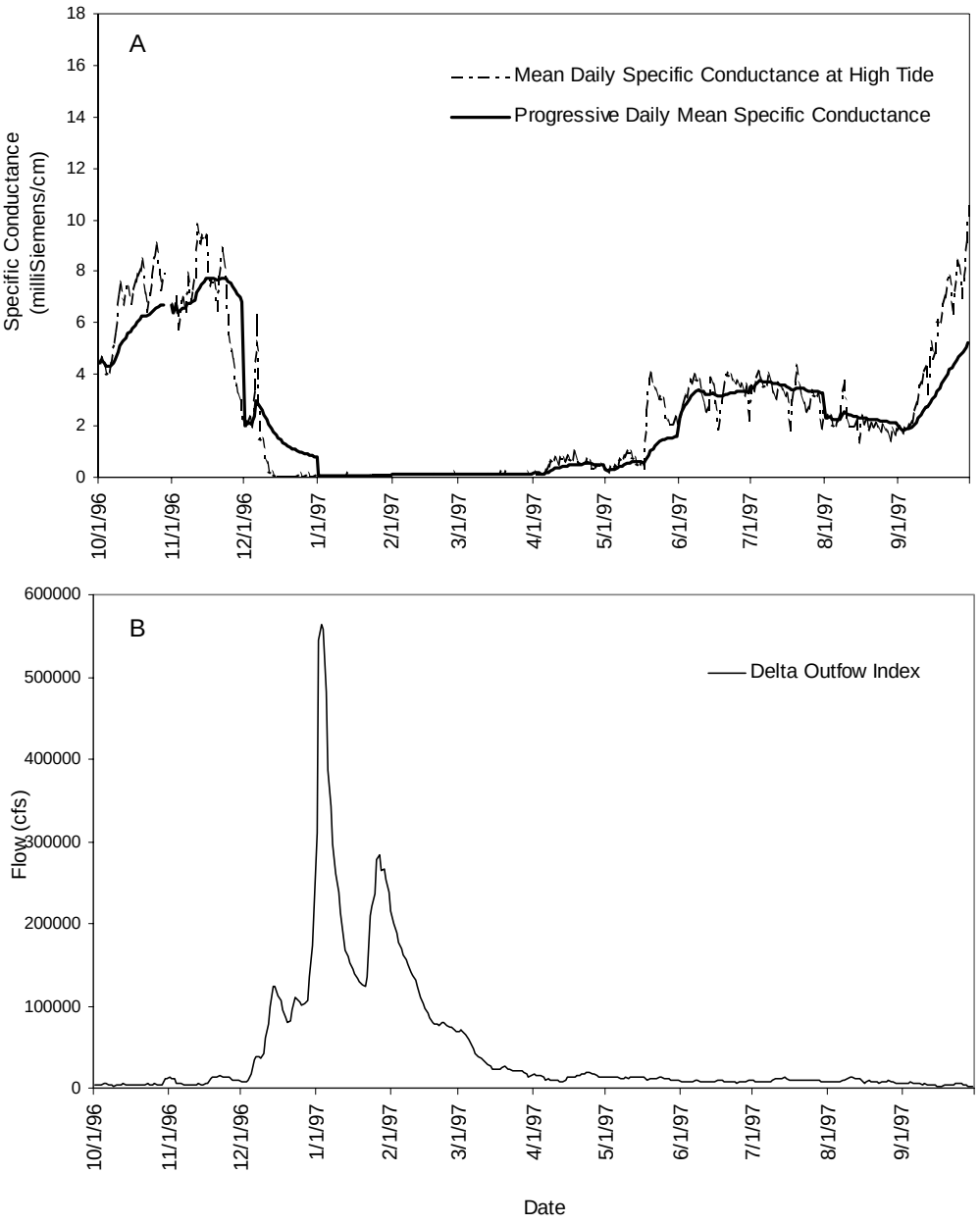

Figure 3 (A) Specific conductance at monitoring station C-2 from 1 October 1996 through 30 September 1997 and (B) Delta Outflow Index

