GRASSLAND BYPASS PROJECT

QUARTERLY NARRATIVE AND GRAPHICAL SUMMARY

January - March 1998

July 5, 1998

A cooperative effort of:
U.S. Bureau of Reclamation
Central Valley Regional Water Quality Control Board
U.S. Fish and Wildlife Service
California Department of Fish and Game
San Luis & Delta-Mendota Water Authority
U.S. Environmental Protection Agency
U.S. Geological Survey

Report prepared by the San Francisco Estuary Institute

I. INTRODUCTION

The Grassland Bypass Project (GBP) intercepts agricultural irrigation return flows south of the Grassland Water District and conveys them through the northernmost 28 miles of the San Luis Drain to a discharge point in Mud Slough, a tributary of the San Joaquin River. The location of the Project and the Grassland Drainage Service Area are shown in Figure 1. A schematic of the GBP showing the hydrology of the Project and sampling locations is provided in Figure 2. The GBP has removed agricultural drainage from wetland water supply channels in the Grassland Water District and from Salt Slough, but has increased quantities of agricultural drainage in the six miles of Mud Slough that receives the re-routed drainage water. A detailed monitoring program, the Grassland Bypass Project Compliance Monitoring Program (GBPCMP) has been in place since October 1996 to evaluate whether the terms and conditions of the Project are being met. Specific conditions for the Project include monthly and annual selenium load values from the San Luis Drain into Mud Slough, selenium load reductions over the long term, removal of subsurface agricultural drainage from the wetland water supply channels, the prevention of significant adverse environmental impacts, and the prevention of significant adverse effects on human health. Detailed background information on the GBP is documented in the “Finding of No Significant Impact and Supplemental Environmental Assessment (FONSI)” and the Interim Use Permit (USBR 1995). The comprehensive monitoring plan (USBR 1996) and the Quality Assurance Project Plan (Entrix 1997) contain detailed descriptions of the sampling and analytical methods employed in the GBPCMP.

The purpose of the Quarterly Narrative and Graphical Data Summary series is to provide an overview of the data collected in the most recent quarter of the GBP. Complete listings of the data are provided in Monthly Data Reports and Quarterly Data Reports. The data and detailed background information on the GBP are also available on the Internet at the following address:

www.mp.usbr.gov/mp400/irrdrn/grasslnd/grasslnd.html.

II. FLOW MONITORING

Flow data in the GBPCMP are measured to allow computation of selenium load discharge, to establish seasonal flow patterns, and to determine the influence of the discharge from the San Luis Drain on the hydrology of Mud Slough. According to the Interim Use Permit, discharge flows into Mud Slough from the San Luis Drain may not exceed 150 cfs (USBR 1995).

Flows in the Project area in the quarter were unusually high due to record amounts of rainfall in the local watershed (Summers Engineering 1998). Flows in the San Luis Drain approached the 150 cfs limit for much of February and March. Storm flows in excess of the capacity of the Drain, in accordance with the Storm Event Plan developed by the GBP, were released into Agatha Canal (station K) from February 3 to February 28 and March 4 to March 6 (Grassland Area Farmers 1998).

Flows in the San Luis Drain (stations A and B) increased sharply in early February, from approximately 30 cfs to approximately 130 cfs, and remained elevated throughout February and March (Figure 3). Flows in the Drain in February in March were the highest observed since the Project began in October 1996. Flow at station A averaged 84.8 cfs for the quarter, slightly lower than the average at station B (86.9 cfs). The average flow at station A in February was 126 cfs. Maximum flow for the quarter was 143 cfs on March 26 at station A and 145 cfs on February 13 at station B.

Of the two monitoring stations in Mud Slough above and below the GBP discharge (stations C and D, respectively), flow is measured only at station D. The average flow at station D for the quarter was 611 cfs. This was much higher than the 363 cfs average flow observed in January - March 1997. The discharge from the SLD (station B) accounted for an average of 14% of the total flow in Mud Slough (station D). Flows in Salt Slough (station F) were of a similar magnitude as those in Mud Slough, averaging 413 cfs for the quarter. Average flow in Salt Slough in January - March 1997 was 366 cfs.

Station N flows during the quarter averaged 10,139 cfs. Flows increased rapidly in January from less than 1000 cfs on January 12 to 5,320 cfs on January 19. Flows were still higher in February, reaching a maximum for the quarter of 24,200 cfs on February 16. This maximum flow was lower than the peak flow reported for station N in 1997 (37100 cfs); the average flow for the quarter in 1997 was also higher (17,114 cfs).

III. WATER QUALITY MONITORING

Water quality data in the GBP are collected to evaluate compliance with selenium load values given in the FONSI and the Interim Use Permit (USBR 1995), to evaluate compliance with the commitment to not discharge drainage to the wetland channels, and to evaluate potential adverse effects of the GBP discharge and of waters in Mud Slough below the discharge on test organisms.

Chemical Monitoring

Selenium

Daily Selenium Measurements

Daily selenium concentrations are measured at stations B and N using autosamplers (USBR 1996). Monthly total selenium load discharge is computed at Station B. Monthly totals are shown in the Table 1 and illustrated in Figure 4a.

Selenium load discharge from the GBP (discharge from the terminus of the Drain as measured at station B) averaged 32.2 lbs/day for the quarter. The maximum daily selenium load discharge (65.5 lbs/day) occurred on March 26. Selenium load discharge increased steadily throughout the quarter from 4.8 lbs/day on January 1 to 53.6 lbs/day on March 31 (Figure 4e). This steady increase was in spite of variable flows (Figure 4c) and selenium concentrations (Figure 4b). The cumulative selenium load discharge for the quarter was 2740 lbs.

Selenium concentrations at station N (San Joaquin River at Crow's Landing) averaged 1.7 ug/l for the quarter. The highest concentration was measured on January 8 (3.1 ug/l).

Weekly Selenium Measurements

Selenium concentrations are measured in weekly grab samples collected at 12 stations (Figures 6-8). The average selenium concentration near the inlet to the San Luis Drain (station A, 70 ug/l) was equal to that near the point of discharge into Mud Slough (station B) (Figure 6).

Selenium concentrations in Mud Slough upstream of the GBP discharge (station C) from October-March averaged 0.9 ug/l, with a maximum concentration of 1.3 ug/l (Figure 6). Concentrations were higher in Mud Slough downstream of the GBP discharge (station D) than upstream at station C (note differences in scales). Concentrations at station D averaged 11.8 ug/l, with a maximum of 24.6 ug/l on March 19.

Selenium concentrations in Salt Slough (station F) and the wetland water supply channels (stations J, K, L, and M) were frequently higher than 2 ug/l (Figure 7). Concentrations above 2 ug/l were measured in December at stations J (six samples), K (six samples), L (eight samples) and M (eight samples). High selenium concentrations in Agatha Canal (station K) measured in February were due to the release of drainage water into the Canal during high flow periods, as discussed previously.

In the San Joaquin River, weekly selenium samples were collected at stations upstream of the GBP discharge (station G), downstream of the discharge and above the Merced River (station H), and downstream of the Merced River (station N) (Figure 8). Selenium concentrations at station G were low, averaging 0.6 ug/l. Concentrations were higher at station H, averaging 2.8 ug/l and reaching a maximum of 5.1 ug/l on January 8.

