GRASSLAND BYPASS PROJECT

DRAFT
QUARTERLY NARRATIVE AND GRAPHICAL SUMMARY

January 1999 – March 1999

July 6, 1999

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 (SFEI 1998). The data and detailed background information on the GBP are also available on the Internet at the following address:

http://www.mp.usbr.gov/mp150/grassland/HomePage/Homepage.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 flow into Mud Slough from the San Luis Drain may not exceed 150 cfs (USBR 1995).

Flows near the inlet of agricultural drainage into the San Luis Drain (Site A), which averaged 43 cfs for the quarter, were lower than flows at the point of discharge of the San Luis Drain into Mud Slough (Site B), which averaged 47 cfs (Figure 3). Maximum flow for the quarter was 66 cfs on February 10 at Site A and 72 cfs on February 10 at Site B.

Of the two monitoring sites in Mud Slough above and below the GBP discharge (sites C and D, respectively) flow is measured only at Site D. The average flow at Site D for the quarter was 213 cfs. The maximum flow at Site D (340 cfs) occurred on March 2. The discharge from the SLD (Site B) accounted for an average of 22% of the total flow in Mud Slough (Site D). Flows in Salt Slough (Site F) averaged 319 cfs for the quarter. The highest flow in Salt Slough (526 cfs) occurred on February 25.

Site N flows during the quarter averaged 2081 cfs. The maximum flow measured was 4780 cfs on February 12.

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 on test organisms of the GBP discharge and of waters in Mud Slough below the discharge.

Selenium

Daily Selenium Measurements

Daily selenium concentrations are measured at sites B and N using autosamplers (USBR 1996). Monthly total selenium load discharge is computed at Site B. Monthly totals are shown in Table 1 and illustrated in Figure 4a. Monthly total selenium load discharge was below the selenium load value in all three months of the quarter.

Selenium load discharge from the GBP (discharge from the terminus of the Drain as measured at Site B) averaged 18.8 lbs/day for the quarter. The maximum daily selenium load discharge (30 lbs/day) occurred on March 16. Flow at Site B averaged 47 cfs for the quarter with a minimum of 21 cfs on December 10 and a maximum of 42 cfs on October 1. Selenium concentrations at Site B were more variable, fluctuating between a minimum of 47 µg/L on February 3 and a maximum of 121 µg/L on January 16. The cumulative selenium load discharge for the quarter was 1692 lbs. The cumulative selenium load discharge for October-March was 2434 lbs.

Selenium concentrations at Site N (San Joaquin River at Crow's Landing) averaged 2.2 µg/L for the quarter. The highest concentration was measured on March 24 (4.4 µg/L). The minimum concentration for the quarter, 0.8 µg/L, was measured on January 25.

Weekly Selenium Measurements

Selenium concentrations are measured in weekly grab samples collected at 12 sites (Figures 6-8). It should be noted that data from weekly grab samples provide a relatively imprecise basis for comparison of differences between sites.

Average selenium concentrations were higher near the inlet to the San Luis Drain (Site A) than near the point of discharge into Mud Slough (Site B) (Figure 6). The average concentration at Site A was 80 µg/L compared to 69 µg/L at Site B.

Selenium concentrations in Mud Slough upstream of the GBP discharge (Site C) averaged 0.7 µg/L, with a maximum concentration of 0.9 µg/L (Figure 6). Concentrations were higher in Mud Slough downstream of the GBP discharge (Site D) than upstream at Site C (note differences in scales). Concentrations at Site D averaged 18 µg/L, with a maximum of 30 µg/L on March 18.

Selenium concentrations in Salt Slough (Site F) and the wetland water supply channels (sites J, K, L2, and M2) were frequently above 2 µg/L at sites J (three samples), L2 (4 samples), and M2 (three samples). One sample at Site K was above 2 µg/L.

In the San Joaquin River, weekly selenium samples were collected at sites upstream of the GBP discharge (Site G), downstream of the discharge and above the Merced River (Site H), and downstream of the Merced River (Site N) (Figure 8). Selenium concentrations at Site G were low, averaging 0.7 µg/L, with one sample below the detection limit of 0.4 µg/L. Concentrations were higher at Site H, averaging 4.2 µg/L.

Specific conductance

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

IV. SEDIMENT MONITORING

Sediment quality is measured in the San Luis Drain and in Mud and Salt Sloughs. The purpose of monitoring sediment 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 µg/g wet weight) and to provide information on the fate and transport of selenium within the Drain. Sites 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.

No new sediment chemistry data were available at the time of preparation of this report.

V. BIOLOGICAL MONITORING

Biological monitoring is conducted 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. These data will be presented and discussed in the GBP Annual Report for the year October 1998 - September 1999.

VI. 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 sites B, C, D, and F. Test results from these sites 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 is conducted at sites B, D, F, and a reference Site (Windmill) on a quarterly basis. Toxicity test results for the year are summarized below; complete datasets are presented in the GBP Monthly Data Reports and GBP Quarterly Data Reports (SFEI 1998).

In the fathead minnow tests, three tests indicated significantly reduced survival or growth. Significant reductions in survival were observed at sites D and F in January. A statistically significant reduction in fathead minnow growth was observed at Site F in January.

In the *Daphnia* tests, no significant reductions in survival or reproduction were observed.

In the *Selenastrum* tests, inhibition of growth was observed in many samples, including two samples from Site B, one sample from Site C (March), one sample from Site D (February), and two samples from Site F (January and February). Inhibition of *Selenastrum* growth has been consistently observed in samples from Site B, and infrequently observed in samples from the other sites.

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.

SFEI. 1998. Monthly and Quarterly Data Reports for the Grassland Bypass Project. Available from SFEI or on the Internet at http://www.sfei.org/grassland/reports/gbppdfs.htm.

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 (Site B) with the monthly load values in the Interim Use Permit (USBR 1995).