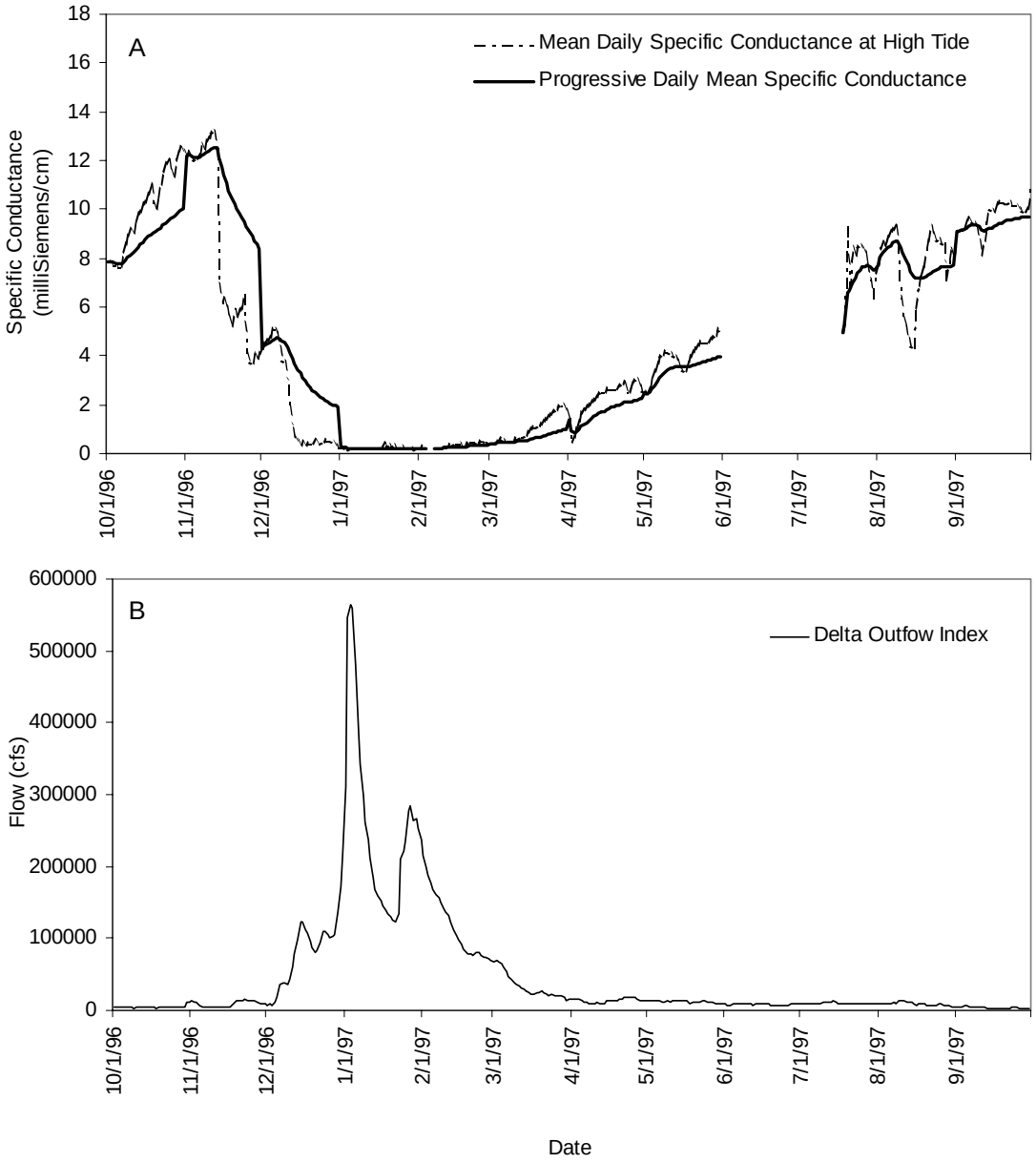

Figure 4 (A) Specific conductance at monitoring station S-64 from 1 October 1996 through 30 September 1997 and (B) Delta Outflow Index

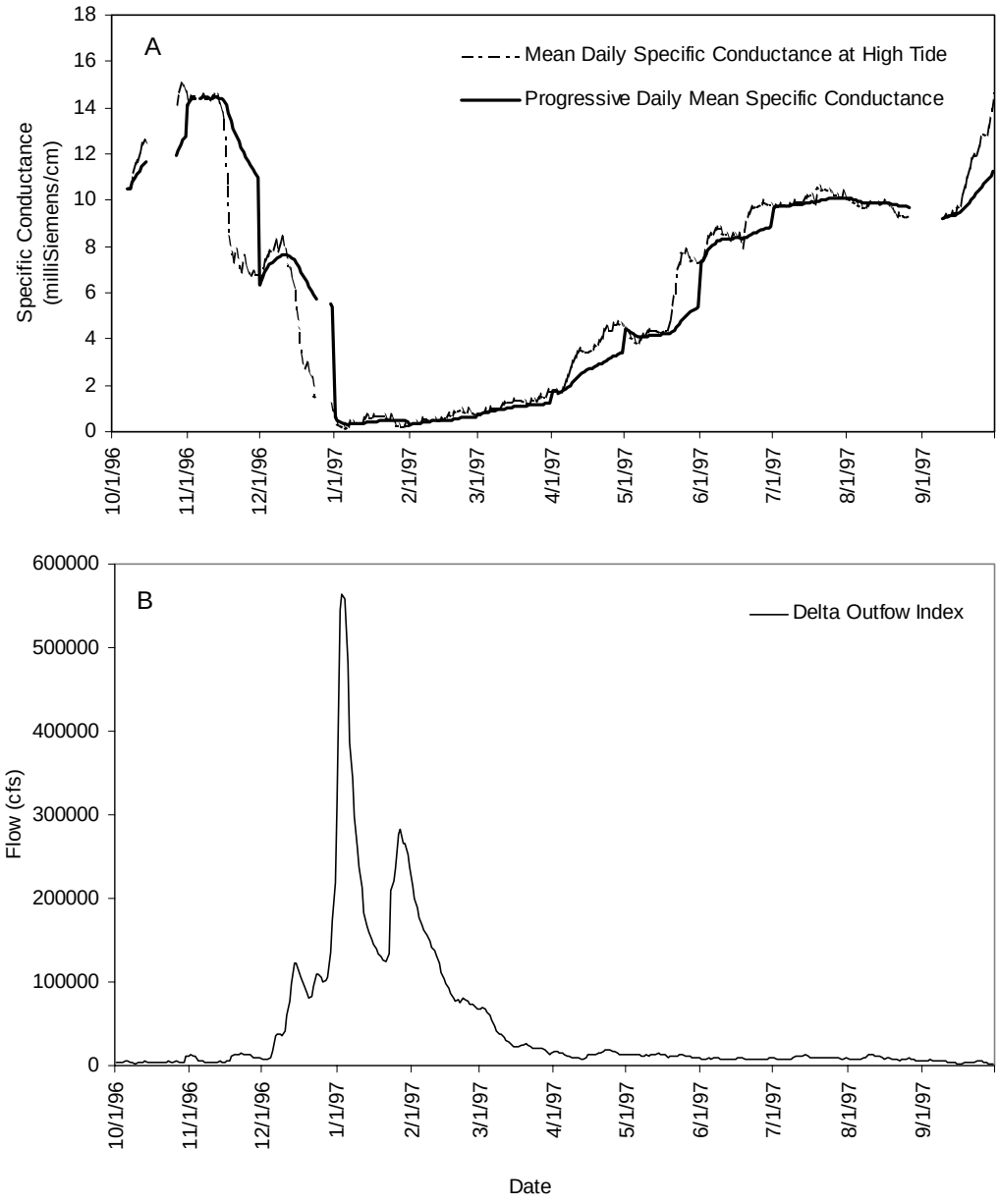

Figure 5 (A) Specific conductance at monitoring station S-49 from 1 October 1996 through 30 September 1997 and (B) Delta Outflow Index