Specific conductance

Specific conductance is measured at 15 min intervals at stations B, D, F, and N, and in weekly grab samples at stations A, B, C, D, F, G, H, J, K, L, M, and N. These data are presented in Figures 9 and 10.

Toxicity Testing

The purpose of the GBP toxicity testing program is to evaluate the potential adverse effects to test organisms of the GBP discharge and of waters in Mud Slough below the discharge. Monthly toxicity tests are conducted in the laboratory using water collected from stations B, C, D, and F. Test results from these stations are compared to results obtained using water from the Delta-Mendota Canal. Monthly toxicity tests include: the 7-day chronic fathead minnow (*Pimephales promelas*) larvae survival and growth test; the 7-day chronic water flea (*Daphnia magna*) survival and reproduction test; and the 4-day chronic algal (*Selenastrum capricornutum*) growth test. A 7-day *in situ* survival test using 4-day-old fathead minnow larvae was conducted at stations B, D, F, and a reference site (Windmill) on a quarterly basis from the beginning of the Project until August 1997, but has not been conducted since that time. Laboratory toxicity test results are summarized below; complete datasets are presented in the GBP Monthly Data Reports and GBP Quarterly Data Reports.

In the fathead minnow tests, many samples exhibited significantly reduced survival or growth, but the GBP discharge did not appear to be the source of the agents responsible for these reductions. No fathead minnow tests performed on samples from station B exhibited reduced survival or growth. In contrast, all of the samples collected at stations C and D in Mud Slough caused significantly reduced survival and growth. Samples from Station F (Salt Slough) caused significantly reduced survival and growth in February and March. The largest reductions in survival and growth were observed at station C, upstream of the GBP discharge.

In the *Daphnia* tests, no field samples caused a reduction in survival. Survival in a control sample from the Delta Mendota Canal in February was only 50%, and failed to meet the acceptability criterion for the test. Survival in the laboratory controls for the *Daphnia* survival test, which has occasionally been low in past sampling, was zero in all three months.

In the *Daphnia* reproduction test, three samples (from stations B, D, and F in January) were significantly reduced relative to the Delta-Mendota control. Reproduction in a control sample from the Delta Mendota Canal in February was lower than in the field samples, and failed to meet the acceptability criterion for the test.

In the *Selenastrum* tests significant inhibition of growth was observed in all samples from station B. No other samples inhibited *Selenastrum* growth.

IV. SEDIMENT MONITORING

Sediment Quality Monitoring

Sediment quality is measured in the San Luis Drain and in Mud and Salt Sloughs. The purpose of monitoring sediment chemistry in the San Luis Drain is to assess whether selenium concentrations in drain sediments are approaching the California Department of Health Services hazardous waste criterion (100 ug/g wet weight) and to provide information on the fate and transport of selenium within the Drain. Stations in Mud and Salt Sloughs are monitored to determine whether changes in sediment chemistry in these locations occur as a result of the GBP and to provide data that can be used in conjunction with biological data to assess accumulation or depletion of selenium in the aquatic food web. The most recent sediment quality data were included in the previous Quarterly Narrative and Graphical Summary.

Sediment Quantity Monitoring

A survey to estimate the quantity of sediment in the San Luis Drain is conducted annually. Results will be summarized and reported when they are available.

V. BIOLOGICAL MONITORING

Organisms are collected throughout the GBP area on a quarterly basis (USBR 1996). Tissue sampling in the GBPCMP is being performed to assess the potential for adverse impacts to fish and wildlife and to assess public health risks. Food web organisms (aquatic plants, invertebrates, and fish) are being analyzed for selenium residues to assess impacts to fish and wildlife. Muscle fillets from gamefish are being analyzed for selenium to assess human health risks. Results of these efforts are discussed in the GBP Annual Report.

REFERENCES

Entrix, Inc. 1997. Final Draft Quality Assurance Plan for the Compliance Monitoring Program for the Use and Operation of the Grassland Bypass Project. Prepared for the U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.

Grassland Area Farmers. 1997. Grassland Bypass Channel operations during two major storm events in January 1997. Report to the Central Valley Regional Water Quality Control Board, Rancho Cordova, CA.

Grassland Area Farmers. 1998. Grassland Bypass Project Storm Event Operations: February, 1998. Submitted by the Grassland Area Farmers, April 10, 1998.

Summers Engineering. 1998. Letter to Grassland Bypass Project Oversight Committee, June 11, 1998.

USBR. 1995. Finding of No Significant Impact and Supplemental Environmental Assessment, Grassland Bypass Channel Project, Interim Use of a Portion of the San Luis Drain for Conveyance of Drainage Water through the Grassland Water District and Adjacent Grassland Areas. U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.

USBR. 1996. Compliance Monitoring Program for Use and Operation of the Grassland Bypass Project. U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA.

Table 1. Comparison of monthly selenium load discharge from the terminus of the San Luis Drain (station B) with the monthly load values in the Interim Use Permit (USBR 1995).

	Selenium load discharge (lbs)	Monthly load value (lbs)	Amount over monthly load value (%)
Oct 1997	248	348	na
Nov 1997	207	348	na
Dec 1997	178	389	na
Jan 1998	335	533	na
Feb 1998	965	866	11
Mar 1998	1,600	1,066	50

na: not applicable (load discharge was less than load value)

Figure 1. Map of the Grassland Bypass Project. Locations of stations D, F, G, H, and N are indicated.