	Selenium load discharge (lbs)	Load value (lbs)	Amount over load value (%)
Oct 1998	277	348	NA
Nov 1998	226	348	NA
Dec 1998	239	389	NA
Jan 1999	284	506	NA
Feb 1999	609	823	NA
Mar 1999	799	1,013	NA

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

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

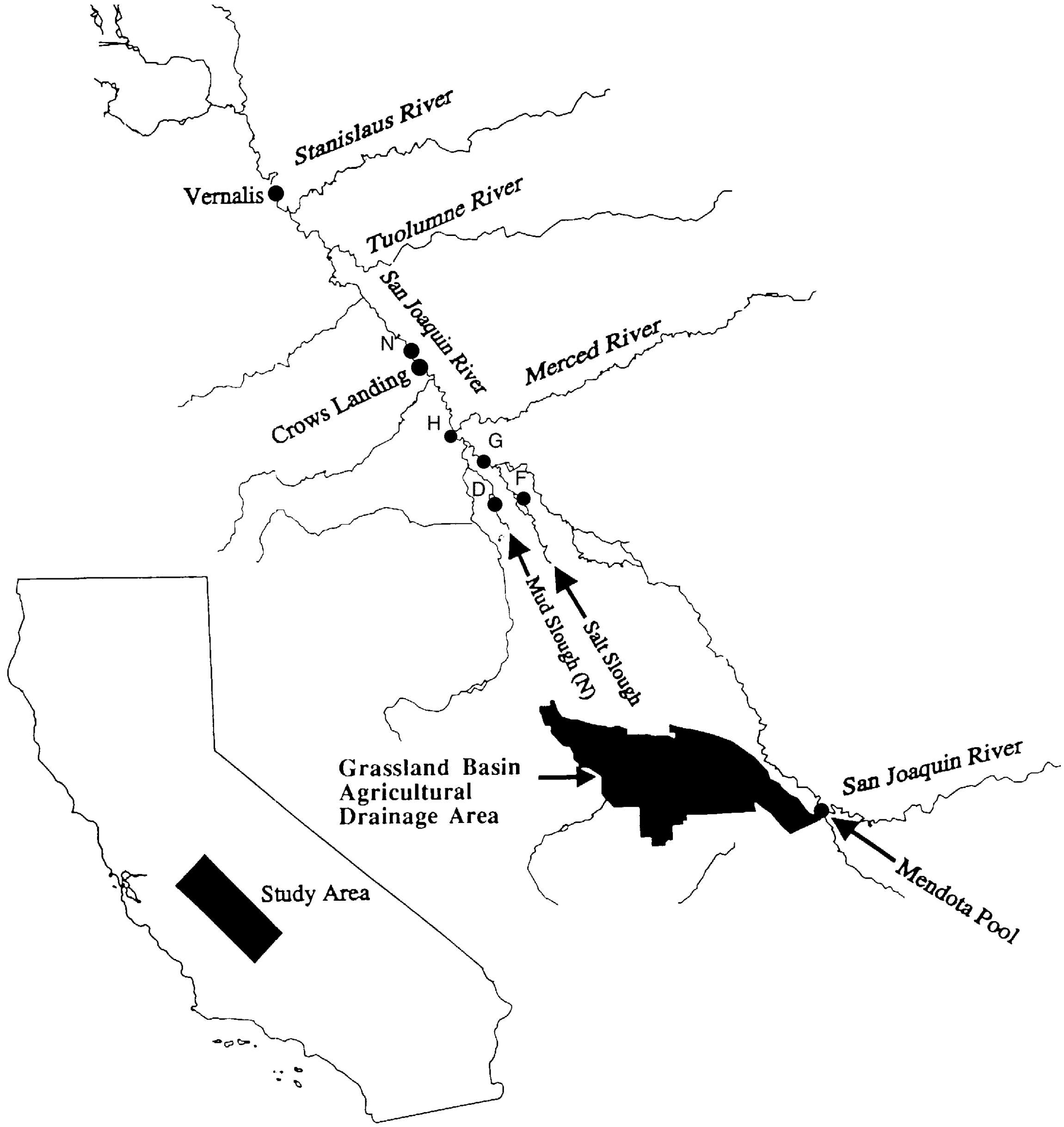


Figure 2. Schematic diagram showing locations of GBP monitoring sites relative to major hydrologic features of the study area.