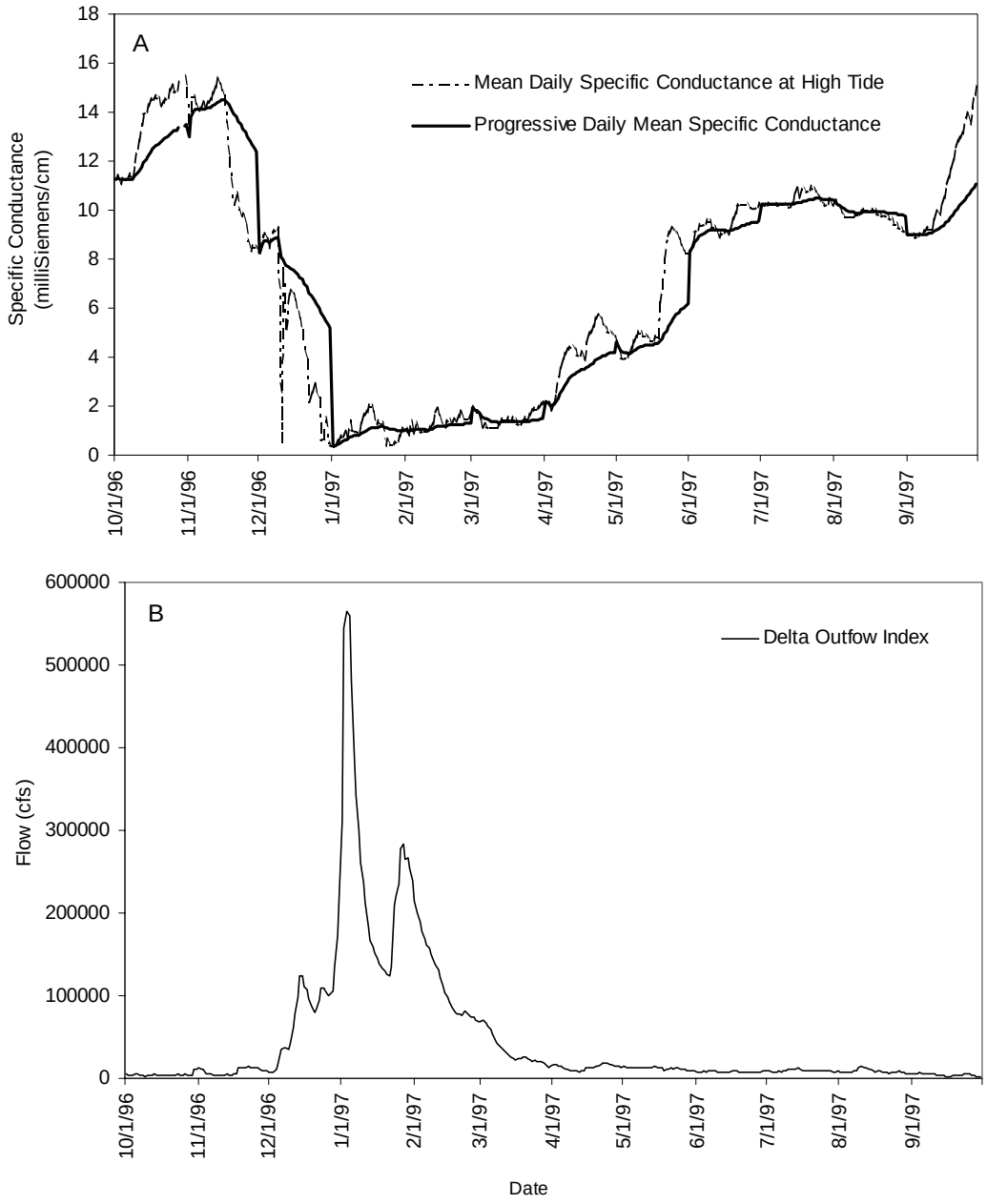

Figure 6 (A) Specific conductance at monitoring station S-21 from 1 October 1996 through 30 September 1997 and (B) Delta Outflow Index