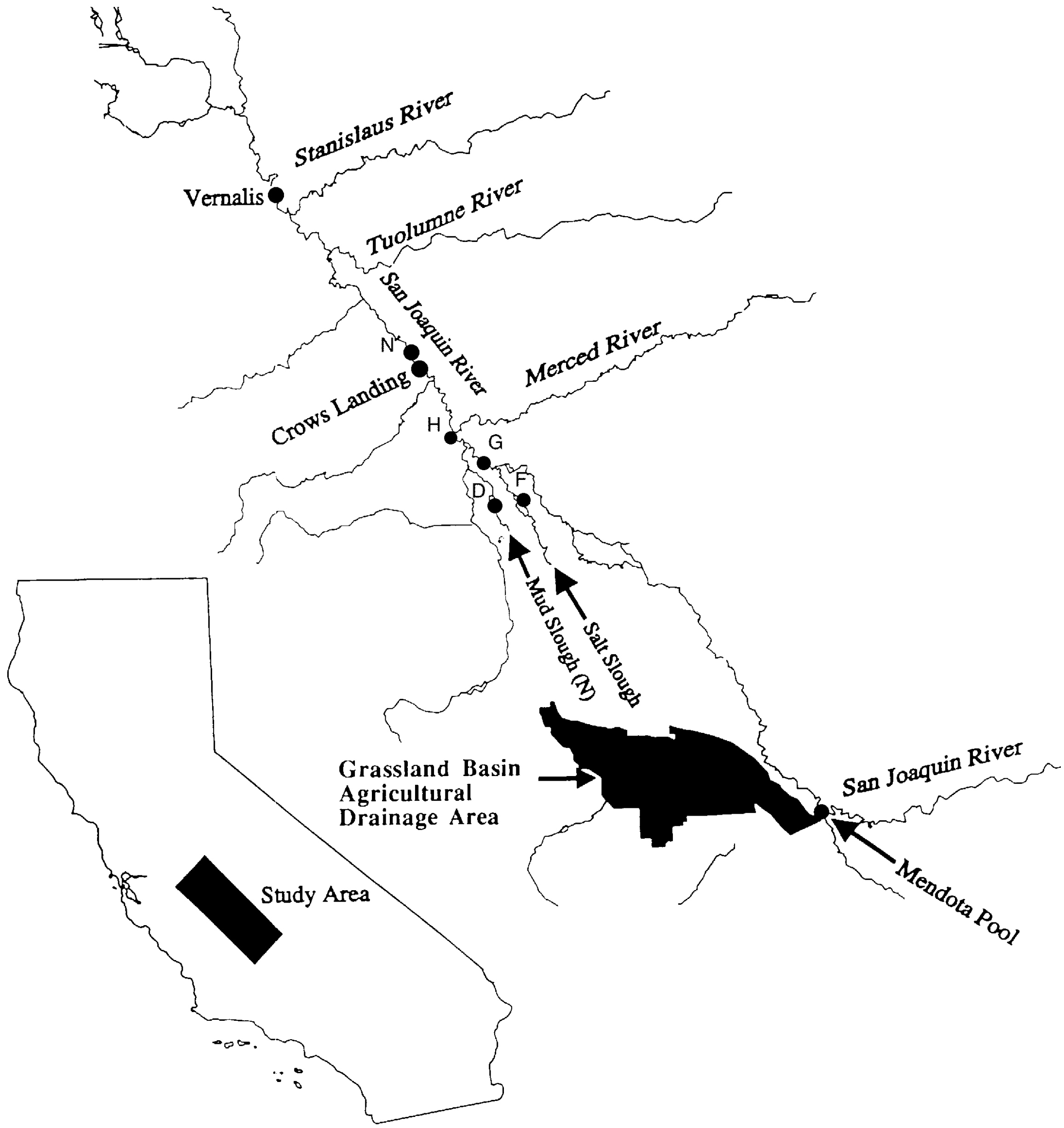


Figure 2. Schematic diagram showing locations of GBP monitoring stations relative to major hydrologic features of the study area.

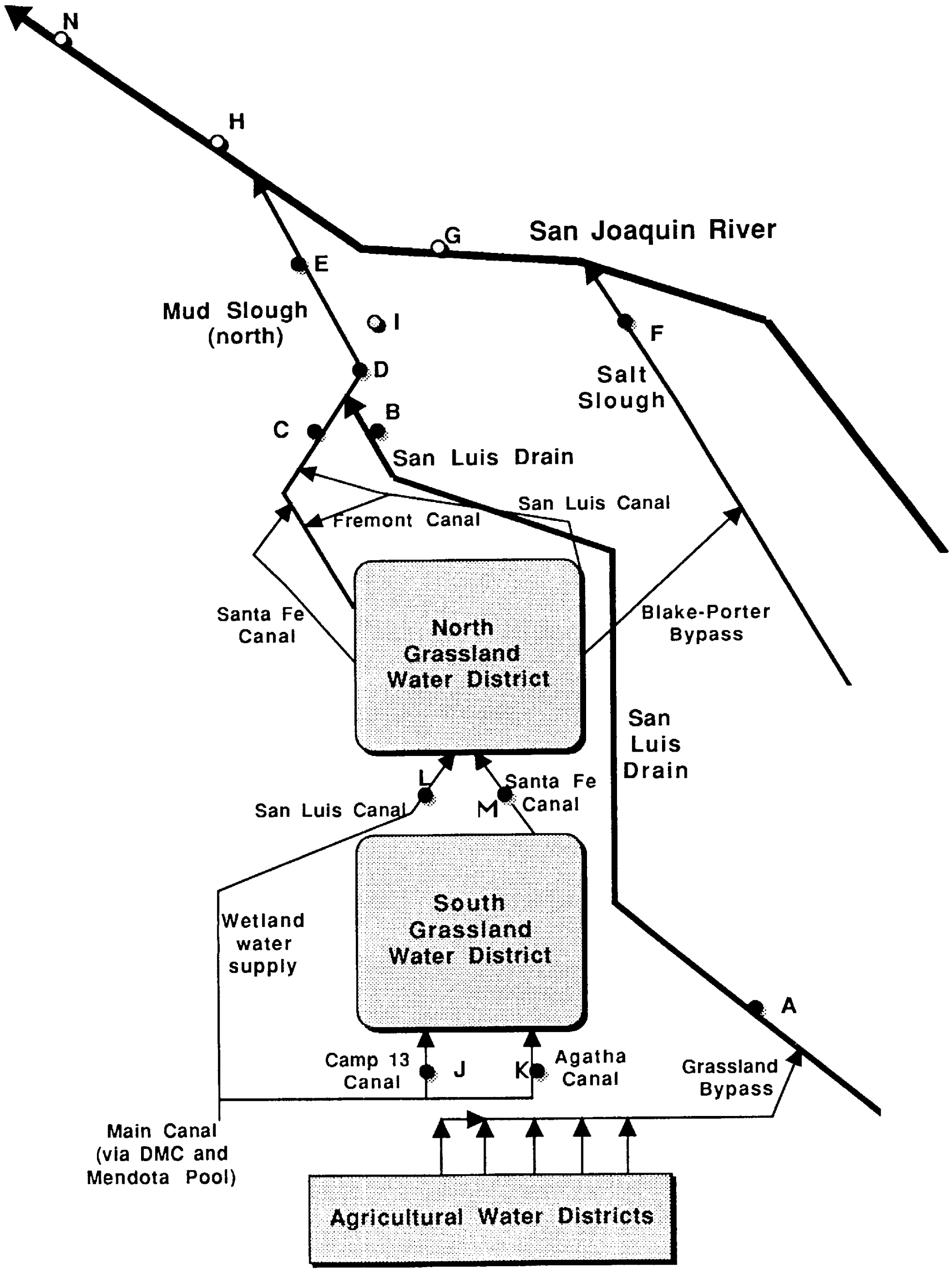


Figure 3. Daily mean flows (cfs) at GBPCMP stations. Flow at station A is recorded as a daily mean. Flows at stations B, D, F, and N are recorded at 15 min intervals. Note different scales of vertical axes and break in vertical axis for station N.