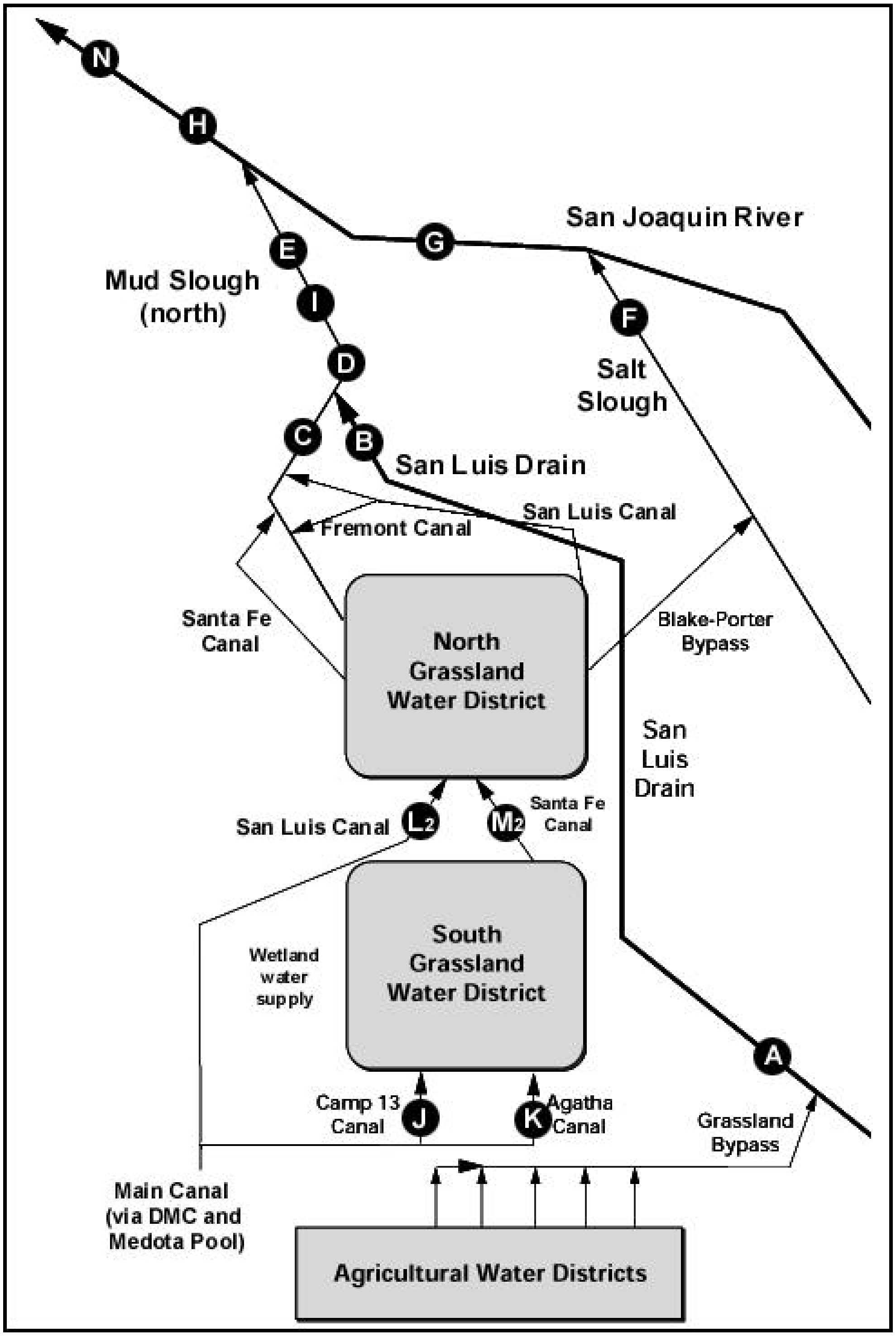


Figure 3. Daily mean flows (cfs) at GBPCMP sites. Flow at Site A is recorded as a daily mean. Flows at sites B, D, F, and N are recorded at 15 min intervals. Note different scales of vertical axes.

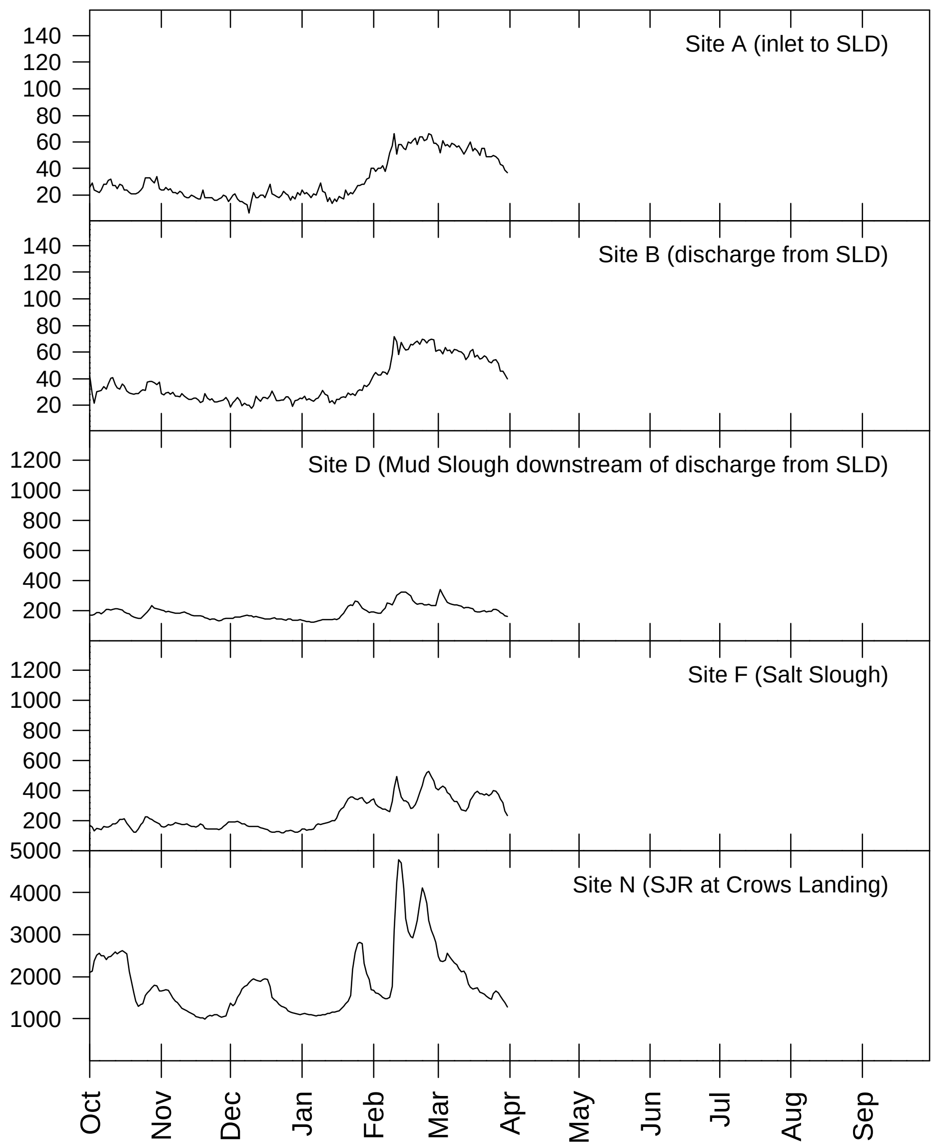


Figure 4. Selenium concentrations and selenium load discharge at Site B (discharge from SLD): a) comparison of monthly load discharge and load values; b) comparison of cumulative load discharge and load values; c) daily average flows; d) daily average selenium concentrations; and e) calculated daily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