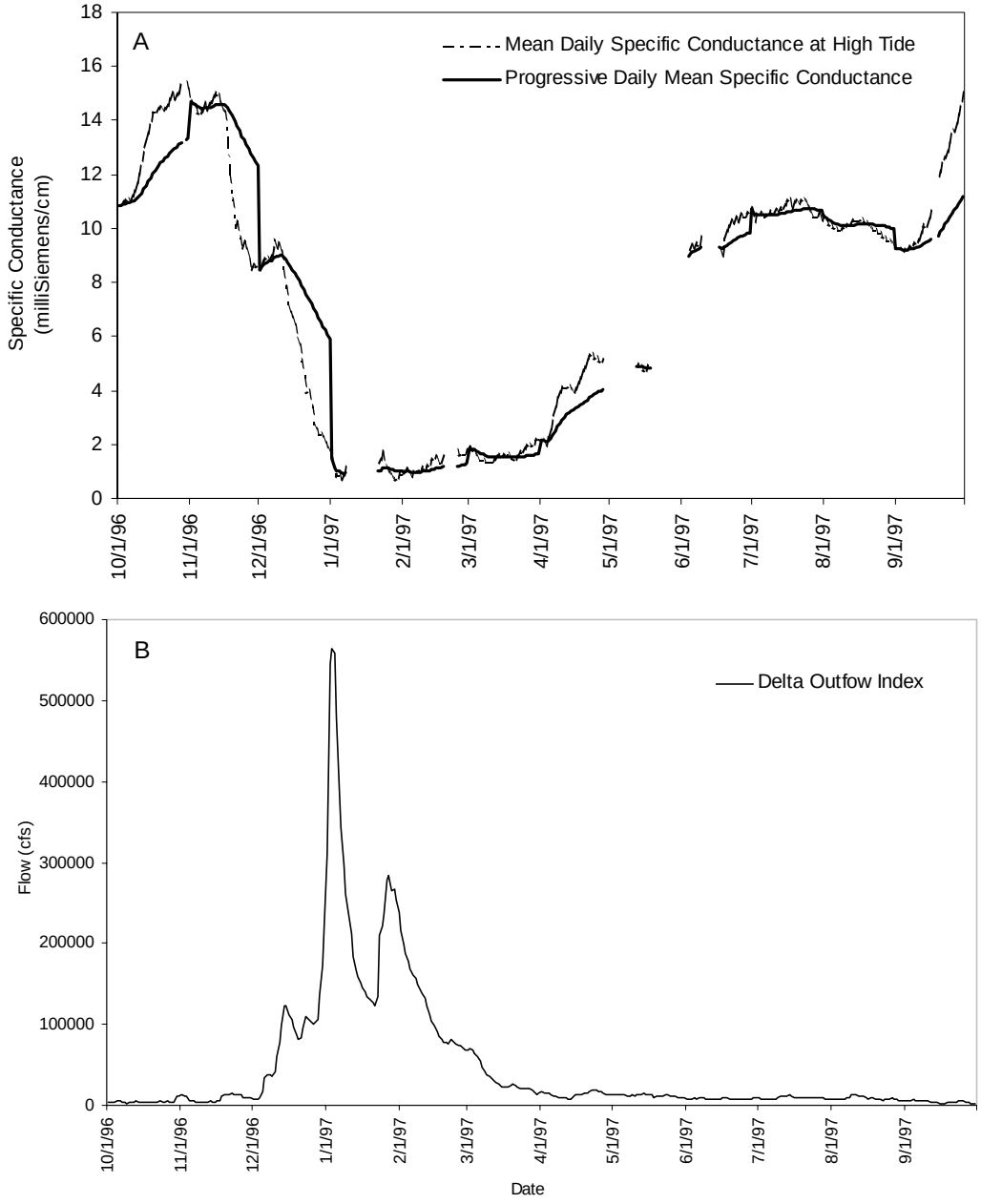

Figure 7 (A) Specific conductance at monitoring station S-42 from 1 October 1996 through 30 September 1997 and (B) Delta Outflow Index

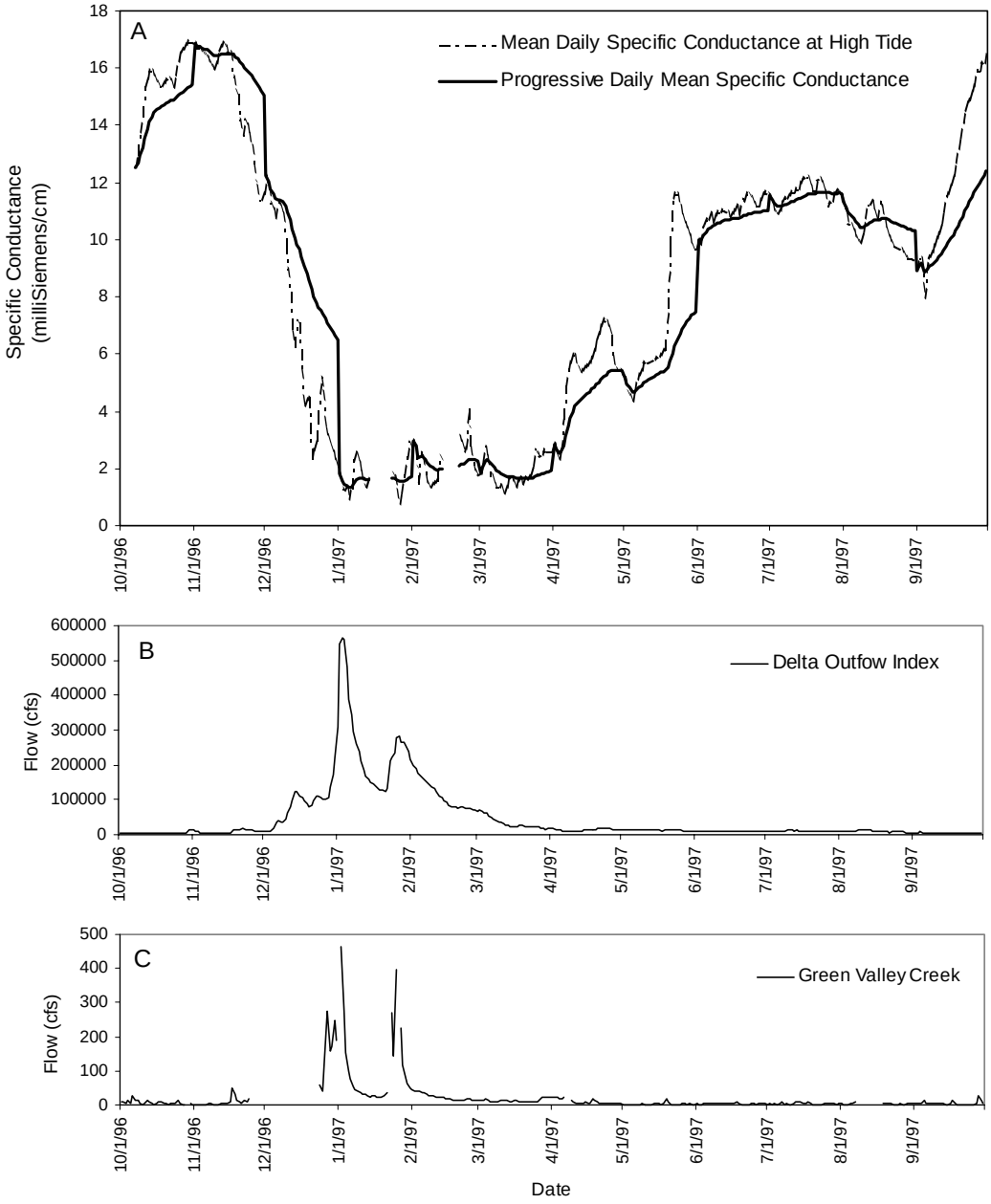

Figure 8 (A) Specific conductance at monitoring station S-35 from 1 October 1996 through 30 September 1997; (B) Delta Outflow Index; and (C) Green Valley Creek flow