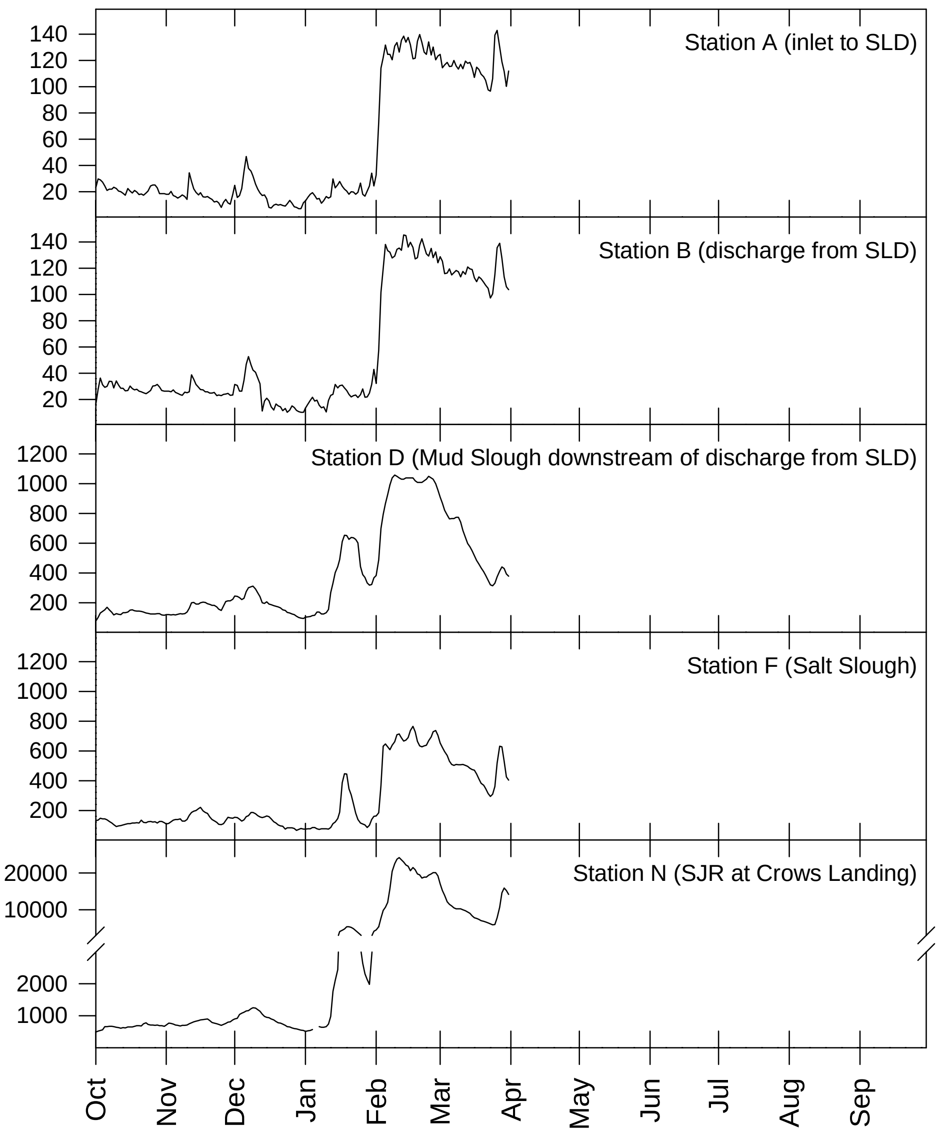


Figure 4. Selenium concentrations and selenium load discharge at station B (discharge from SLD): a) comparison of monthly load discharge and load values; b) comparison of cumulative load discharge and load values; c) daily average flows; d) daily average selenium concentrations; and e) calculated daily average load discharge.

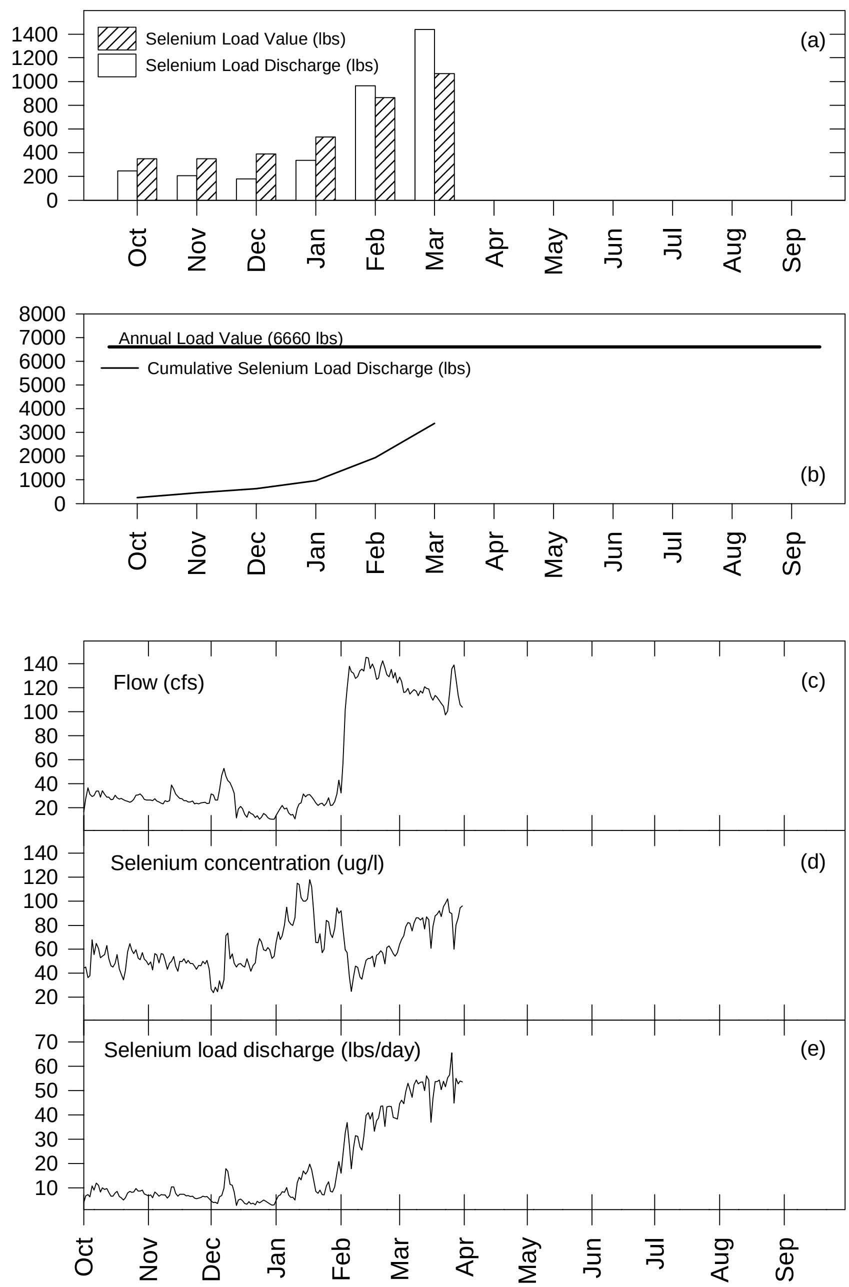


Figure 5. Daily average flows and selenium concentrations at station N (San Joaquin River at Crow's Landing). Flows at station N for January and February were estimated (see text). Note break in vertical axis for flow plot.