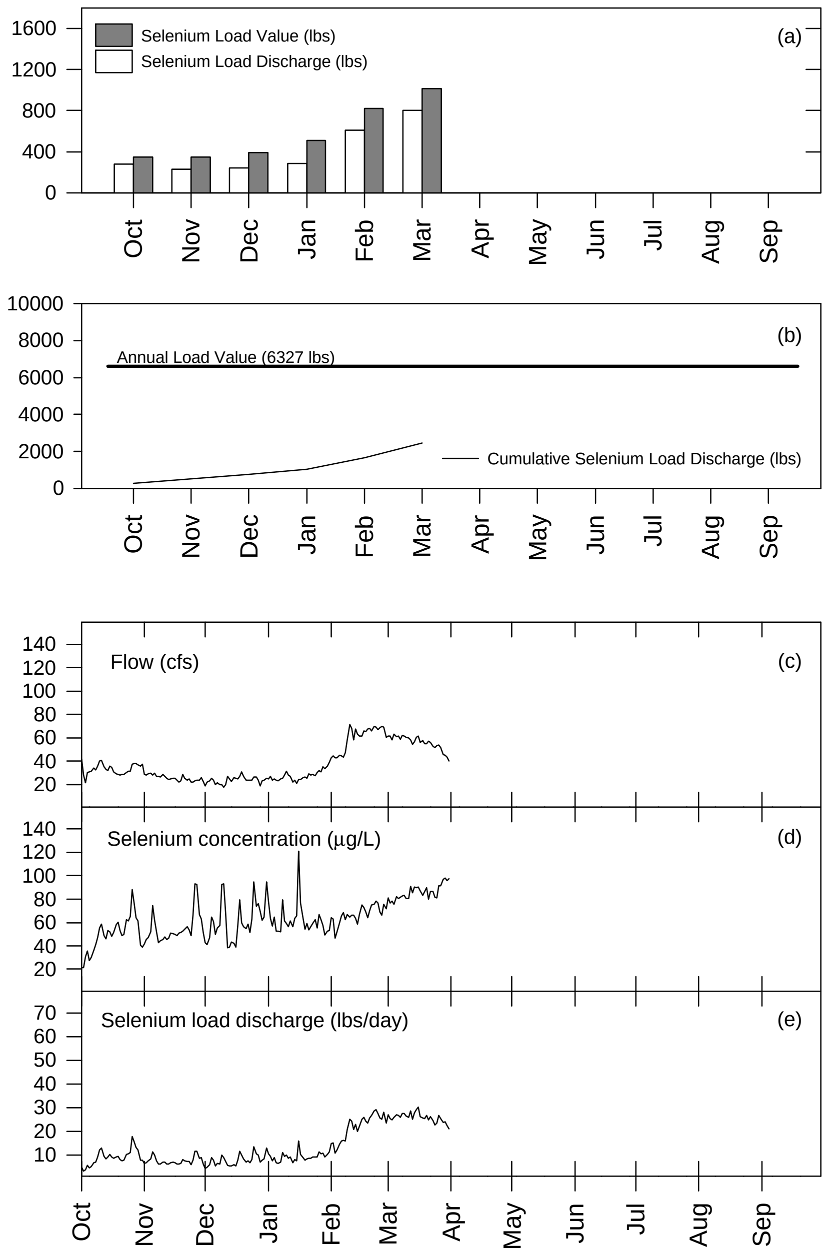


Figure 5. Daily average flows and selenium concentrations at Site N (San Joaquin River at Crow's Landing).

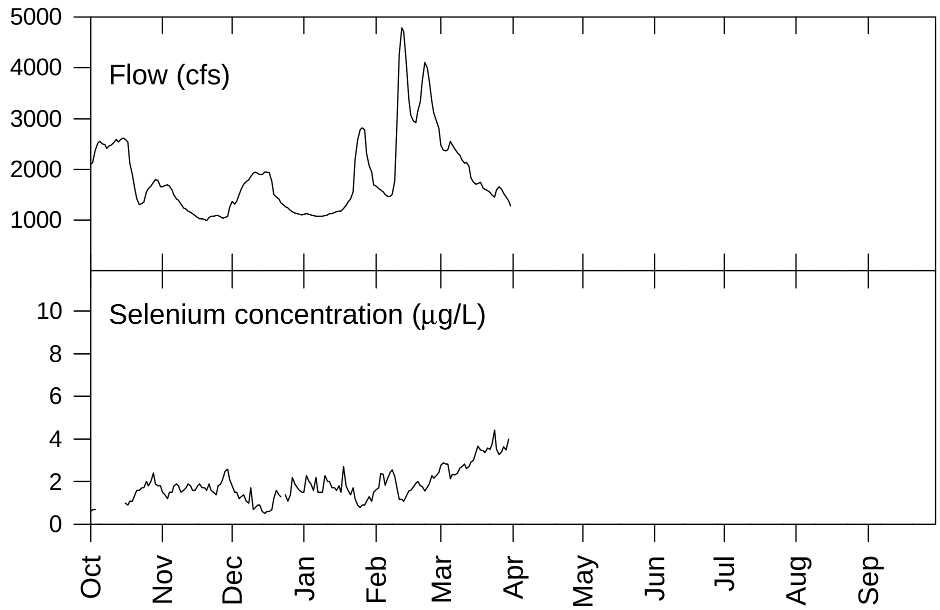


Figure 6. Selenium concentrations (µg/L) at Site A (near the inlet to the San Luis Drain), Site B (discharge from the San Luis Drain), Site C (Mud Slough upstream of the GBP discharge), and Site D (Mud Slough downstream of the GBP discharge). Data from weekly grab samples.