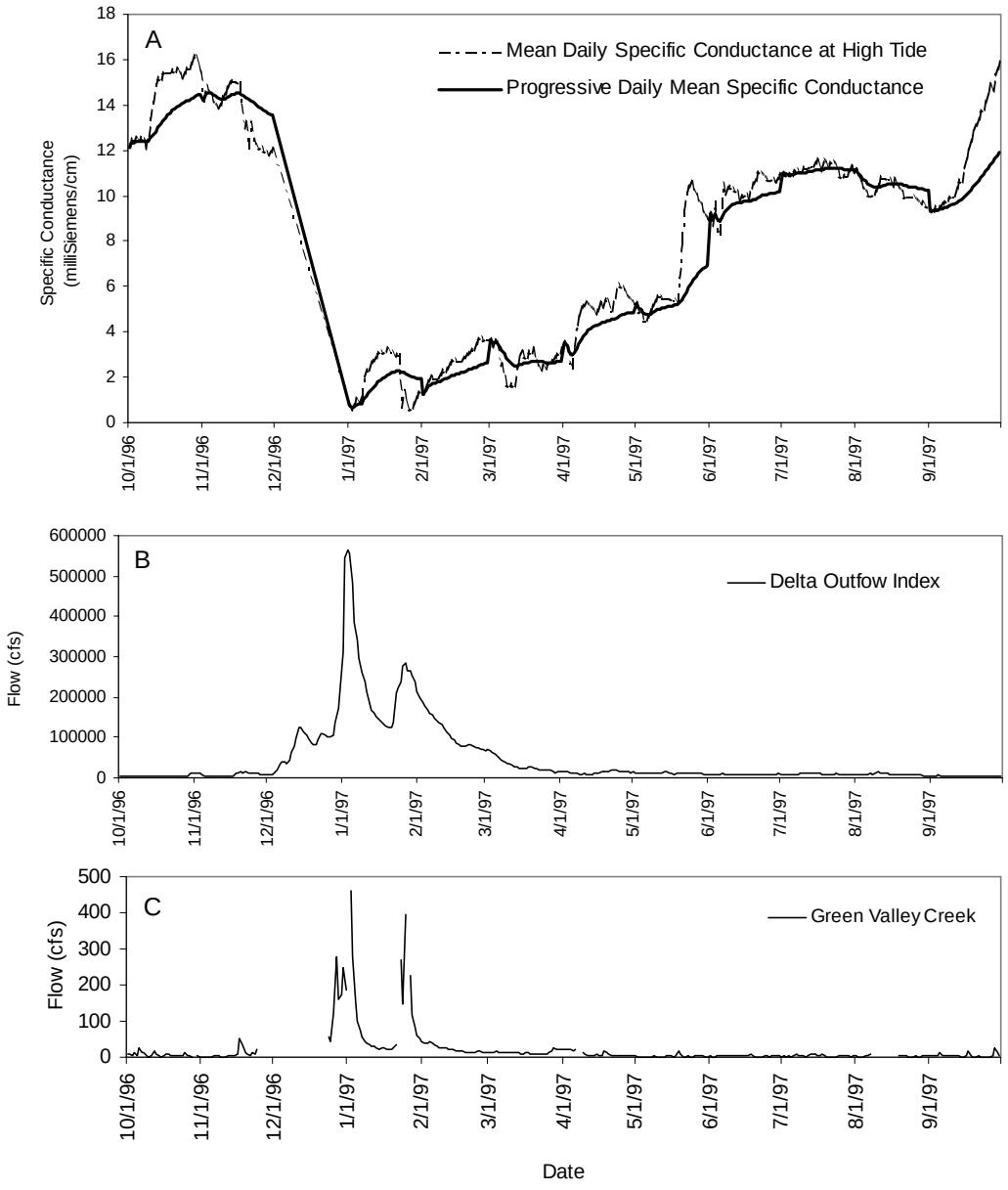

Figure 9 (A) Specific conductance at monitoring station S-97 from 1 October 1996 through 30 September 1997; (B) Delta Outflow Index; and (C) Green Valley Creek flow

Salt Marsh Harvest Mouse

Background

The salt marsh harvest mouse (SMHM), *Reithrodontomys raviventris*, is endemic to Suisun Marsh and the marshes of San Francisco Bay (USFWS 1984). The species was listed as an endangered species by the United States Fish and Wildlife Service (USFWS) in 1970 and by DFG in 1971.

As a condition of the USACE permit (No. 20698N) for maintenance dredging of the MIDS, SMHM were live-trapped and removed from the dredge spoil area, which included 19 acres of SMHM habitat (DWR 1996).

Methods

Capture of SMHM was done using Sherman live traps baited with a mixture of birdseed and ground walnuts. In addition to bait, a paper towel was placed in each trap to provide bedding if an animal was captured. Traps were set in the late afternoon, and checked early the next morning. Trap effort was measured by the number of trap-nights (one trap set for one night). Criteria reported by Shellhammer (1984) were used to differentiate the salt marsh harvest mouse from the morphologically similar western harvest mouse (*Reithrodontomys megalotis*).