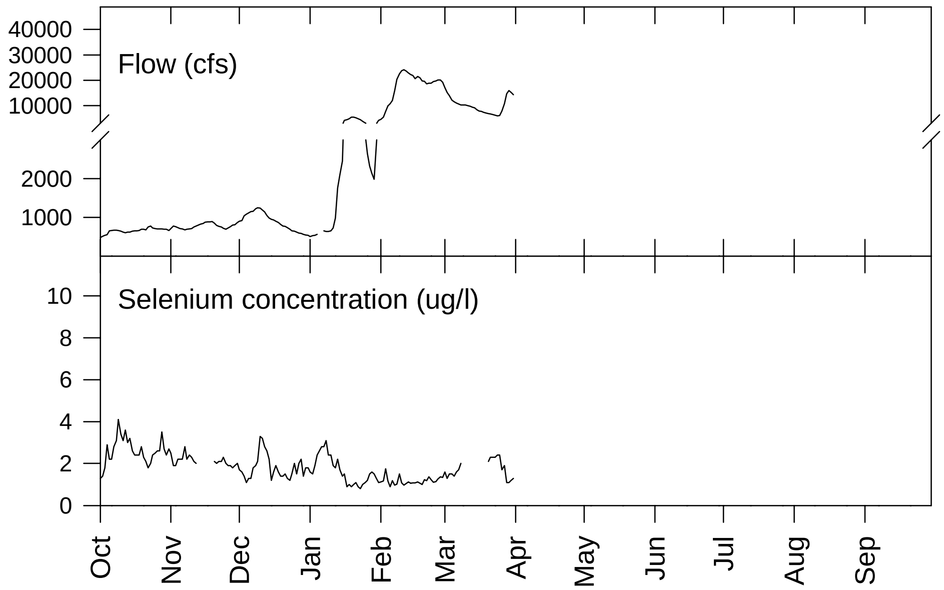


Figure 6. Selenium concentrations (ug/l) at station A (near the inlet to the San Luis Drain), station B (discharge from the San Luis Drain), station C (Mud Slough upstream of the GBP discharge), and station D (downstream of the GBP discharge). Data from weekly grab samples.

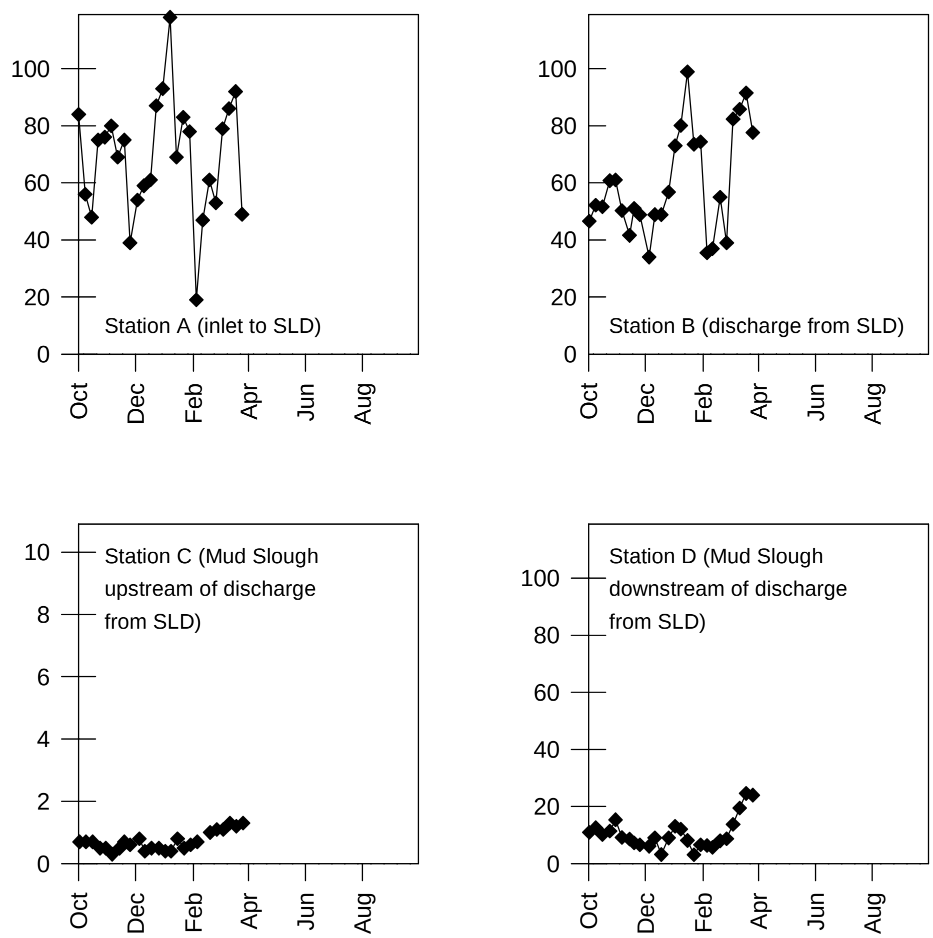


Figure 7. Selenium concentrations (ug/l) at station F (Salt Slough) and in the wetland water supply channels at station J, station K, station L, and station M. Data from weekly grab samples.