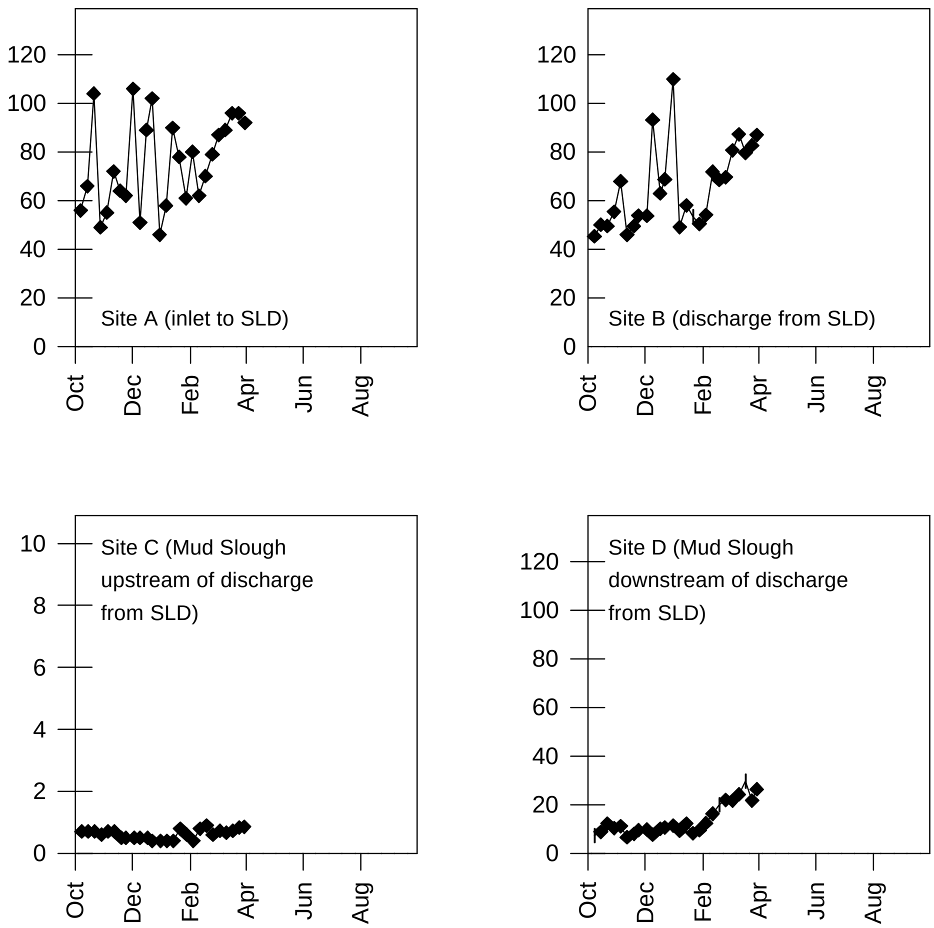


Figure 7. Selenium concentrations (µg/L) at Site F (Salt Slough) and in the wetland water supply channels at Site J, Site K, Site L2, and Site M2. Data from weekly grab samples.

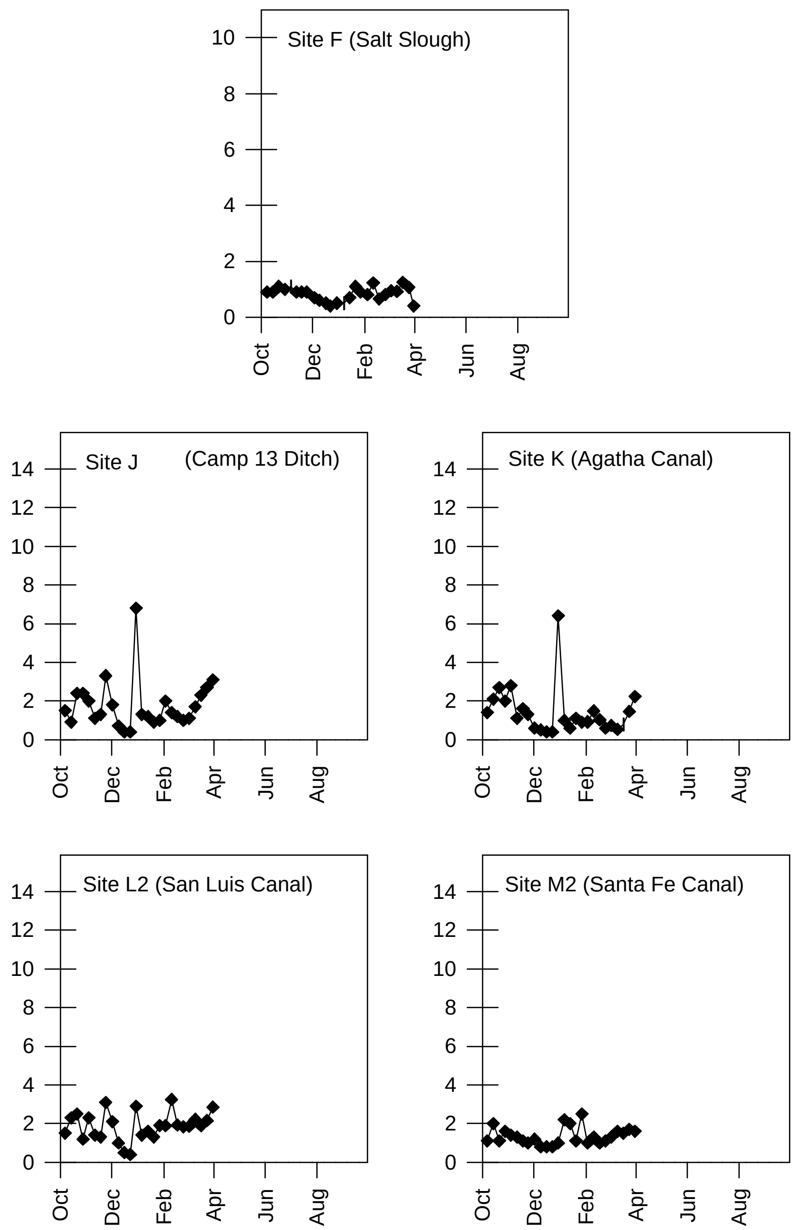


Figure 8. Selenium concentrations (µg/L) at San Joaquin River sites G (San Joaquin River upstream of Mud Slough confluence), H (San Joaquin River downstream of Mud Slough confluence), and N (at Crow's Landing, downstream of Merced River confluence). Data from weekly grab samples.

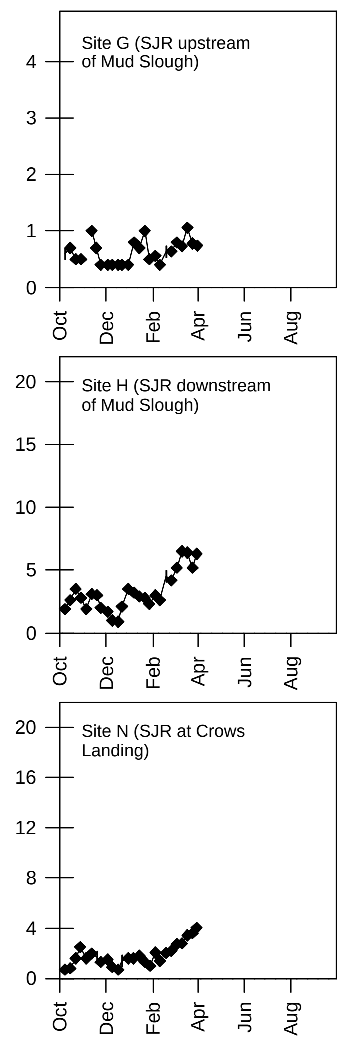


Figure 9. Daily average specific conductance (µS/cm) derived from measurements at 15 min intervals at sites B (discharge from the SLD), D (Mud Slough downstream of the GBP discharge), F (Salt Slough), and N (San Joaquin River at Crow's Landing).