Live-trapping was conducted in the spoils area on the south side of the MIDS (Figure 10) from 28 July through 11 September 1997. A temporary berm had been constructed approximately 50 feet south of the MIDS levee to contain the dredge spoils. Traps were set for SMHM between the levee and the berm. Traps were placed approximately every 10 meters, and each section of the spoils area was trapped for four consecutive nights. All captured SMHM were ear-tagged and released at a DFG SMHM set-aside area located at the Benicia Industrial Unit (see Figure 10).

From 23 through 26 June 1997, before translocating captured SMHM, the Benicia Unit was sampled to estimate the resident SMHM population size. In an effort to assess survival of translocated mice, the Benicia site was again sampled on three separate occasions in attempt to recapture the translocated mice. Two of the trapping events, 3 through 5 August 1997 and 9 and 10 September 1997, occurred during water year 1997. The third event, 20 through 23 October 1997, occurred during water year 1998.

Results

In approximately 4,000 trap nights (the actual number of traps was not recorded) along the MIDS, 28 SMHM were captured, ear-tagged, and released at the Benicia Unit. Other species captured at MIDS included western harvest mice, voles (*Microtus* sp.), and house mice (*Mus musculus*).

Three of the SMHM translocated from the MIDS were recaptured at the Benicia Unit. Each of the three was recaptured only once: two during the night following their release and the third 27 days after release.

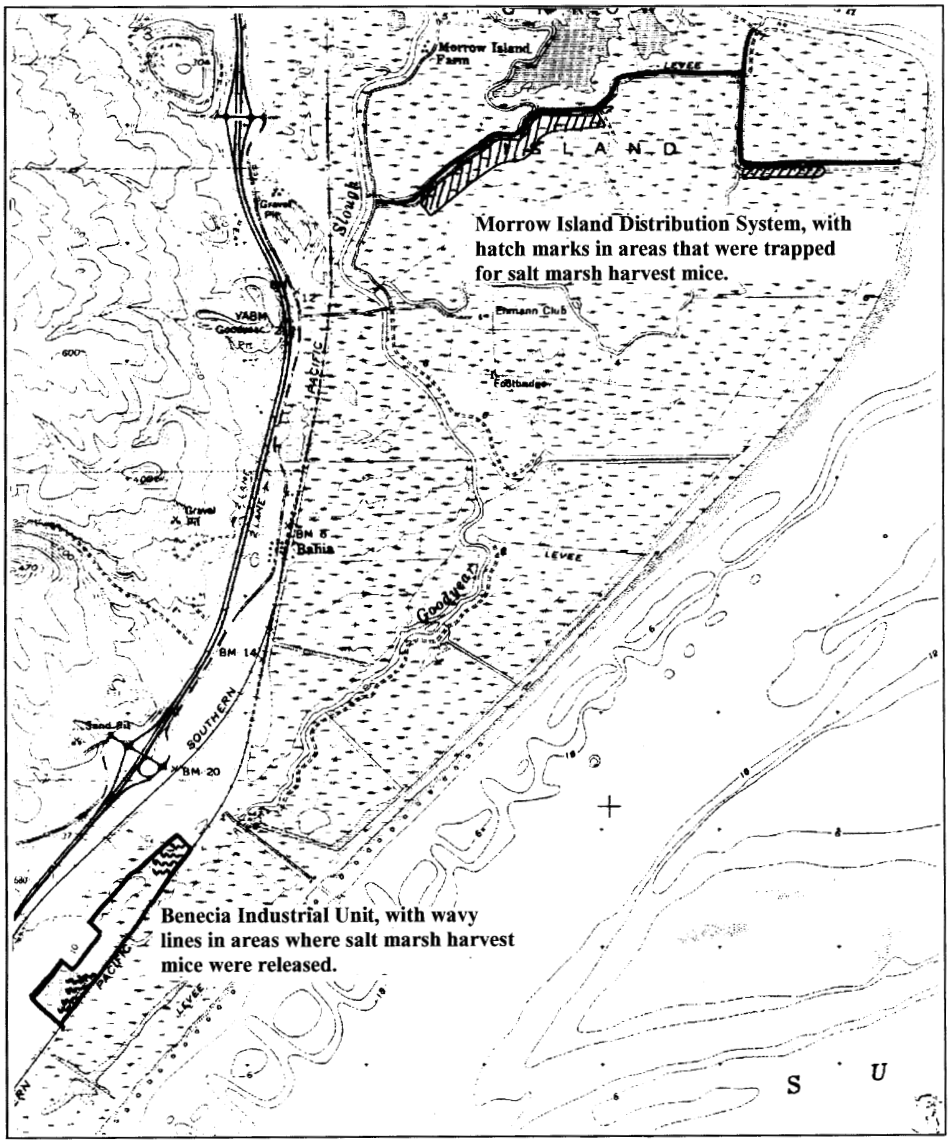

Figure 10 Morrow Island Distribution System salt marsh harvest mouse trap and release sites

Trapping at the Benicia Unit conducted before the MIDS dredging resulted in the capture of only one SMHM in 482 trap nights. However, during later trapping that occurred concurrently with the releases of SMHM from MIDS, 18 untagged SMHM were captured at the Benicia Unit during 798 trap nights. These SMHM may have moved into the area from adjacent lands that became flooded due to a leaking flap gate. Other species captured at the Benicia Unit were western harvest mice, voles, deer mice (*Peromyscus* sp.), ornate shrews (*Sorex ornatus*), house mice, and one rat (*Rattus* sp.).

Waterfowl

Background

Waterfowl (ducks, geese, and swans) numbers throughout the Pacific Flyway have declined since the mid-1980s. This decline has been attributed to loss of breeding habitat in the primary breeding grounds of the plains states and Canada, and the loss of wintering habitat along the Pacific Coast. The trend in California (Figure 11) is similar to that throughout the flyway. In January 1997, 3.5 million waterfowl were counted in California, including 2.6 million ducks, of which 790,000 were pintails and 360,000 were mallards (USFWS unpublished data).