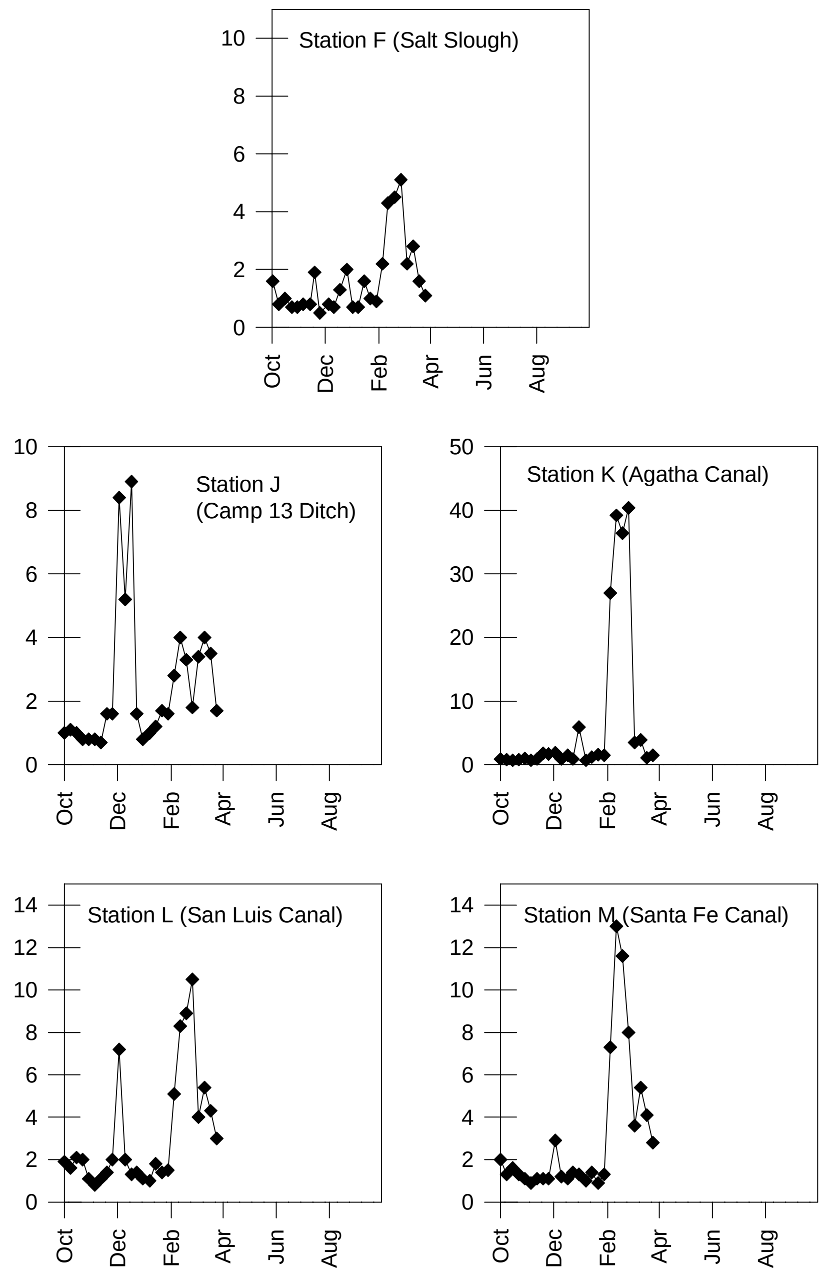


Figure 8. Selenium concentrations (ug/l) at San Joaquin River stations G (San Joaquin River upstream of Mud Slough confluence), H (San Joaquin River downstream of Mud Slough confluence), and N (at Crow's Landing, downstream of Merced River confluence). Data from weekly grab samples.

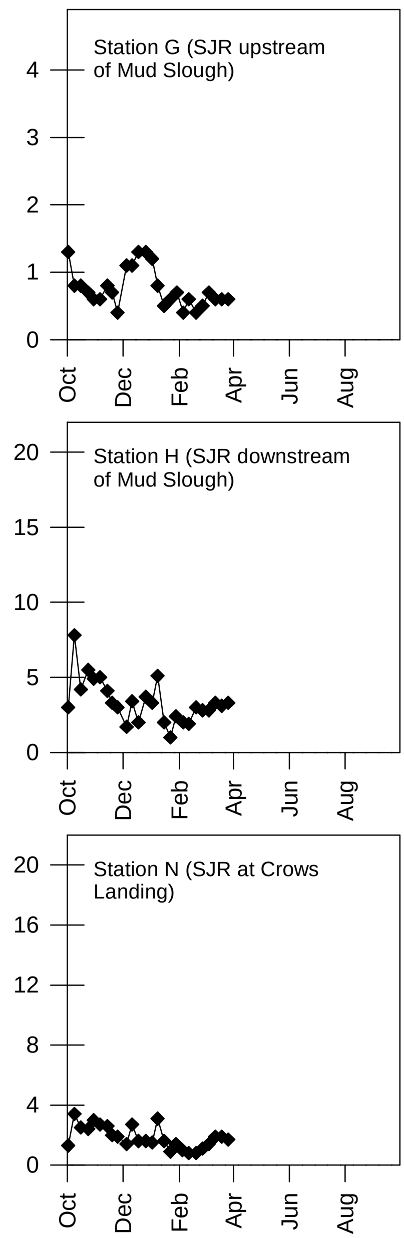


Figure 9. Daily average specific conductance (µS/cm) derived from measurements at 15 min intervals at stations B (discharge from the SLD), D (Mud Slough downstream of the GBP discharge), F (Salt Slough), and N (San Joaquin River at Crow's Landing).

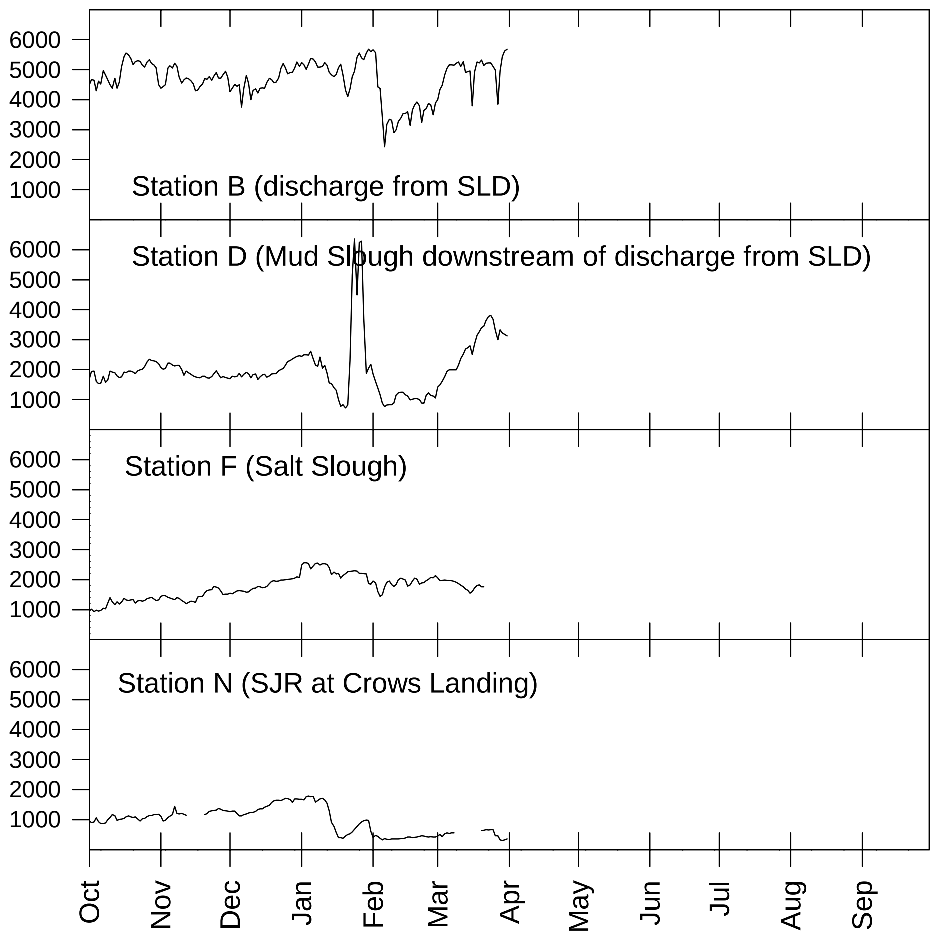


Figure 10. Specific conductance (µS/cm) in weekly grab samples. Letters indicate stations.