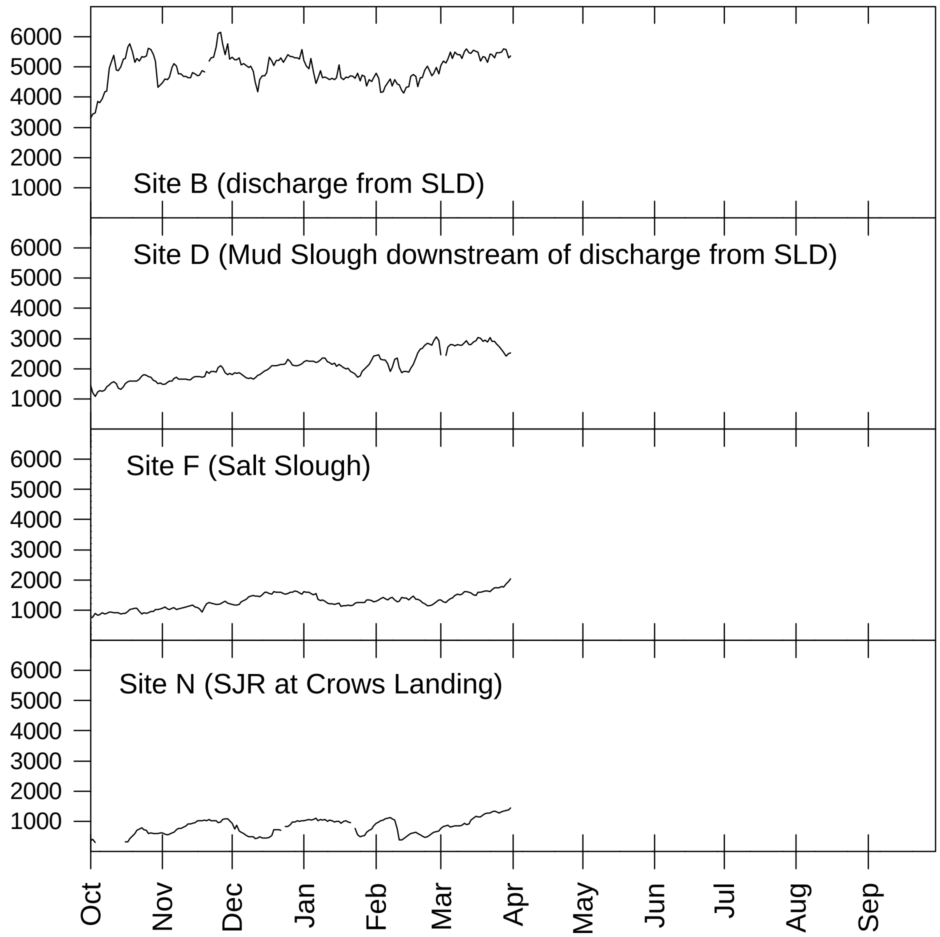


Figure 10. Specific conductance (μS/cm) in weekly grab samples. Letters indicate sites.

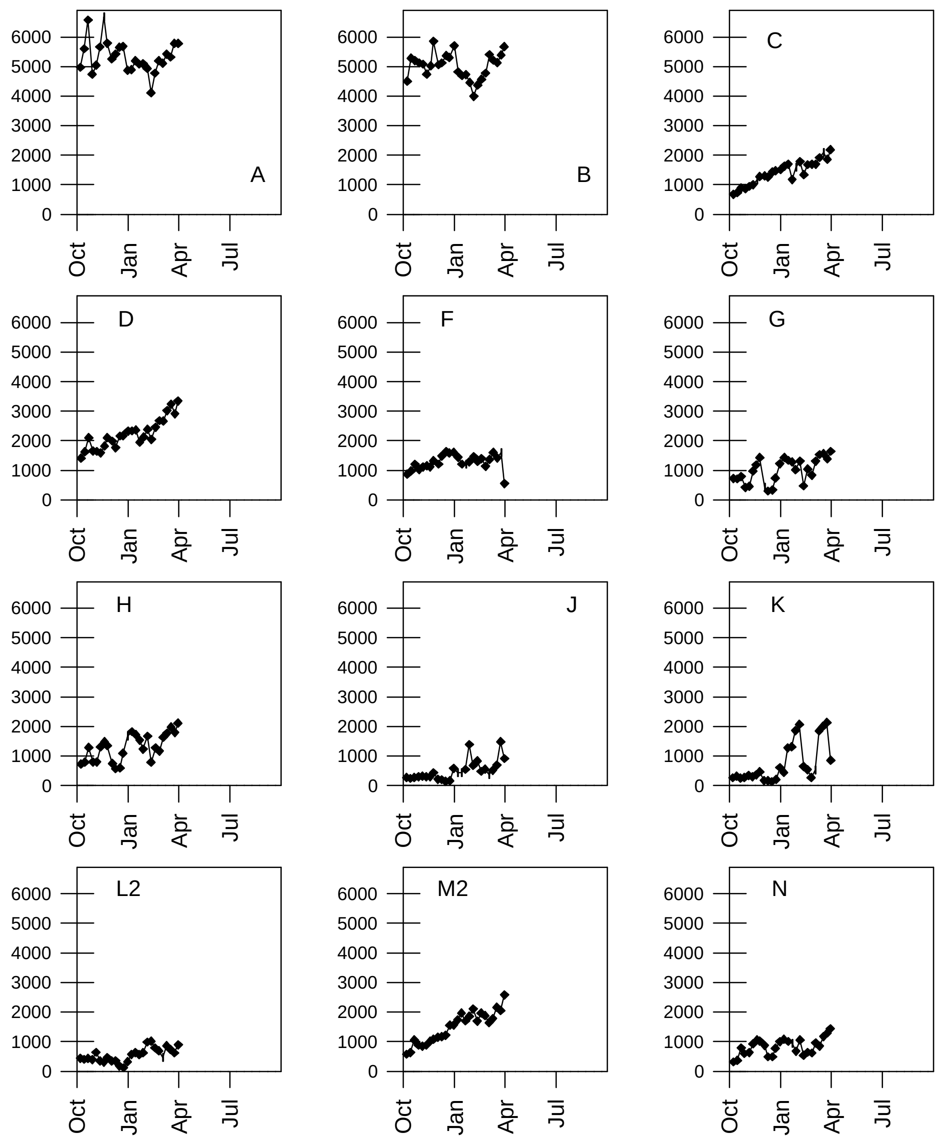


Figure 11. Comparison of toxicity test results from Site B with results from the Delta Mendota Canal reference location. The different tests are described in the text.