Suisun Marsh is a key waterfowl wintering area on the Pacific Flyway. For species including northern pintail (*Anas acuta*), mallard (*Anas platyrhynchos*), American wigeon (*Anas americana*), green-winged teal (*Anas crecca*), northern shoveler (*Anas clypeata*), ruddy duck (*Oxyura jamaicensis*), canvasback (*Aythya valisineria*), white-fronted goose (*Anser albifrons*), and Canada goose (*Branta canadensis*) (DWR 1984).

Each year, migrant waterfowl begin arriving in Suisun Marsh in August, and by October the highest counts there are obtained. From October through December, waterfowl numbers remain fairly constant, then decline in January. Total numbers of waterfown counted in the Suisun Marsh, however, have been declining since the mid-1960s (Figure 12).

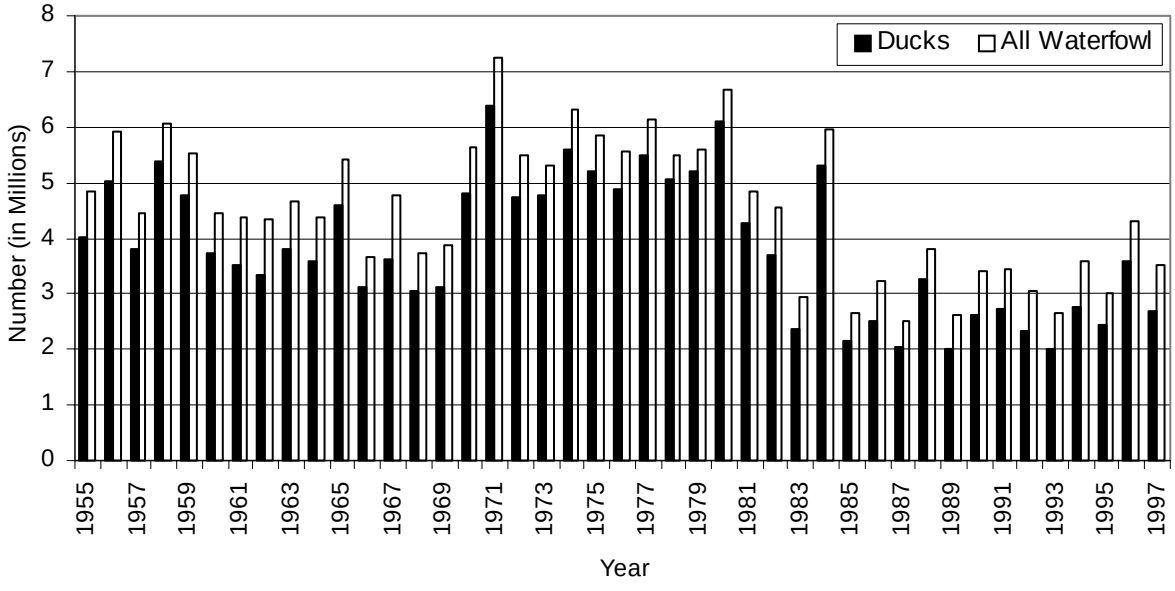

Figure 11 Midwinter count of ducks and total numbers of waterfowl in California from 1955 through 1997

Methods

All Suisun Marsh waterfowl population estimates used in this report were provided in tabular form by DFG, Wildlife Management Division (DFG unpublished data) and stored on a microcomputer. DFG conducted waterfowl population surveys in the Suisun Marsh from September 1996 through January 1997. Survey counts in this document include numbers of northern pintail, mallards, total ducks, and total waterfowl. Numbers of pintails and mallards are included because these species are most common in the marsh and are, therefore, used as indicators of overall waterfowl abundance.

During aerial surveys, aircraft are flown 100 to 150 feet above the ground at 90 to 105 miles per hour (USFWS 1987). Observers record the estimated the number of individuals and species composition of flocks within one-eighth of a mile on either side of the plane. Factors such as weather, land use changes, and waterfowl movements prevent the counts from representing reliable population estimates. However, results are useful for evaluating long-term trends in waterfowl numbers occurring in the marsh.

Results

The number of mallards (71,930) counted in water year 1997 was greater than the ten-year average (57,600) (Table 7). However, the overall number of waterfowl counted was lower.