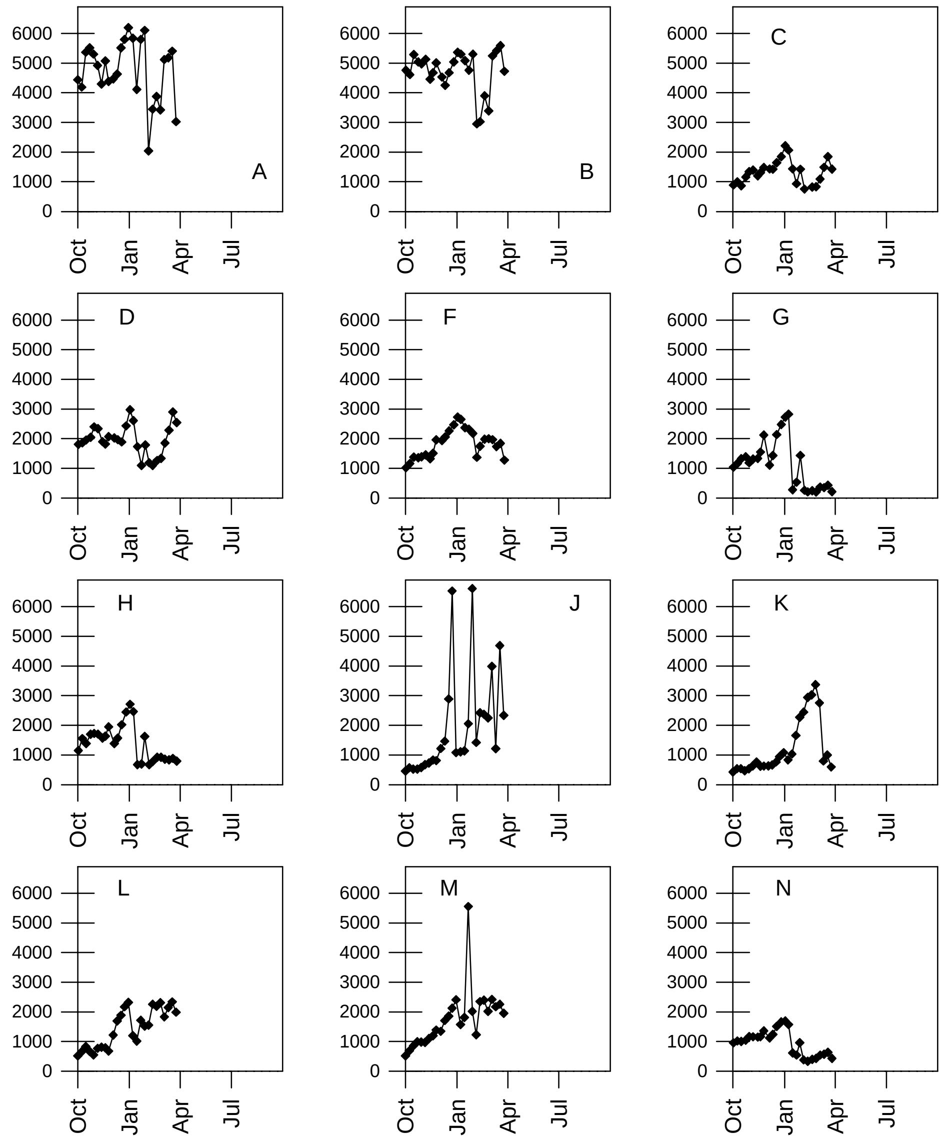
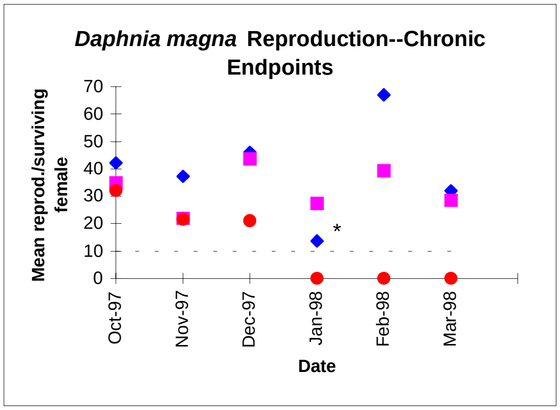
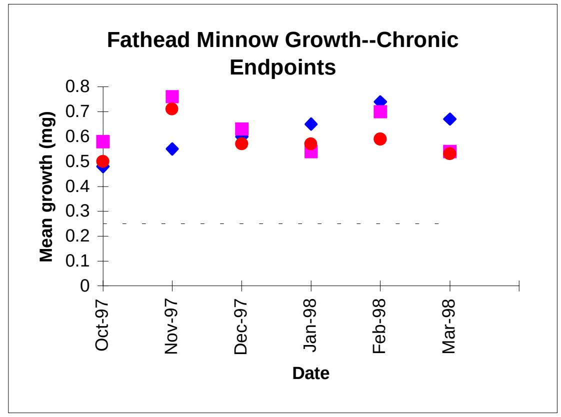
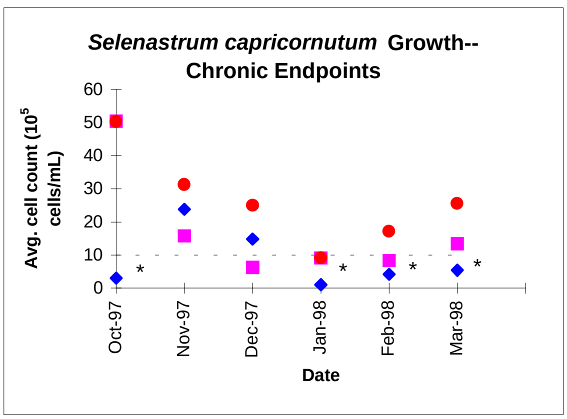
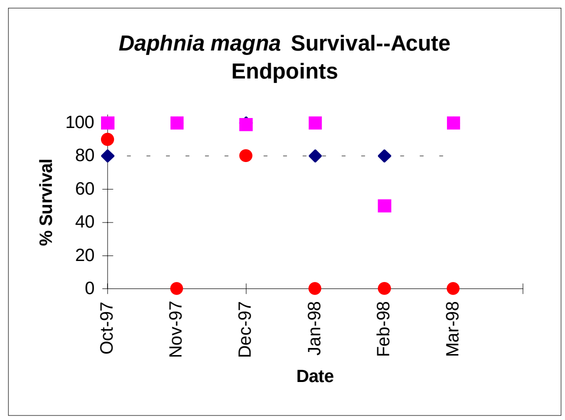


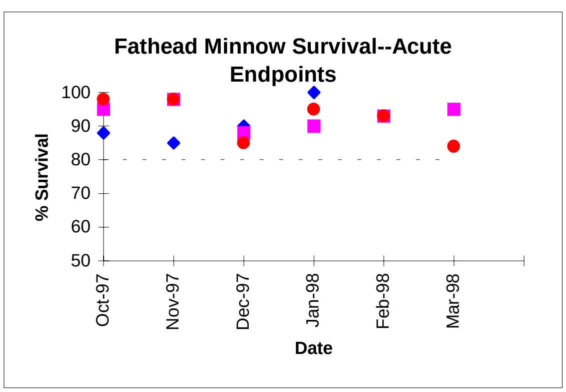
Figure 11. Comparison of toxicity test results from station B with results from the Delta Mendota Canal reference location. The different tests are described in the text.











■ Delta Mendota Canal (control)
◆ Site B
* Results statistically different from control
● Laboratory Control
-- Minimum test acceptability for control

Figure 12. Comparison of toxicity test results from station C with results from the Delta Mendota Canal reference location. The different tests are described in the text.