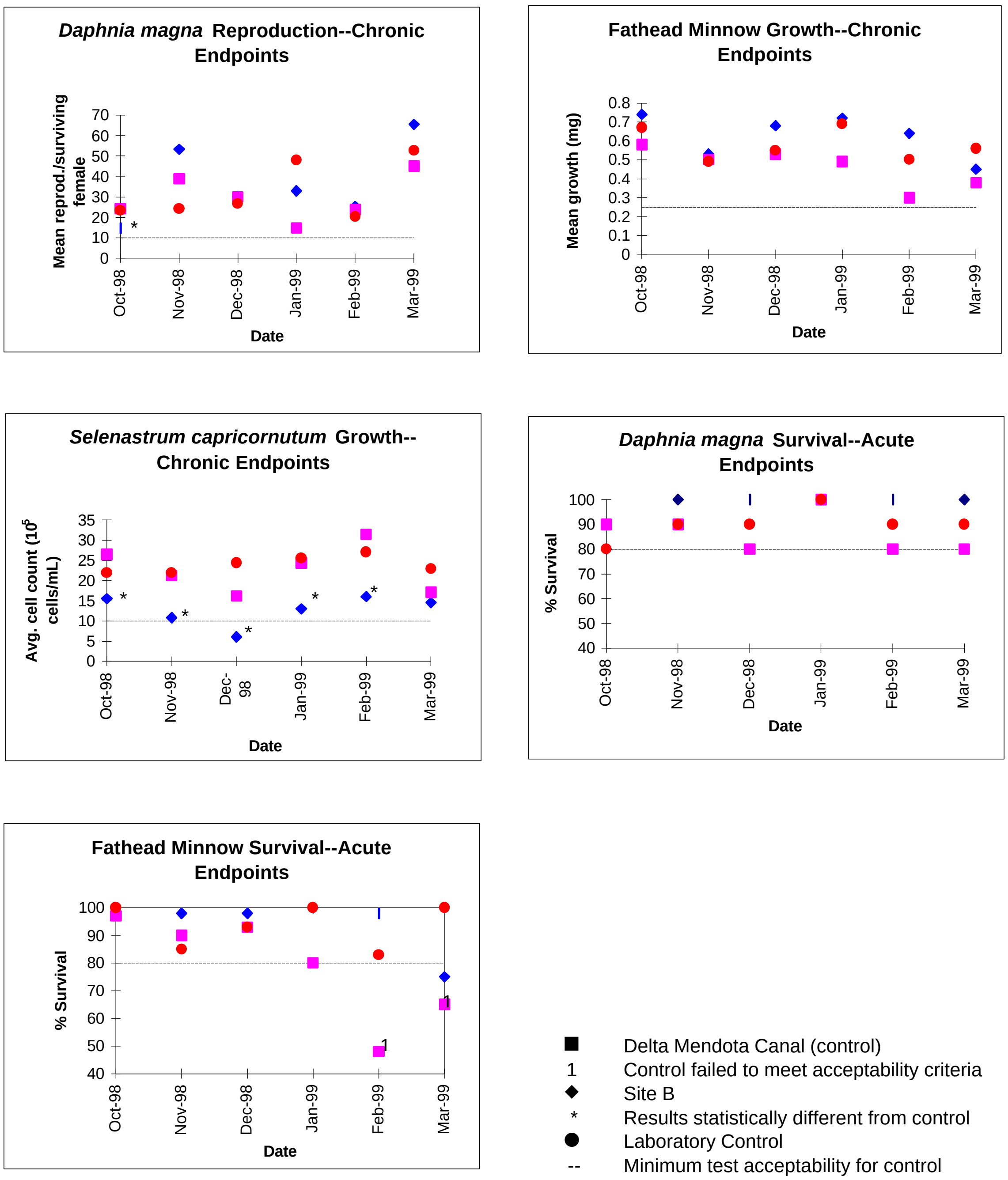
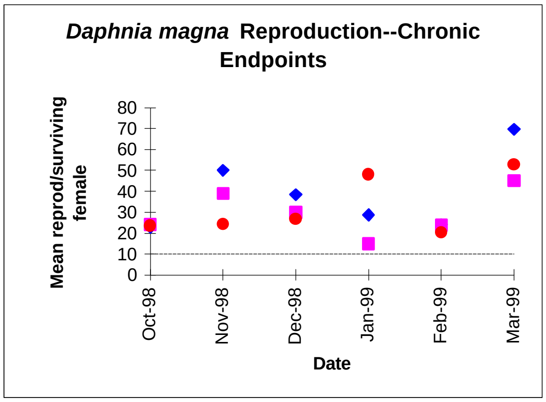
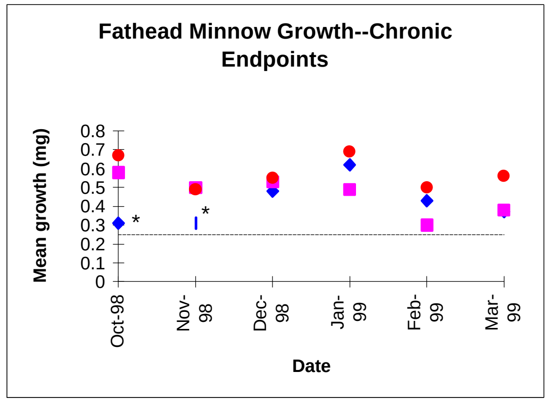
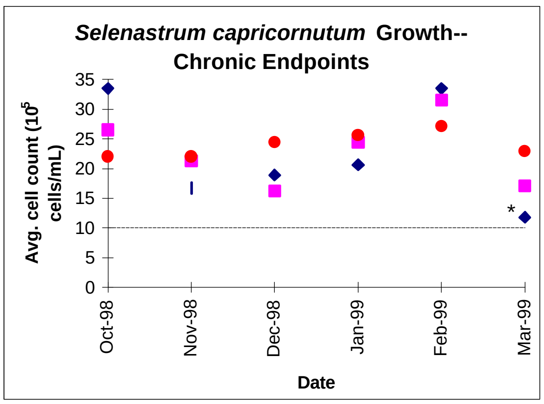
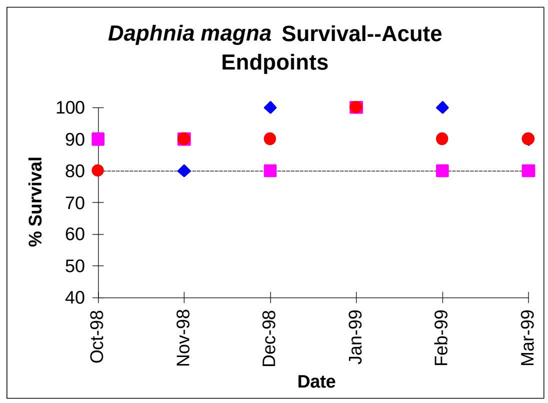