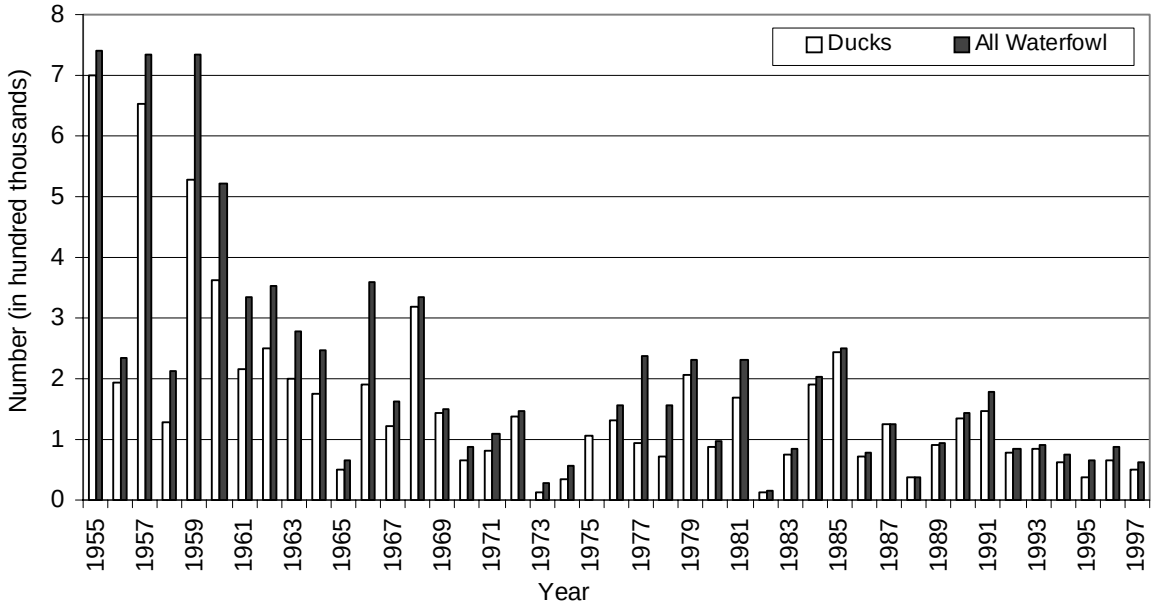

Figure 12 Midwinter count of ducks and total numbers of waterfowl in Suisun Marsh from 1955 through 1997

Table 7 Waterfowl counted in Suisun Marsh during water year 1997 and average numbers counted from 1987 through 1996

Month	*Mallards*	*Pintails*	*All Ducks*	*All Waterfowl*
Numbers Observed for Water Year 1997				
September	3,950	5,190	10,750	10,995
October	29,580	39,330	97,665	114,398
November	9,835	43,500	89,345	98,961
December	22,460	18,860	116,500	128,774
January	6,105	5,290	50,240	63,526
Total	71,930	112,170	364,500	416,654
Average Numbers Observed for Water Years 1987 through 1996				
September	3,700	6,600	15,000	15,800
October [a]	17,500	35,500	94,500	101,500
November	13,900	34,300	89,300	94,600
December	12,300	37,700	110,200	119,000
January	10,200	24,200	86,200	98,500
Total	57,600	138,300	395,200	429,400

[a] Averages for mallards, all ducks, and all waterfowl were calculated from less than eight years of data.

Vegetation

The triennial vegetation survey scheduled for water year 1997 was postponed to update the objectives and methodology. DFG's Natural Heritage Division is preparing a final proposal for a survey methodology. The next vegetation survey is scheduled for water year 1999.

Maintenance

Routine Maintenance

Routine maintenance conducted at DWR facilities in the marsh included pothole repair, grading of levee roads, and weed control with herbicides and mowing. Routine maintenance was accomplished in accordance with USACE Nationwide Permit No. 3 and under San Francisco Bay Conservation and Development Commission Permit Number 35-78(M).

Approximately 40 tons of earthfill and ten tons of rock were used to fill holes that developed around the SMSCG control building. Approximately 400 tons of earthfill material and 200 tons of rock were used to repair RRDS levees.

1997 Flood Damage Repair

A January 1997 flood washed out the Suisun Creek streamflow monitoring station (S-15). The station was rebuilt during summer 1997 and relocated approximately 50 yards downstream on the opposite bank. The new station (S-16) enables safer access for maintenance and data retrieval.

Approximately 500 tons of gravel were used to repair flood damage between miles 2.5 and 3.0 on RRDS.

Other Maintenance

Morrow Island Distribution System

Maintenance dredging was conducted on MIDS during summer 1997 (DWR 1997). Thirty-eight thousand cubic yards of material were removed from the system and placed alongside of the levees. During summer 1998, after the material dries, it will be used to raise the levees to their original design height. Most of the planned work was accomplished except for the M-Line outfall slide gates and timber walkway, which will also be completed in 1998.

The MIDS Environmental Compliance Advisory Team (ECAT) was established to evaluate completed work and to outline maintenance work scheduled for summer 1998, including a fish screen on the MIDS intake. The ECAT will provide management with an evaluation of the effectiveness of the coordination team and the lessons learned from it.

Roaring River Distribution System

The actuators on the intake gates of the RRDS were automated during water year 1997. Information is telemetered to the DWR Delta Field Division, which controls the gates. Automation allows better control of intake flow velocity through the fish screens, enabling DWR to meet the USFWS intake velocity criteria for the protection of delta smelt while maximizing the volume of water diverted from Montezuma Slough for the public and privately managed wetlands adjacent to the RRDS.

References

[DFG] California Department of Fish and Game. [Unpublished data]. Wildlife Management Division.

[DWR] California Department of Water Resources. 1984. Plan of Protection for the Suisun Marsh Including Environmental Impact Report. Sacramento (CA): California Department of Water Resources. 176 p + appendices.

[DWR] California Department of Water Resources. 1996. Biological Assessment for the Proposed Morrow Island Distribution System Maintenance. Sacramento (CA): California Department of Water Resources. 70 p.

[DWR] California Department of Water Resources. 1997. Initial Study for Morrow Island Distribution System Maintenance. Sacramento (CA): California Department of Water Resources. 33 p.

California Department of Water Resources, California Department of Fish and Game, and U.S. Bureau of Reclamation. 1987. Suisun Marsh Monitoring Agreement. March 2, 1987.

Shellhammer HS. 1984. Identification of salt marsh harvest mice, *Reithrodontomys raviventris*, in the field and with cranial characteristics. *California Fish and Game* 70(2):113–20.

[USFWS] United States Fish and Wildlife Service. 1984. Salt Marsh Harvest Mouse and California Clapper Rail Recovery Plan. Portland (OR): United States Fish and Wildlife Service. 141 p.

[USFWS] United States Fish and Wildlife Service. 1987. Standard Operating Procedures for Aerial Survey of Waterfowl and Habitats on the Breeding Grounds in North America. Co-op U.S. Fish and Wildl. Serv. and Can. Wildl. Serv. 95 p.

[USFWS] United States Fish and Wildlife Service. 1997. [Unpublished data]. Sacramento National Wildlife Refuge.