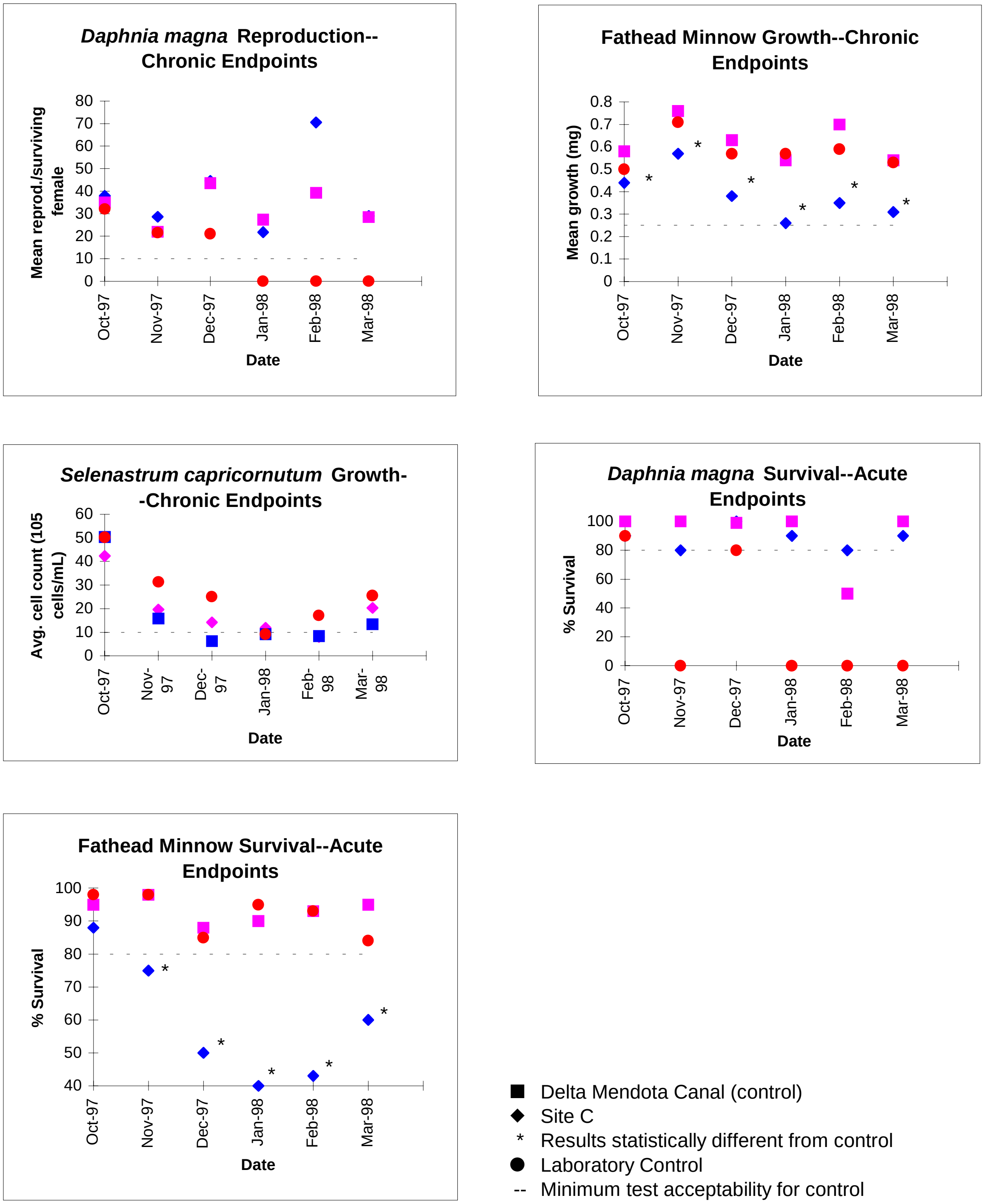


Figure 13. Comparison of toxicity test results from station D with results from the Delta Mendota Canal reference location. The different tests are described in the text.

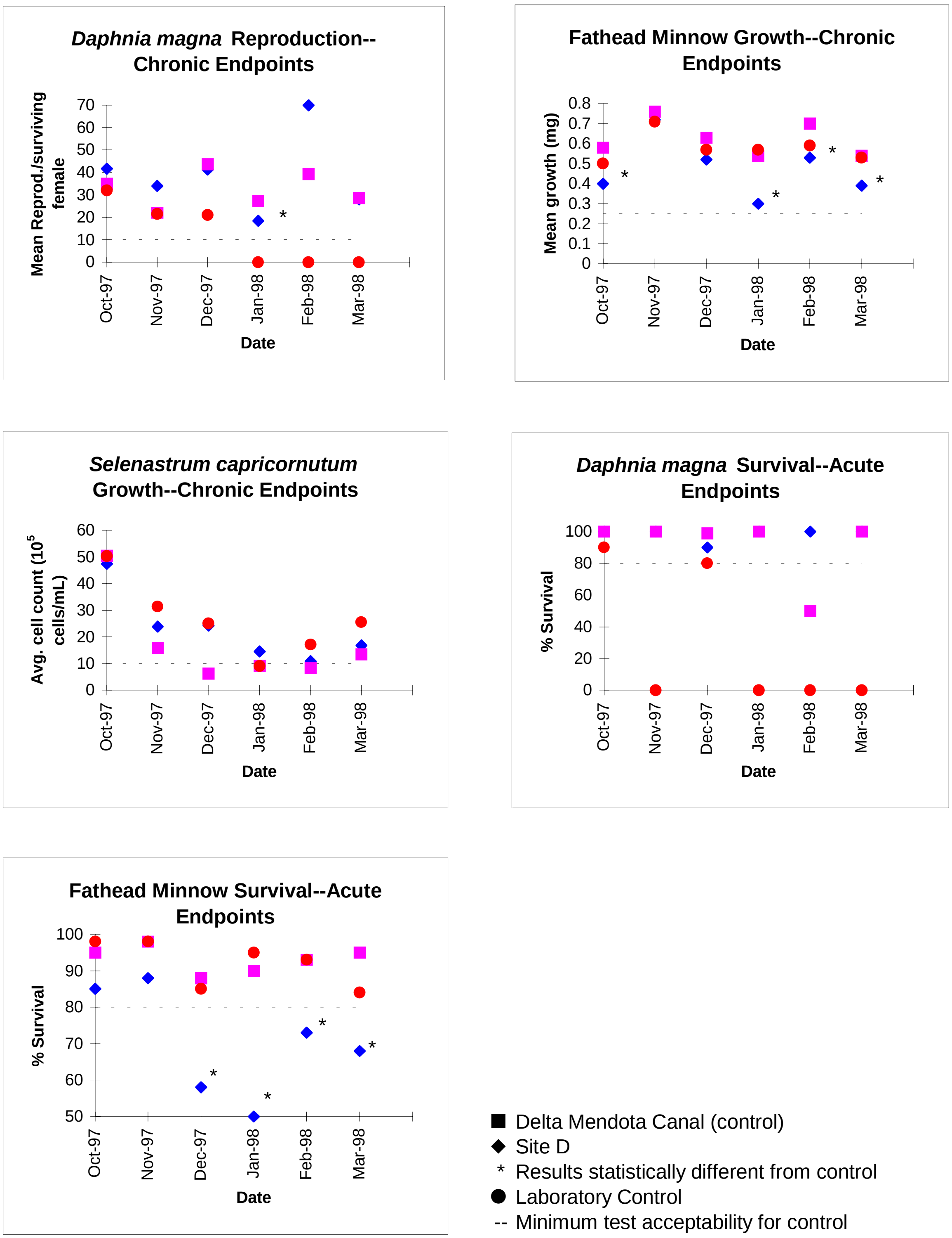


Figure 14. Comparison of toxicity test results from station F with results from the Delta Mendota Canal reference location. The different tests are described in the text.