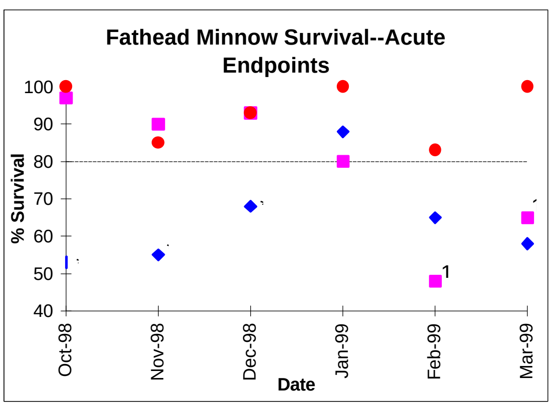
Figure 12. Comparison of toxicity test results from Site C with results from the Delta Mendota Canal reference location. The different tests are described in the text.





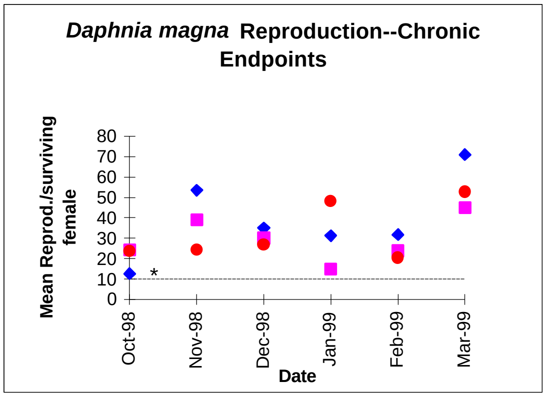


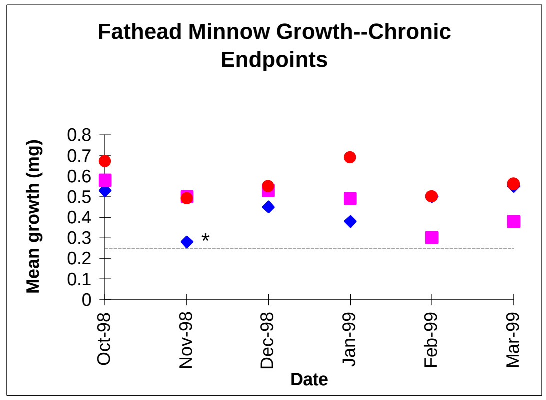


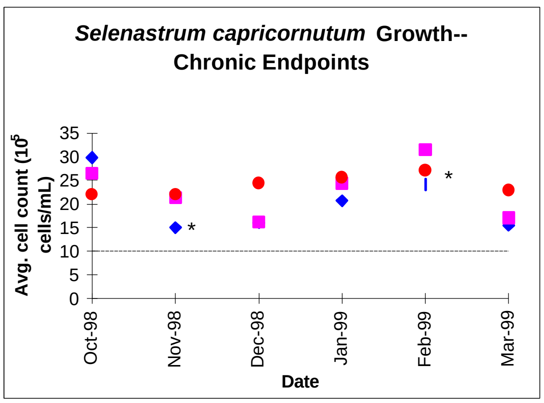


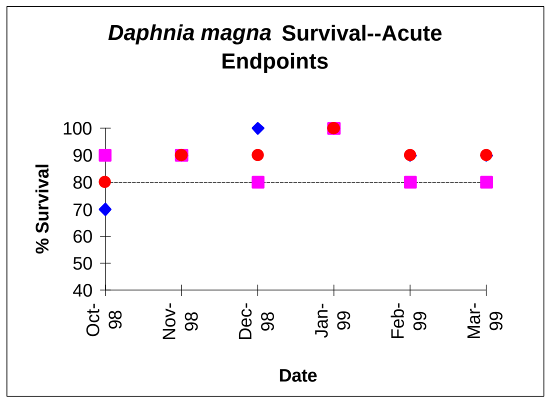
■	Delta Mendota Canal (control)
1	Control failed to meet acceptability criteria
◆	Site C
*	Results statistically different from control
●	Laboratory Control
--	Minimum test acceptability for control

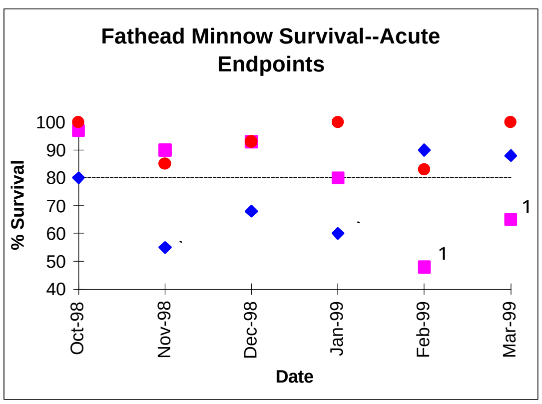
Figure 13. Comparison of toxicity test results from Site D with results from the Delta Mendota Canal reference location. The different tests are described in the text.











- ■ Delta Mendota Canal (control)
- 1 Control failed to meet acceptability criteria
- ◆ Site D
- * Results statistically different from control
- ● Laboratory Control
- -- Minimum test acceptability for control

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